

Visual Thinking

RUDOLF ARNHEIM

University of California Press

Berkeley, Los Angeles, London

Contents

1. Early Stirrings	1
<i>Perception torn from thinking, 2. The senses mis-trusted, 4. Plato of two minds, 6. Aristotle from below and from above, 8.</i>	
2. The Intelligence of Perception (i)	13
<i>Perception as cognition, 13. Perception circum-scribed, 15. Exploring the remote, 17. The senses vary, 17. Vision is selective, 19. Fixation solves a problem, 23. Discernment in depth, 26. Shapes are concepts, 27. Perception takes time, 29. How ma-chines read shape, 31. Completing the incomplete, 33.</i>	
3. The Intelligence of Perception (ii)	37
<i>Subtracting the context, 37. Brightness and shape as such, 40. Three attitudes, 43. Keeping the context, 46. The abstraction of shape, 47. Distortion calls for abstraction, 51. Permanence and change, 52.</i>	
4. Two and Two Together	54
<i>Relations depend on structure, 54. Pairing affects the partners, 60. Perception discriminates, 65. Per-ception compares, 66. What looks alike? 69. Mind versus computer, 72.</i>	

5. The Past in the Present	80	
<i>Forces acting on memory, 81. Percepts supplemented, 84. To see the inside, 87. Visible gaps, 89. Recognition, 90.</i>		
6. The Images of Thought	97	
<i>What are mental images like? 98. Can one think without images? 100. Particular and generic images, 102. Visual hints and flashes, 107. How abstract can an image be? 109.</i>		
7. Concepts Take Shape	116	
<i>Abstract gestures, 117. A pictorial example, 118. Experiments with drawings, 120. Thought in visible action, 129.</i>		
8. Pictures, Symbols, and Signs	135	
<i>Three functions of images, 135. Images to suit their functions, 140. What trademarks can tell, 144. Experience interacting with ideas, 148. Two scales of abstraction, 150.</i>		
9. What Abstraction Is Not	153	
<i>A harmful dichotomy, 154. Abstraction based on generalization? 157. Generality comes first, 163. Sampling versus abstraction, 169.</i>		
10. What Abstraction Is	173	
<i>Types and containers, 174. Static and dynamic concepts, 178. Concepts as highspots, 182. On generalization, 186.</i>		
11. With Feet on the Ground	188	
<i>Abstraction as withdrawal, 188. The extraction of principle, 191. Against the grain, 194. In love with classification, 199. In touch with experience, 202.</i>		
12. Thinking With Pure Shapes	208	
<i>Numbers reflect life, 208. Quantities perceived, 211. Numbers as visible shapes, 213. Meaningless shapes make trouble, 217. Self-evident geometry, 222.</i>		
13. Words in Their Place	226	
<i>Can one think in words? 227. Words as images, 229. Words point to percepts, 232. Intuitive and intellectual cognition, 233. What words do for images, 238. The imagery of logical links, 240. Language overrated, 242. The effect of linearity, 246. Verbal versus pictorial concepts, 251.</i>		
14. Art and Thought	254	
<i>Thinking in children's drawings, 255. Personal problems worked out, 260. Cognitive operations, 263. Abstract patterns in visual art, 269.</i>		
15. Models for Theory	274	
<i>Cosmological shapes, 274. The nonvisual made visible, 280. Models have limits, 282. Figure and ground and beyond, 283. Infinity and the sphere, 287. The stretch of imagination, 290.</i>		
16. Vision in Education	294	
<i>What is art for? 295. Pictures as propositions, 296. Standard images and art, 299. Looking and understanding, 301. How illustrations teach, 305. Problems of visual aid, 308. Focus on function, 313. The burden of it all, 315.</i>		
Notes	317	
Bibliography	325	
Index	339	

estranged sight of a person because this particular back view is linked by no immediate continuity to the more characteristic front view (Figure 15). Also, the view chosen by Seurat has a strongly structured character of its own and therefore contradicts its referent almost as violently as does Price's straight line. Or when Andrea Mantegna limits his presentation of the dead Holofernes to the sole of a naked foot peeping through the dark opening of the general's tent he uses a small part to represent a whole that can be completed only by experience.

Every break of the visual continuity between percept and memory norm also interrupts the dynamics connecting the two. A bent figure receives much of its characteristic expression through its visible pull toward or away from the norm, of which it is perceived to be a deviation. Therefore, the particular specimen is not seen merely, dispassionately and undynamically, as belonging under the heading of a familiar species. It looks rather like a particular manifestation of a matrix that has generated variations under the stress of given conditions. The forces of this generative process animate perception visibly, every time a perceived thing evokes its prototype.

6.

The Images of Thought

One can say a great deal about the relation of memory to perception without facing the disturbing question of what memory is actually like. We say that a visitor to the zoo, approaching the cage of the elephants, compares the appearance of the animals with his own visual concept of elephant and thereby identifies what he sees. I have dealt at some length with the nature of the percept derived from the physical object, emphasizing in particular that it is not a mechanical recording but the active grasping of structural features. How, then, is its counterpart in memory constituted? Is it an internal picture of some kind, which enables a person to contemplate with closed eyes the imprint of a particular elephant or of something elephantlike?

As long as one studies the relations between memory residues and direct perception one can concentrate on the effect exerted upon the percept and delay asking what exerts it. The situation may be illustrated by the example of an artist who makes a drawing of something he knows from memory. He sits in his studio and draws an elephant. If you ask him from what model he is drawing he may deny convincingly that he has anything like an explicit picture of the animal in his mind. And yet, as he works, he constantly judges the correctness of what he is producing on paper and steers and modifies his shapes accordingly. With what does he compare them? What is this "inner design," the *disegno interno*, as Federico Zuccari called it in 1607 in order to distinguish it from the *disegno esterno* on the canvas? What was the *certa idea* Raphael had in

mind when he wrote in a famous letter to Count Baldassare Castiglione: "In order to paint a beautiful woman I should need to see several fair ones, and you would have to help me with the selection; but since fair women and competent judges are rare, I make use of a certain idea that comes to my mind."

The question is easily avoided because the operation seems to take place in the perceived outside world, on the drawing board; as the lines and colors appear, they look right or wrong to the draftsman, and they themselves seem to determine what he must do about them. Some aspects of his judgment may indeed give the impression as though they depended on the percept alone, for example, the formal factors of balance and good proportion. Actually, however, even they are inseparable from the question: "Is this my notion of the elephant?" and this question can only be answered by reference to some standard in the mind of the draftsman.

What are mental images like?

When the inner counterpart of the percept is not applied to any external image but stands on its own, the question of what it is like becomes even more urgent. Thinking, in particular, can deal with objects and events only if they are available to the mind in some fashion. In direct perception, they can be seen, sometimes even handled. Otherwise they are represented indirectly by what is remembered and known about them. Aristotle, explaining why we need memory, pointed out that "without a presentation intellectual activity is impossible." But he also ran immediately into the difficulty that has plagued philosophers and psychologists ever since. Thinking is necessarily concerned with generalities. How, then, can it be based on individual memory images?

John Locke used the word "ideas" to describe perceptual as well as memory material and individual as well as generic phenomena. He defined ideas as "whatsoever is the object of the understanding when a man thinks" and as the equivalent of "whatever is meant by phantasm, notion, species, or whatever it is which the mind can be employed about in thinking . . ." This definition ignores the distinction, customary today, between percept and concept. Locke applied his term to sensations (simple ideas) but also to the percepts of objects (complex ideas) and finally to concepts (abstract ideas). Did he intend to describe these various mental phenomena

as one and the same thing, or did he rather leave the issue in abeyance? Probably the latter; for Locke also felt uneasy about the nature and status of concepts as phenomena of the mind. He said:

The ideas first in the mind, it is evident, are those of particular things, from whence, by slow degrees, the understanding proceeds to some few general ones; which being taken from the ordinary and familiar objects of sense, are settled in the mind, with general names to them. Thus particular ideas are first received and distinguished, and so knowledge got about them; and next to them, the less general or specific, which are next to particular. For abstract ideas are not so obvious or easy to children, or the yet unexercised mind, as particular ones. If they seem so to grown men, it is only because by constant and familiar use they are made so. For, when we nicely reflect upon them, we shall find that general ideas are fictions and contrivances of the mind that carry difficulty with them, and do not so easily offer themselves as we are apt to imagine. For example, does it not require some pains and skill to form the general idea of a triangle, (which is yet none of the most abstract, comprehensive, and difficult,) for it must be neither oblique nor rectangle, neither equilateral, equicrural, nor scalenon; but all and none of these at once. In effect, it is something imperfect, that cannot exist; an idea wherein some parts of several different and inconsistent ideas are put together.

Locke thought of generalities as makeshift devices, needed by a mind too imperfect to hold the total range of a concept in simultaneous view and therefore restricted, for practical purposes, to summaries. But he failed to see what concrete shape these conglomerations of mutually exclusive properties could take in the mind. To say that general ideas "cannot exist" obviously did not solve the problem. If thinking was based on them they had to exist in some form. Berkeley saw this clearly, and his objections to Locke, which will be discussed later, are surely well taken.

The dilemma was very real. Visual presence seemed to be an obstacle to generality and therefore apparently had to be abandoned by the very thinking that required it. If visual presence was given up, was there a non-perceptual realm of existence in which thinking could dwell? The problem is still with us. A recent paper by Robert H. Holt, symptomatically entitled *Imagery: The Return of the Ostracized*, describes various kinds of imagery. "Thought image" is defined as

A faint subjective representation of a sensation or perception without an adequate sensory input, present in waking consciousness as part of an act of thought. Includes memory images and imagination images; may be visual, auditory, or of any other sensory modality, and also purely verbal.

The Lockean flavor of disapproval is still there: the thought image is faint because it does not have enough of what it ought to have. It is second-best to perception. Elsewhere in Holt's paper, there is some recognition of the positive role imagery might play just because of its particular nature. But what is this nature?

Can one think without images?

Around the turn of our century psychologists looked for an answer by experiment. They asked their subjects questions that made them think, e.g., "Should a man be allowed to marry his widow's sister?" Afterwards they enquired: What took place within you? From his results Karl Bühler concluded in 1908 that "in principle any subject can be thought and meant completely and distinctly without any help of imagery [Anschaungshilfen]." At about the same time Robert S. Woodworth was led to assert that "there is non-sensuous content" and that "according to my experience, the more effective the thinking process is at any moment, the more likely is imageless thought to be detected."

The doctrine of "imageless thought" did not hold that nothing observable goes on when a person thinks. The experiments did not indicate that the fruit of thought drops out of nowhere. On the contrary, the consensus was that thinking often takes place consciously; but this conscious happening was said not to be imagery. Even skilled observers were at a loss to describe what went on in their minds while they were thinking. In order to define such imageless presence positively, Ach called it "Bewusstheit (awareness)." Marbe called it "Bewusstseinslagen" (dispositions of consciousness).¹ But mere names were of little help.

Not much is heard about this puzzling situation these days. In a recent investigation on the mental image, Jean Piaget deals with memory extensively but indirectly, by what it enables children to do. But Holt, in the paper I quoted above, pleads for a new and more direct consideration of mental imagery with psychologists who maintain that the nature of thinking should be determined by what it accomplishes. His point is well taken. Experiments on problem solving have told us much about the kinds of tasks a child or animal can perform and the conditions that help or hinder such a performance. But the experiments have also shown that if one wishes to understand why subjects succeed in one situation and fail in another,

one has to make inferences about the kind of process that goes on in their nervous systems or minds. For example, the nature of problem solving by "insight" can only be described if one knows what mechanisms it involves. The term "insight" refers to "sight" and raises the question of how much the perceptual awareness of the problem situation contributes. Without any idea of what sort of process is at work, how is one to comprehend why certain conditions enhance understanding whereas others hamper it? And how is one to discover the best methods of training the mind for its profession?

Looking back at the controversy about the role of imagery in thinking, one can see now that its conclusions remained unsatisfactory, first of all, because both contending parties seem to have tacitly agreed that imagery could be involved in thinking only if it showed up in consciousness. If introspection did not reveal at least minimal traces of imagery in every thought process there was no way of asserting that such imagery was indispensable. The so-called sensationalists tried to cope with the negative results of many experiments by suggesting that "automatism or mechanization" could reduce the visual component of thought to "a feeble spark of conscious life," and that under such conditions experimental observers could not be expected to identify the "unanalyzable degenerate" (Titchener) as what it actually was.

Nowadays psychologists would agree that to demonstrate the presence of a phenomenon in consciousness would greatly help in convincing them that it exists in the mind. But if a mental fact is not found in awareness one can no longer conclude that it does not exist. Quite apart from the rather special mechanisms of repression described by the psychoanalysts, many processes—perhaps most of them—are now known to occur below the threshold of awareness. This includes much of the routine input of our senses. A good deal of what we notice and react to with our eyes and ears, with our sense of touch, and the muscle sense involves no consciousness, or so little that we often cannot remember whether or not we saw our face when we brushed our hair in the morning, whether we felt the pressure of the chair when we sat down for breakfast, or whether we "saw" the elderly lady we avoided running into when we walked to work. Sensory experience, then, is not necessarily conscious. Most certainly it is not always consciously remembered.

In thinking, there are many responses given automatically, or

almost so, because they are readily available or because the needed operations are so simple as to be almost instantaneous. They will disclose little about the nature of thought. Probably for this reason, the experimenters I just mentioned had their subjects wrestle with tasks that mobilized their power of reasoning.

If even under these circumstances thoughts were reported to be "imageless," there are essentially three ways of coping with the findings. Since thinking must take place in some medium, one can propose that human beings think in words. This theory is not tenable, as I shall try to show in a later chapter. Or one can argue, as I have done so far, that imagery may do its work below the level of consciousness. This is quite likely to be true in many cases but tells us nothing about what the images are like and how they function. There is a third approach. Perhaps thought images are and were accessible to consciousness, but in the early days of experimentation, observers were not geared to acknowledging them. Perhaps they did not report the presence of images because what they experienced did not correspond to their notion of what an image is.

Particular and generic images

What are mental images like? According to the most elementary view, mental images are faithful replicas of the physical objects they replace. In Greek philosophy, the School of Leucippus and Democritus "attributed sight to certain images, of the same shape as the object, which were continually streaming off from the objects of sight and impinging upon the eye." These *eidola* or replicas, just as physical as the objects from which they had detached themselves, remained in the soul as memory images. They had all the completeness of the original objects. The closest approximation to these faithful replications which the modern psychologist has been able to discover are the so-called eidetic images — a kind of photographic memory that, according to the Marburg psychologist Erich Jaensch, was to be found in 40 per cent of all children and also in some adults. A person endowed with eidetic recall, for example, was able to commit a geographic map to memory in such a way that he could read off from the image the names of towns or rivers he did not know or had forgotten. In an experiment on eidetic imagery made around 1920 by August Riekel, a ten-year-old boy was asked to examine the picture reproduced in Figure 16 for nine seconds. Later, looking at

an empty white screen, he was able to glean details of the picture as though it were still present. He could count the number of the windows on the house in the back and the number of cans on the milk cart. When asked about the sign on top of the door he deciphered it with difficulty: "That's hard to read . . . it says 'Number,' then an 8 or 9 . . ." He also could make out the name of the shop owner and the drawing of a cow beneath the word *Milchhandlung*.



Figure 16

Not much has been heard of eidetics since the 1920's. The most striking recent reports on vivid imagery have come from the laboratory of Wilder Penfield, who obtained them by stimulating certain areas in the temporal lobes of the brain electrically. The experiential responses, as Penfield calls them, are described by the patients as flash-backs to scenes they knew in the past. One of them heard "the singing of a Christmas song in her church at home in Holland. She seemed to be there in the church and was moved again by the beauty of the occasion, just as she had been on that Christmas Eve some years before." All patients agreed that the experience is more vivid than anything they could recollect voluntarily; it is not remembering but reliving. The experienced episode proceeds at its natural speed as long as the electrode is held in place; it can neither be stopped nor turned back by the patient's will. At the same time it is not like a

dream or hallucination. The person knows that he is lying on the operation table and is not tempted to talk to people he sees in his vision. Such images seem to approach the completeness of scenes directly perceived in the physical environment; like that outer visual world, they seem to have the character of something objectively given, which can be explored by active perception the way one scrutinizes a painted or real landscape. In this respect, they can also be compared with afterimages. The ghostly white square that appears after a person has stared at a black one turns up without any initiative of the observer. He can neither control nor modify it, but he can use it as a target for active perception. Eidetic images seem to be of this kind. They behave like the projections of stimuli rather than like products of the discerning mind. Therefore, they can serve as material for thought but are unlikely to be a suitable instrument of thought.

The kind of "mental image" needed for thought is unlikely to be a complete, colorful, and faithful replica of some visible scene. But memory can take things out of their contexts and show them in isolation. Berkeley, who insisted that generic mental images were inconceivable, admitted nevertheless that he was "able to abstract in one sense, as when I consider some particular parts or qualities separated from others, with which, though they are united in some object, yet it is possible they may really exist without them." He could, for example, imagine "the trunk of a human body without the limbs." This sort of quantitative difference between the memory image and the complete array of stimulus material is the easiest to conceive theoretically. It leaves untouched the notion that perception is a mechanical copy of what the outer world contains and that memory simply preserves such a copy faithfully. The mind, we are told, can cut pieces from the cloth of memory, leaving the cloth itself unchanged. It can also make collages from memory material, by imagining centaurs or griffins. This is the crudest concept of imagination or fantasy—a concept that concedes to the human mind nothing more creative than the capacity to combine mechanically reproduced "pieces of reality."

Incompleteness is indeed frequently reported in memory experiments. Kurt Koffka tells in an experimental study of 1912 that one of his observers, asked to respond to the stimulus word *jurist*, stated: "All I saw was a briefcase held by an arm!" Even more frequently, an object, or group of objects, appears in memory on

empty ground, completely deprived of its natural setting. I shall show soon that one cannot account for the refined abstractions commonly found in mental imagery by simply asserting that memory images often fail to reproduce some of the parts of the complete object. But even this unsophisticated procedure of abstraction by selection is not satisfactorily described by the theory implied in Berkeley's example.

There is a fundamental difference between Berkeley's "human body without limbs" and the jurist's arm holding the briefcase. Berkeley refers to a physically incomplete object—a mutilated trunk or a sculptured torso—completely perceived. In Koffka's example a complete object is incompletely perceived. The jurist is no anatomical fragment; but only a significant detail of him is seen. The difference is somewhat like that between a marble torso seen in broad daylight and a complete body partially revealed by a flashlight. This sort of incompleteness is typical of mental imagery. It is the product of a selectively discerning mind, which can do better than consider faithful recordings of fragments.

The paradox of seeing a thing as complete, but incompletely, is familiar from daily life. Even in direct perception, an observer glancing at a lawyer or judge might catch little but the salient feature of an arm carrying a briefcase. However, since direct perception always takes place against the foil of the complete visual world, its selective character is not evident. The memory image, on the other hand, does not possess this stimulus background. Therefore it is more evidently limited to a few salient features, which correspond perhaps to everything the original visual experience amounted to in the first place or which are the partial components the observer drew from a more complete trace when he was asked to visualize a jurist. It is as though, for the purpose of imagery, a person can call on memory traces the way he calls on stimulus material in direct perception. But since mental images can be restricted to what the mind summons actively and selectively, their complements are often "amodal," that is, perceived as present but not visible.

The capacity of the mind to raise parts of a memory trace above the threshold of visibility helps to respond to the question: How can conceptual thinking rely on imagery if the individuality of images interferes with the generality of thought? The first answer is that mental images admit of selectivity. The thinker can focus on what is relevant and dismiss from visibility what is not. However, this

answer takes care only of the crudest definition of abstraction, namely, generalization through the picking out of elements. A closer look at the experimental data makes us suspect that mental imagery is actually a much subtler instrument, capable of serving a less primitive kind of abstraction.

Berkeley had no difficulty in admitting the existence of fragmentary mental images. But he saw that fragmentation was not sufficient to produce the visual equivalent of a concept. In order to visualize the concept of a horse, more was needed than the ability to imagine a horse without a head or without legs. The image had to leave out all references to attributes in which horses differ; and this, Berkeley contended, was inconceivable.

When, early in our century, the experiment was actually made, several reliable investigators, working independently, found that generality was precisely what observers attributed to the images they saw. Alfred Binet subjected his two young daughters, Armande and Marguerite, to prolonged and exacting enquiries. At one occasion, he had Armande observe what happened when he uttered the word *hat*. He then asked her whether she had thought of a hat in general or of a particular hat. The child's answer is a classic of introspective reporting: "C'est mal dit: en général—je cherche à me représenter un de tous ces objets que le mot rassemble, mais je ne m'en représente aucun." ('In general' expresses it badly: I try to represent to myself one of all the objects that the word brings together, but I do not represent to myself any one of them). Asked to respond to the word *snow*, Marguerite first visualizes a photograph, then "I saw the snow falling . . . in general . . . not very clearly." Binet notes that Berkeley is being refuted when one of the girls reports "a lady, who is dressed, but one cannot tell whether her dress is white or black, light or dark."

Koffka, using a similar procedure, obtained many *Allgemeinvorstellungen* (generic images), which were often quite "indistinct"—a waving tricolor flag, rather dark, no certainty as to whether the colors run vertically or horizontally; a train which one cannot distinguish as being a freight or passenger train; a coin of no particular denomination; a "schematic" figure, which might be male or female. (In a more recent study, *What People Dream About*, Calvin S. Hall found that in 10,000 dreams he collected from men and women 21 percent of the characters were not identified as to sex.)

In reading these experimental reports, one notices, in the formulations of the investigators as well as in those of their observers, a

tendency to get around the paradox of images that are particular and at the same time generic by describing these experiences as indistinct or unclear: You cannot tell whether the object is blue or red because the image is not sharp enough! Such a description tends to dismiss the phenomenon as a purely negative one, the implication being that if the observer could only discern the object a little better, he would be able to tell whether it is red or blue. But there is no such thing as a negative phenomenon. Either the incomplete image is experienced or it is not, and if it is, the challenge to Berkeley's contention is fully with us.

Visual hints and flashes

Among psychologists, Edward B. Titchener had the gift and the courage to say exactly what he saw, no matter how offensive his observations were to common sense theory. He reports in his *Lectures on the Experimental Psychology of the Thought-Processes* of 1909:

My mind, in its ordinary operations, is a fairly complete picture gallery,—not of finished paintings, but of impressionist notes. Whenever I read or hear that somebody has done something modestly, or gravely, or proudly, or humbly, or courteously, I see a visual hint of the modesty or gravity or pride or humility or courtesy. The stately heroine gives me a flash of a tall figure, the only clear part of which is a hand holding up a steely grey skirt; the humble suitor gives me a flash of a bent figure, the only clear part of which is the bowed back, though at times there are hands held deprecatingly before the absent face . . . All these descriptions must be either self-evident or as unreal as a fairy-tale.

This was the voice of a new era. As clearly as words permit, Titchener pointed out that the incompleteness of the mental image is not simply a matter of fragmentation or insufficient apprehension but a positive quality, which distinguishes the mental grasp of an object from the physical nature of that object itself. He thus avoids the stimulus-error or—as he rightly suggests it would better be called—the *thing-error* or *object-error*, that is, the assumption that the mind's account of a thing is identical with all or some of the thing's objective properties.

The reference to painting and to Impressionism is significant. Titchener's descriptions of visual experience differ as fundamentally from those of other psychologists as did the paintings of the Im-

pressionists from those of their predecessors. In spite of the considerable liberties which artists before the generation of Edouard Manet took in fact with the objects they portrayed, the accepted convention held that a picture had to be intended as a faithful likeness. Only with the Impressionists did aesthetic theory begin to accept the view that the pictorial image is a product of the mind rather than a deposit of the physical object. The realization that the image differs in principle from the physical object lays the groundwork for the doctrine of modern art. A similar fundamental break with tradition occurs in the psychology of visual experience a few decades later.

The comparison with Impressionist painting can also help us to understand the nature of Titchener's "visual hints" and "flashes." Instead of spelling out the detailed shape of a human figure or a tree the Impressionist offered an approximation, a few strokes, which were not intended to create the illusion of the fully duplicated figure or tree. Rather, in order to serve as the stimulus for the intended effect, the reduced pattern of strokes was to be perceived as such. However, one would again commit the stimulus-error if one identified the resulting experience with the strokes that provoked it. The intended results were in fact hints and flashes, indicators of direction and color rather than defined outlines or patches. The assembly of colored strokes on the canvas was responded to by the beholder with what can only be described as a pattern of visual forces.

The elusive quality of such experiences is hard to capture with our language, which commonly describes objects by their tangible, material dimensions. But it is a quality invaluable for abstract thought in that it offers the possibility of reducing a theme visually to a skeleton of essential dynamic features, none of which is a tangible part of the actual object. The humble suitor is abstracted to the flash of a bent figure. And this perceptual abstraction takes place without removal from the concrete experience, since the humble bend is not only understood to be that of the humble suitor but seen as the suitor himself.

Note that these images, although vague in their outlines, surfaces, and colors, can embody with the greatest precision the patterns of forces called up by them. A popular prejudice has it that what is not sharply outlined, complete, and detailed is necessarily imprecise. But in painting, for example, a sharply outlined portrait by Holbein or Dürer is no more precise in its perceptual form than the tissue of

strokes by which a Frans Hals or Oskar Kokoschka defines the human countenance. In mathematics, a topological statement or drawing identifies a spatial relation such as *being contained in* or *overlapping* with the utmost precision although it leaves the actual shapes entirely undetermined. In logic, nobody contends that the generality of a concept makes for vagueness because it is devoid of particularized detail; on the contrary, the concentration on a few essentials is recognized as a means of sharpening the concept. Why are we reluctant to admit that the same can be true for the mental image? In the arts, the reduction of a human figure to the simple geometry of an expressive gesture or posture can sharpen the image in precisely this way. Why should it not do the same in mental imagery? Here again an observation of Titchener's can be of help. He invited his students to compare an actual nod of the head with the mental nod that signifies assent to an argument, or the actual frown and wrinkling of the forehead with the mental frown that signifies perplexity. "The sensed nod and frown are coarse and rough in outline; the imaged nod and frown are cleanly and delicately traced."

To be sure, a sketchy image, painted on canvas or seen by the mind's eye, can be imprecise and confused, but so can the most meticulously detailed picture. This is a matter of shapelessness rather than of lack of detail or precision. It depends on whether or not the structural skeleton of the image is organized and orderly. The composite pictures of healthiness, illness, criminality, or family character which Francis Galton obtained by superimposing the portrait photographs of many individuals are fuzzy and unenlightening because they are shapeless, not because they are blurred.

How abstract can an image be?

So far I have referred to mental images of physical objects, such as human figures or landscapes. Some of these images, however, had been evoked by abstract concepts such as modesty or gravity or pride. Also, the visual content of some of these images had been reduced to mere flashes of shape or direction, so that what was actually seen could hardly be described as a likeness of the object. The question arises: How abstract can a mental image be?

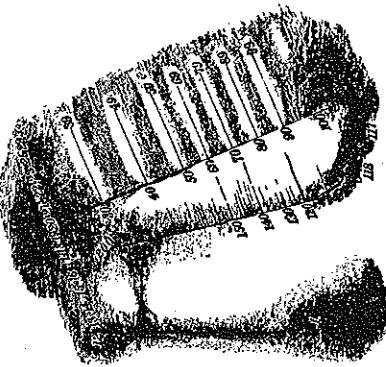
Synesthesia come to mind because they commonly involve non-mimetic images. In cases of *audition colorée* or color hearing, a

83 Inquiries into Human Faculty

I give woodcuts of representative specimens of these forms, and very brief descriptions of them extracted from the letters of my correspondents. Sixty-three other diagrams on a smaller scale will be found in Plates I., II. and III., and two more which are coloured are given in Plate IV.

D. A. "From the very first I have seen numerals up to

nearly 200, range themselves always in a particular manner, and



In thinking of a number it always takes its place in the figure. The more attention I give to the properties of numbers and their interpretations, the less I am troubled with this clumsy framework for them, but it is indebtable in my mind's eye even when for a long time less consciously so. The higher numbers are to me quite abstract and unconnected with a shape. This rough and untidy production is the best I can do towards representing the idea.

1. The engraver took much pains to interpret the meaning of the

rather faint but carefully made drawing, by strengthening some of the shades.

The result was very satisfactory, judging from the author's

own view of it, which is as follows:—Certainly if the engraver has

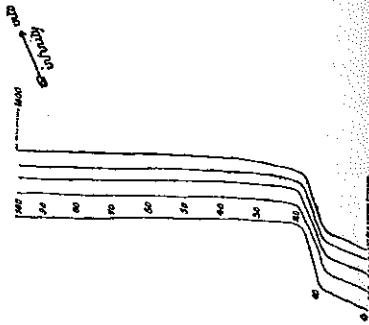
been as successful with all the other representations as with that of my

shape and its accompaniments, your article must be entirely correct.

Number-Forms

84

senting what I see. There was a little difficulty in the performance, because it is only by catching oneself at unaware, so to speak, that one is quite sure that what one sees is not affected by temporary imagination. But it does not seem much like, chiefly, because the mental picture never seems *on* the hat but *in* a thick, dark gray atmosphere deepening in certain parts especially where I emerge, and about 20. How I get from 100 to 120 I hardly know, though if I could require these figures a few times without thinking of them on purpose, I should soon notice. About 200 I lose all framework. I do not see the actual figures very distinctly, but what there is of them is also nearly entirely dependent on a clear mental vision of their *place* in the diagram. This as nearly as I can draw it, is the following:—



T. M. "The representation I carry in my mind of the numerical series is quite distinct to me, so much so that I cannot think of any number but I at once see it (as it were) in its peculiar place in the diagram. My remembrance of dates is also nearly entirely dependent on a clear mental vision of their *place* in the diagram. This as nearly as I can draw it, is the following:—

person will see colors when he listens to sounds, especially music. In general, these visual sensations fail to make music more enjoyable or more understandable even when tones evoke the same colors somewhat consistently. On the other hand, the attempts to accompany music with moving colored shape (Oskar Fischinger, Walter Ruttmann, Norman McLaren) have been strikingly successful when the common expressive characteristics of motion, rhythm, color, shape, musical pitch, strengthened each other across sensory boundaries. Whether or not such combinations of sensory modes are helpful or disturbing depends largely on whether structural correspondences can be experienced among them.

The same holds true when theoretical concepts, such as the number series or the sequence of the twelve months are accompanied with color associations or spatial arrangements. These accompaniments, too, appear quite spontaneously in some persons, as Francis Galton established in his famous inquiries into imagery, of which a sample page is given in Figure 17. They also can be quite stable. But although they are sometimes used as mnemonic aids, there is no indication that they are of help in the active handling of the concepts. This is so because the structural relations among the visual counterparts do not seem to illustrate those among the concepts. One of the Fellows of the Royal Society whom Galton interviewed saw the number series from zero to a hundred habitually arranged in "the shape of a horseshoe, lying on a slightly inclined plane, with the open end towards me," and with the numeral 50 located on the apex. No benefit to the professor's arithmetic is likely to have come from this image.

Theoretical concepts are not handled in empty space. They may be associated with a visual setting. The images resulting from these associations may appear more accidental than they actually are. Titchener, after sitting on the platform behind "a somewhat emphatic lecturer, who made great use of the monosyllable 'but'" had his "feeling of but" associated ever afterward with "a flashing picture of a bald crown, with a fringe of hair below, and a massive black shoulder, the whole passing swiftly down the visual field, from northwest to southeast." Although Titchener himself cites this example as an instance of association by circumstance, the image may have taken so firmly to the concept because there was an intrinsic resemblance of the barrier character of "but" and that of the turned-away speaker and his massive black shoulder. And

Figure 17. From Galton: *Inquiries into Human Faculty and Its Development*.

although the image is not likely to have helped Titchener's reasoning, it will have sharpened his sensitivity to the dynamic quality of "but"-clauses, i.e., to the kind of brake these clauses impose on affirmative statements.

Some visualizations of theoretical concepts can be described as routine metaphors. Herbert Silberer has reported on the "hypnagogic states" which he frequently experienced when he made an effort to think but was hampered by drowsiness. Once, after a futile effort to confront Kant's and Schopenhauer's philosophy of time, his frustration expressed itself spontaneously in the image of a "morose secretary" unwilling to give information. At another occasion, when he was about to review an idea in order not to forget it, he saw, while falling asleep, a lackey in livery, standing before him as though waiting for his orders. Or, after pondering how he might improve a halting passage in his writing, he saw himself planing a piece of wood. Here the images reflect an almost automatic parallelism among attitudes of the mind and events in the physical world. Rather similar examples are cited in Darwin's studies on the expression of emotion. While a person is struggling with an irritating problem of thought he may scratch his head, as though trying to assuage a physical irritation. The organism functions as a whole, and the body produces a physical equivalent of what the mind is doing. In Silberer's hypnagogic states, the physical counterpart is conjured up by spontaneous imagery.

This sort of simple-minded illustration may be more of a distraction than a help to the thinker. When Galton discovered, to his astonishment, that "the great majority of the men of science to whom I first applied protested that mental imagery was unknown to them" he finally concluded that "an overready perception of sharp mental images is antagonistic to the acquirement of habits of highly-generalized and abstract thought, especially when the steps of reasoning are carried on by words as symbols, and that if the faculty of seeing the pictures was ever possessed by men who think hard, it is very apt to be lost by disuse."

But there is only a fine line between the pedestrian explicitness of the illustrative image and the power of a well chosen example to test the nature and consequences of an idea in a kind of thought experiment. Thinking, I said earlier, can deal with directly perceived objects, which often are handled physically. When no objects are

present, they are replaced by some sort of imagery. These images need not be lifelike replicas of the physical world. Consider the following instance from Silberer's half-dreams. In the twilight state of drowsiness he reflects on "transsubjectively valid judgments:" Can judgments be valid for everybody? Are there some that are? Under what conditions? Obviously there is no other way of searching for the answers than to explore pertinent test situations. In the drowsy thinker's mind there arises suddenly the image of a big circle or transparent sphere in the air with people surrounding it, whose heads reach into the circle. This is a fairly schematic visualization of the idea under investigation, but it also makes its basic structural theme metaphorically tangible: the dwelling of all heads in a common realm, the exclusion of the bodies from this community, etc. It is something of a working model. The image presents natural objects—human figures, a sphere—but in a thoroughly unnatural constellation, not realizable on our gravity-ridden earth. The visual constellation is dictated by the dominating idea in the mind of the dreamy thinker. The centric symmetry of the converging figures is a simple, clear, most economical representation of "shared judgments," brought about without any concern for what is feasible in practical space. Also the transparency of the sphere, this paradoxical solid into which heads can reach, indicates that the image is physically tangible only to the extent that suits the thought and is compatible with it. While thoroughly fantastic as a physical event, the image is strictly functional with regard to the idea it embodies.

Galton, although critical of "overready perception of sharp mental images," realized that there was no reason to starve the visualizing faculty. He suggested that if this faculty is free in its action and not tied to reproducing hard and persistent forms "it might then produce generalized pictures out of its past experience quite automatically."

If objects can be reduced to a few essential flashes of direction or shape, it seems plausible that there can be even more abstract patterns, namely, configurations or happenings which do not portray any of the inventory of the physical world at all. In the arts, our century has produced nonrepresentational painting and sculpture. I pointed to Impressionism when I referred to Titchener's descriptions of imagery; and indeed one can date with some precision the phase of modern painting corresponding to some of his examples:

"Horse is, to me, a double curve and a rampant posture with a touch of mane about it; cow is a longish rectangle with a certain facial expression, a sort of exaggerated pout." But Titchener can sound even more modern. He describes the "patterns" aroused in him by a particular writer or book: "I get a suggestion of dull red . . . of angles rather than curves; I get, pretty clearly, the picture of movement along lines, and of neatness or confusion where the moving lines come together. But that is all,—all, at least, that ordinary introspection reveals." While Titchener was recording his introspections, artists such as Wassily Kandinsky were exploring the mysterious zone between the representational and the abstract. Titchener visualizes the concept of "meaning": "I see meaning as the blue-grey tip of a kind of scoop, which has a bit of yellow above it (probably a part of the handle), and which is just digging into a dark mass of what appears to be plastic material"—an image that would have qualified for exhibition at Kandinsky's *Blue Rider*.

How much modern art had Titchener seen and absorbed? I do not know, but in the instances I have cited he was surely able to look at the outer and the inner worlds of the mind in the spirit of the modern painters. This was not true for the average person, including the average psychologist. Up to our day it is not uncommon for psychologists, especially in dealing with perception, to speak about artists as though they were engaged in producing illusions of physical reality. For the psychologists who conducted the experiments on "imageless thought" as well as for their observers, an image was probably the sort of thing known from realistic illustrations or posters. If they looked at the famous paintings of the past—a Raphael, a Rembrandt, or even a Courbet—with the usual prejudice and without much care, they saw explicitly complete replicas of nature, landscapes and interiors, still lifes and human figures. Were they likely to acknowledge the presence of highly abstract patterns in their minds if by images they meant something completely different? Théodule Ribot, who collected nine hundred replies, gives only an occasional example of non-mimetic patterns; one of his observers saw the infinite represented by a black hole. Not surprisingly, one looks in vain for evidence in the more recent work on the psychology of thinking, which shares with behaviorism a preference for external, observable manifestations.

In the experiments that led to the doctrine of imageless thought, imagery is unlikely to have been absent. But it may well have in-

volved many patterns more abstract than those described by Koffka or Binet. The latter studies hardly called for thinking. Images evoked by words such as *hat* or *flag* can be reasonably concrete, whereas the solution of theoretical problems more often than not requires highly abstract configurations, represented by topological and often geometrical figures in mental space. These non-mimetic images, often faint to the extent of being barely observable, are likely to have been the "nonsensuous content," those "nonsensorial feelings of relations" that gave so much trouble because of their paradoxical status. They may be quite common and indeed indispensable to any mind that thinks generic thoughts and needs the generality of pure shapes to think them. "I am inclined to believe," admitted Ribot, "that the logic of images is the prime mover of constructive imagination."

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 hour-glass 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 crash 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 hardness, 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-



Figure 18. Rhona Watkins. Woodcut (1966)

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,

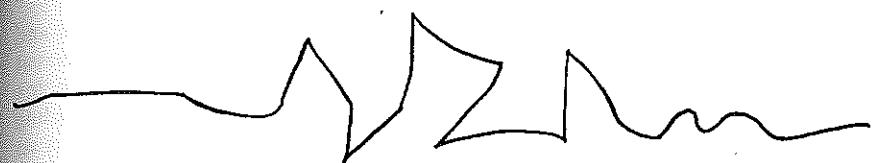


Figure 19

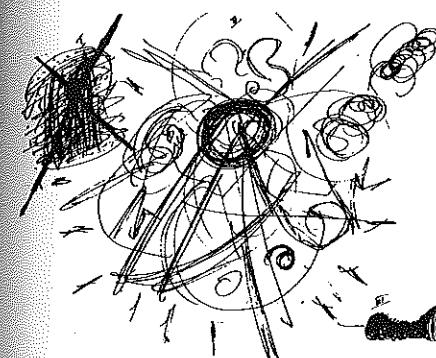


Figure 20. "The *past* has been nothing—it is forgotten, and when thought of once again it is an illusion; the past is covered with dust.—The *present* is everything—movement, joy, despair, hope, doubt—it is now; one lives in the present.—The *future* is unknown."

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

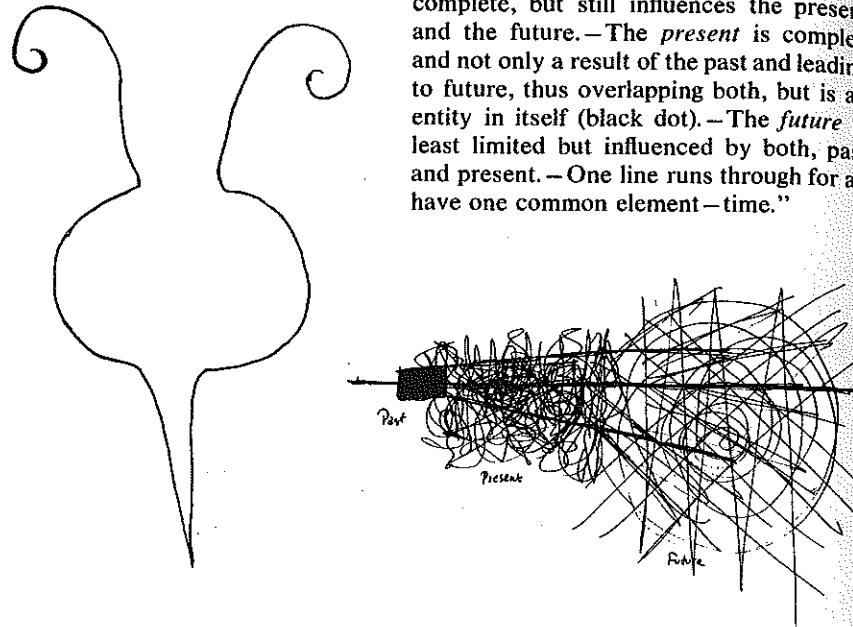


Figure 21

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 over-lay 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

Figure 22, below. "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."

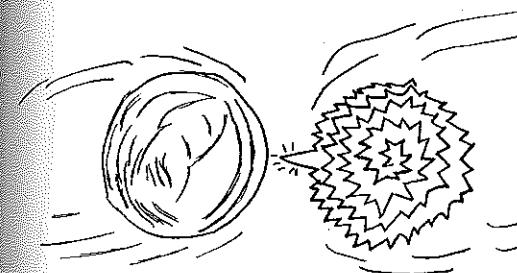


Figure 23

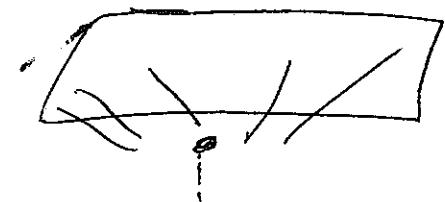


Figure 24. "Here is a picture of my mother (top) and father (bottom). Although neither shape is particularly revolting in itself, the combination makes for an exaggeration of both forms, so that the top becomes more overpowering when placed next to the bottom form. And the bottom form diminishes in relation to the upper. Ugh!"

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

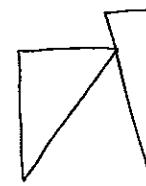
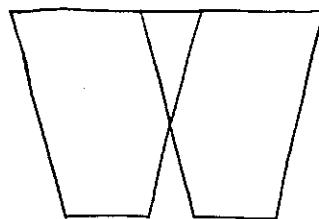


Figure 25

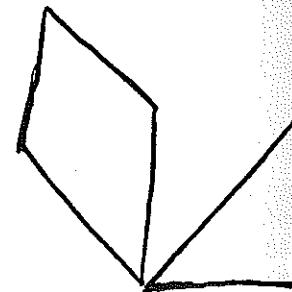


Figure 26

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

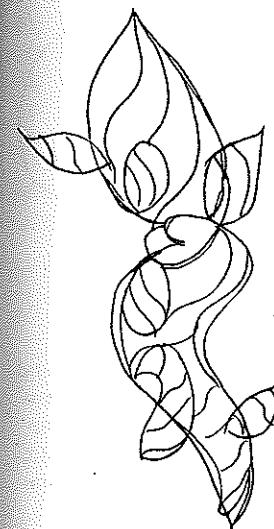


Figure 27



Figure 28, above. "Good marriage: Smoothness and harmony; an easy and pleasant life. Bad marriage: Ups and downs, uneasy path in life. A rough life."

Figure 29, below. Left, good marriage; right, bad marriage.



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 con-nubial 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-

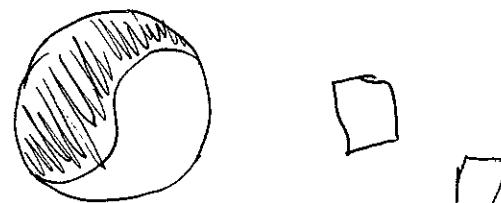


Figure 30. Left, good marriage; right, bad marriage.

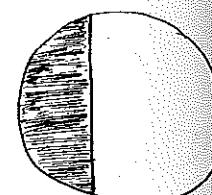


Figure 31

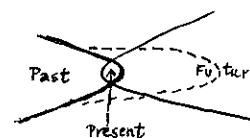


Figure 32. "The *past* has happened and is definite, therefore the darker line. *Present* exists where past and future overlap. *Future* develops from past and is indefinite, therefore the lighter line. The past constantly affects the future: dotted line."

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—if 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 as 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."

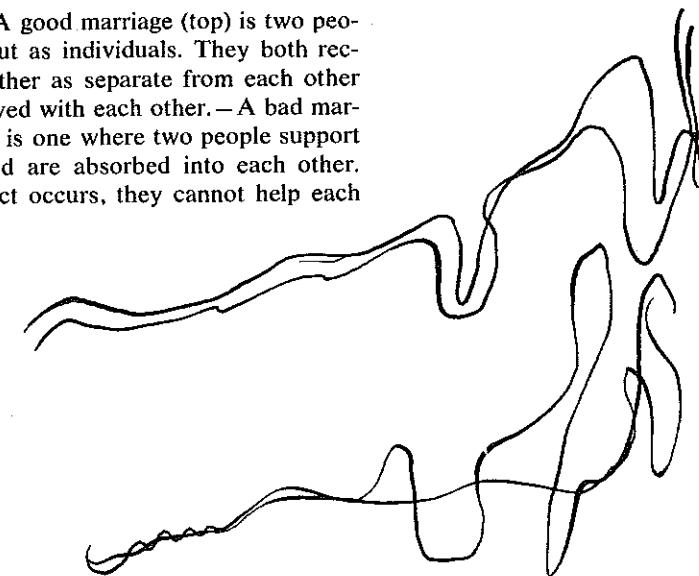
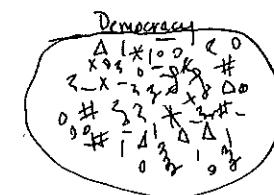


Figure 34. "Equality among individuals."

Fig. 35. "All types can fit into system (outer circle) in harmony and without losing their identities as individual entities, both persons and concepts. All contribute to the whole."



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-

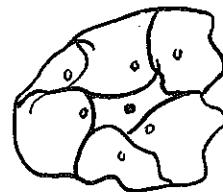


Figure 36. "Individuals who think more freely but are restricted when they come in contact with spheres of others."

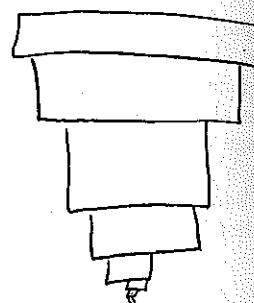


Figure 37

ing about social coexistence at a very elementary level. Figure 36 is more elaborate in that it describes dynamically the deformations of individuals resulting from the uninhibited push and pull of human intercourse. The individual differences of shape are seen here as the result of free interaction, and the State is nothing but the sum of what neighbors do to each other. There is little organization and no government. The drawing is done from the outside in: the center is what remains after the individual pushes have exerted themselves.

On the contrary, pyramids of various shapes describe a hierarchic structure of democratic society (Figure 37). They stand on their base or tip, depending on whether the masses or the head of the state are envisaged as the ruler. However, they are statically limited to shape because they define the hierarchy only by diminishing quantity: the many are governed by the few. Vectors are often added in mandala or sunburst patterns, which show the centric organization of democracy. In Figure 38, the arrows run from the peripherally placed citizens, who are described by the variety of their differences, toward the center, thus indicating the contribution of the citizens to the government. That center, however, is empty. The government is nobody, and no arrows of control lead from the center to the governed. Individuals are given the right to authority but are not subjected to it.

Informal though these experiments are they show that educated young adults approach without much difficulty the task of representing abstract concepts by means of non-mimetic drawings. Quite clearly also, these abstractions go to the core of the themes. Of course, in thinking about the nature of the concepts to be drawn,

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.

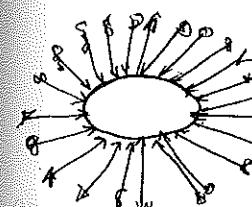


Figure 38. "Everyone free to take part in government. Great difference in background."

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

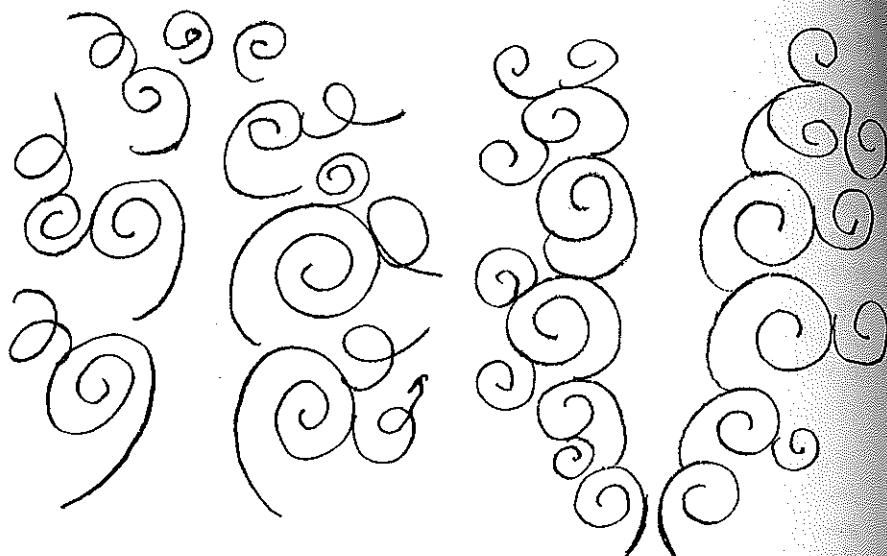


Figure 39

Figure 40

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

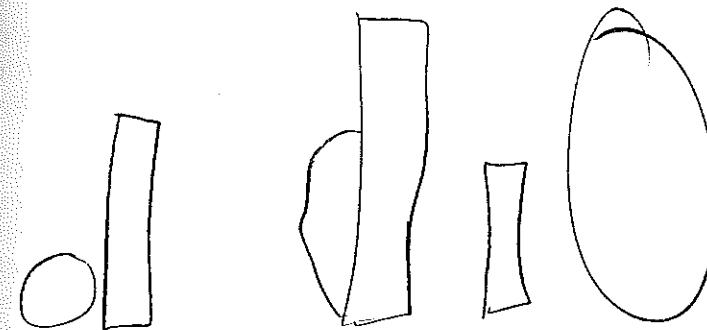


Figure 41

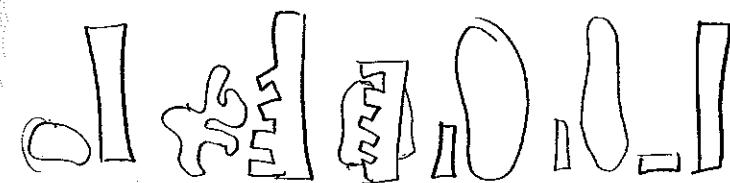


Figure 42

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

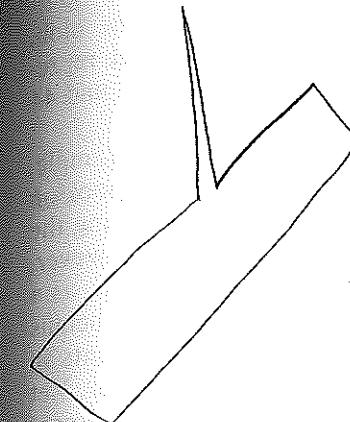


Figure 43

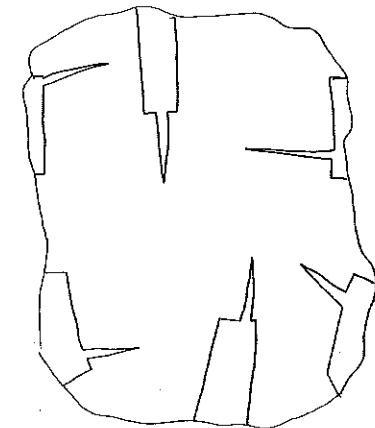


Figure 44

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.

8.

Pictures, Symbols, and Signs

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

three terms so tangibly that the reader will know what I mean by them.

The three terms—picture, symbol, sign—do not stand for kinds of images. They rather describe three functions fulfilled by images. A particular image may be used for each of these functions and will often serve more than one at the same time. As a rule, the image itself does not tell which function is intended. A triangle may be a sign of danger or a picture of a mountain or a symbol of hierarchy. We need to know how well or badly various kinds of images fulfill these functions.

An image serves merely as a *sign* to the extent to which it stands for a particular content without reflecting its characteristics visually. In the strictest sense it is perhaps impossible for a visual thing to be nothing but a sign. Portrayal tends to slip in. The letters of the alphabet used in algebra come close to being pure signs. But even they stand for discrete entities by *being* discrete entities; a and b portray twoness. Otherwise, however, they do not resemble the things they represent in any way, because further specification would distract from the generality of the proposition. On the other hand, signs possess visual characteristics derived from requirements other than those of portrayal, that is to say, they appear as they do for good reasons. The 1926 international convention on road signs decided that all traffic signs warning of danger should be given a triangular shape. Perhaps the sharpness of a triangle makes it look a bit more like danger than would, say, a circle, but its shape was chosen mainly because it is easily identified in itself and distinguished from other signs. In written language, the variety of letter groups used to designate words serves similar purposes of identification and distinction, and therefore letters and words are, to this extent, signs. Many words fail to fulfill their function well because languages are not created rationally but grow informally and produce accidental, arbitrary, adulterated shapes. Words can be ambiguous; for example, *pupil* refers to schoolchildren and to holes in the eyes, since the original connotation of smallness has been split up into different meanings. Apart from such imperfections, however, the characteristics of signs tend to be selected in such a way as to serve their function. In this sense, they are not arbitrary. The previously mentioned “innate releasing mechanisms” in biology are signs. Konrad Lorenz says of these visual releasers that their simplicity of shape and color makes them distinct in appearance and “improbable” in occurrence, that is, unlikely to be confused with other things visible in the environment.

“Improbability” in occurrence, that is, unlikely to be confused with other things visible in the environment.

To the extent to which images are signs they can serve only as indirect media, for they operate as mere references to the things for which they stand. They are not analogues, and therefore they cannot be used as media for thought in their own right. This will become evident in the discussion of numerals and verbal languages, which are the sign media *par excellence*.

Images are *pictures* to the extent to which they portray things located at a lower level of abstractness than they are themselves. They do their work by grasping and rendering some relevant qualities—shape, color, movement—of the objects or activities they depict. Pictures are not mere replicas, by which I mean faithful copies that differ from the model only by random imperfections.

A picture can dwell at the most varied levels of abstractness. A photograph or a Dutch landscape of the seventeenth century may be quite lifelike and yet select, arrange, and almost unnoticeably stylize its subject in such a way that it focuses on some of the subject’s essence. On the other hand, a totally non-mimetic geometrical pattern by Mondrian may be intended as a picture of the turmoil of New York’s Broadway. A child may capture the character of a human figure or a tree by a few highly abstract circles, ovals, or straight lines.

Abstractness is a means by which the picture interprets what it portrays. This precious accomplishment is ignored if one pretends that an abbreviated representation invites the beholder to fill in the missing realistic detail. If this were true, a simply drawn cartoon or caricature would produce a particularly active response of this kind. The assertion is based on no evidence; it is simply inferred from the traditional notion that perception consists in a complete recording of the visual field and that therefore a percept of “incomplete” material will be completed by the mind from the stores of past experience. If this were so, all pictures would be transformed subjectively by the beholder into mechanically faithful replicas. The “incompleteness” would be remedied. But abstractness is not incompleteness. A picture is a statement about visual qualities, and such a statement can be complete at any level of abstractness. To be sure, when the picture is incomplete, imprecise, or ambiguous with regard to these abstract qualities, the observer is called upon to make his own decisions about what he sees. (This

is true, for instance, for the inkblots of the Rorschach Test or the pictures of the Thematic Apperception Test, used by psychologists to induce subjective interpretations.)

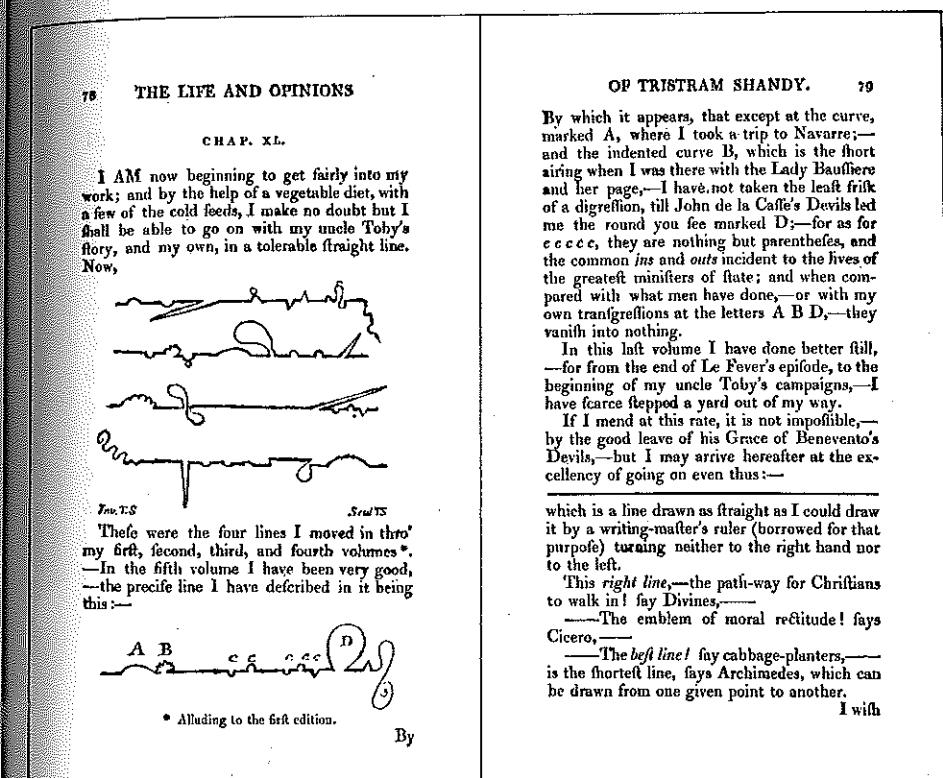
Fortunately, "completion" by "imagination" is all but impossible and the desire to attempt it quite rare. A cartoon is seen at exactly the level at which it is drawn. Its forceful liveliness does not derive from supplements contributed by the observer but is made possible, on the contrary, by the intense visual dynamics of simplified line and color. It is true that the abstract style of such pictures removes their subject matter from physical reality. Human traits and impulses appear, unencumbered by physical matter and free from the tyranny of gravitation and bodily frailty. A blow on the head is an abstract assault responded to by an equally abstract expression of distress. In other words, the pictorial interpretation emphasizes the generic qualities with which all thinking is concerned—a kind of unreality quite different from that of miraculous, superhuman tales, which are generally represented with realistic faithfulness. The latter endow nonexistent forces with material bodies whereas the former extract constituent forces from physical substance.

An image acts as a *symbol* to the extent to which it portrays things which are at a higher level of abstractness than is the symbol itself. A symbol gives particular shape to types of things or constellations of forces. Any image is, of course, a particular thing, and by standing for a kind of thing it serves as a symbol, e.g., if it presents a dog in order to show what the concept *dog* is. In principle, any specimen or replica of a specimen can serve as a symbol, if somebody chooses to use it that way. But in such cases, the image leaves the effort of abstracting entirely to the user. It does not help him by focusing on relevant features. Works of art do better. For example, Ambrogio Lorenzetti's murals in the town hall of Siena symbolize the ideas of good and bad government by showing scenes of struggle and of prosperous harmony; and being works of art, they do so by inventing, selecting and shaping these scenes in ways that display the relevant qualities more purely than random views of town and country life would. Or, to use another example, Holbein's portrait of Henry VIII is a picture of the king, but it also serves as a symbol of kingship and of qualities such as brutality, strength, exuberance, which are located at a higher level of abstraction than is the painting. The painting, in turn, is more abstract than the visual appearance of the king in flesh and blood because it sharpens the formal features

of shape and color which are analogues of the symbolized qualities.

Symbolic functions can also be fulfilled by highly abstract images. The amateur drawings I discussed in the preceding chapter gave visible geometrical shape to the dynamic patterns characterizing ideas or institutions. The arrows by which physicists depict vectors show relevant qualities of forces, namely, their strength, direction, sense, and point of application. Musical notation operates partly by means of symbols; that is, it represents the pitch level of sounds by the structurally analogous location of the notes on the staff. In a similar way, drawings can symbolize a state of mind by translating some of its dynamic properties into visible patterns. Figure 45 shows a page from Sterne's *Tristram Shandy*, depicting the hero's straightforward intention modulated by a more or less erratic spirit.

Figure 45.



Images to suit their functions

Since images can be made at any level of abstraction, it is worth asking how well different degrees of abstractness suit the three functions here under discussion. I will limit myself to a few examples taken from the two extremities of the scale of abstraction. How about highly realistic images? As mentioned before, mere replicas may be useful as raw material for cognition but are produced by cognitive acts of the lowest order and do not, by themselves, guide understanding. Paradoxically, they may even make identification difficult, because to identify an object means to recognize some of its salient structural features. A mechanically produced replica may hide or distort these features. One of the reasons why persons brought up in cultures that are unacquainted with photography have trouble with our snapshots is that the realistic and accidental detail and partial shapelessness of such images do not help perception. It is a problem we shall meet again when we look at the so-called visual aids in education. Faithfulness and realism are terms to be used with caution because a *bona fide* likeness may fail to present the beholder with the essential features of the objects represented.

The human mind can be forced to produce replicas of things, but it is not naturally geared to it. Since perception is concerned with the grasping of significant form, the mind finds it hard to produce images devoid of that formal virtue. In fact, it is by the structural properties of lines and colors that even some "material" desires are best satisfied. For example, the mechanical faithfulness of artless color photography or painting is not the surest way of arousing sexual stimulation through the sense of sight. Sensuous pleasure is aroused more effectively by the smoothness of swelling curves, the tension animating the shapes of breasts and thighs. Without the dominance of these expressive forces the picture is reduced to the presentation of pure matter. To offer matter devoid of form, which is the perceptual carrier of meaning, is pornography in the only valid sense of the word, namely, a breach of man's duty to perceive the world intelligently. A harlot (Greek, *porné*) is a person who offers body without spirit.

As symbols, fairly realistic images have the advantage of giving flesh and blood to the structural skeletons of ideas. They convey a sense of lifelike presence, which is often desirable. But they may be inefficient otherwise because the objects they represent are, after all, only part-time symbols. A newspaper reported that one day,

some time ago, the Reverend January of the Zion Hill Baptist Church in Detroit took his four-year-old son, Stanley, to view a large mural, which had just been painted in the auditorium of a local school. "I see a train," said Stanley. "That track," said the Reverend January, "is the future coming toward us. The train is this country's unity, far off but bearing down on us." "No," said Stanley, "it's a train."

This disagreement between father and son arose because a train is not a full-time symbol. It is a piece of railway equipment, first of all, and acts as a symbol only by moonlighting—as an avocation, not advertised and therefore not necessarily recognized by the four-year-olds of our time nor by quite a few of their elders. The more lifelike a piece of sculpture or painting, the more difficult may the artist find it to make his point symbolically. Courbet's painting, *L'Atelier*, of 1855, presented groups of realistically painted persons surrounding the artist himself at work in his studio. The painting was subtitled *une allégorie réelle* and intended to show on one side the people of the practical life and on the other those concerned with feeling and thought, both equally arrested in a state of dreamlike suspension, while the painter alone, vigorously at work on a canvas, held the center as the only person actively dealing with reality. Werner Hofmann, in an extensive analysis of this painting, mentions that "the realists felt the allegorical implications to be superfluous, the symbolists thought them out of keeping with the very robustness of the style." Only by a careful and unprejudiced examination of the whole painting will the viewer come to realize that, for example, the nude woman watching the artist at work in his studio is not only his model, at the realistic level of the representation, but also the muse, the traditional allegory of truth, the fullness of life, all at the same time.

The dilemma becomes particularly poignant when an artist aspires to fantasy and deeper meaning but lacks the pictorial imagination to make such qualities visible. Examples can be found among the more pedestrian Surrealists. There is a painting by René Magritte showing a tediously painted tobacco pipe on empty ground and the inscription: *Ceci n'est pas une pipe*. Unfortunately a pipe is all it is. A similar problem arises from the unskillful use of *objets trouvés* in collages or sculpture. The beholder is confronted with the untransfigured presence of refuse. What he sees may inspire him to think, but the thought is not in the work. Yet, Picasso can evoke the very nature of a bull's head by simply combining the handlebar and the saddle of an old bicycle.

The more particular a concept, the greater the competition among its traits for the attention of the user. This becomes evident when traffic signs, posters, and similar pictorial indicators try to symbolize a limited point by means of a complex image. Martin Krampen has pointed to the example of a snail used in an older pictographic traffic sign to call for a reduction of speed. The fairly lifelike picture of the snail may indeed engage the driver's mind more vividly than the message "Reduce Speed," but Krampen notes that a snail is not only slow but also slimy, easily frightened, etc. Of course, the highway setting helps in picking out the relevant aspect, but the image itself offers no guidance for the selection.

The specificity of an image also calls for correspondingly specific knowledge in the person who is to understand it. Rudolf Modley notes that a traffic sign showing a pedestrian in Western clothing may be puzzling or unwelcome to drivers in a non-Western country and that the picture of an old-fashioned locomotive may let a driver of the young generation expect a museum of historical railroad engines rather than a crossing. Specific characterization can make it easier to identify the particular kind of thing if it is known to the observer but harder to draw forth a more abstract meaning.

At the other extremity of the scale of abstraction are highly stylized, often purely geometrical shapes. They have the advantage of singling out particular properties with precision. A simple arrow concentrates more efficiently on pointing than does a realistically drawn Victorian hand with fingernails, sleeve, cuff, and buttons. The arrow is also more nearly a full-time symbol and therefore invites the beholder to treat it as a statement rather than a piece of the practical world. However, highly abstract concepts, although narrow in intension, are broad in extension, that is, they can refer to many things. A drawing of two overlapping circles may be a picture of some physical object, such as a new type of pretzel or eyeglasses. It may be the ground-plan for a two-ring circus. It may also be a symbol of a good marriage or the brotherhood of nations. Still more generically, it may be meant to show the logical relation of any two overlapping concepts. Which of these meanings is aimed at, only the context can reveal.

This creates a problem in a civilization which constantly throws things together that do not belong together or puts them in places contradictory to their function. All the mobility, transportation, transmission, and communication in our century removes things

from their natural location and thereby interferes with their identification and efficiency. An apple makes its point more easily when seen in an orchard or fruit store. Placed in the company of hundreds of other household items, or advertised in the midst of heterogeneous matter, or talked about in places that have no relevance to fruit, the apple must make a much greater effort to be recognized and responded to. A palace or church crowning a hilltop town or introduced by an imposing vista, a triumphal arch placed at the crossing of a star of avenues are defined and helped by their location; whereas a traditional church building buried among New York skyscrapers not only receives no help but is refuted and derided by its setting. We pay for lack of redundancy in the environment by spending a greater effort on identifying the particular item or on making it identifiable.

A highly abstract design that bears little or no obvious resemblance to its referent must be restricted to a unique application or rely heavily on explanatory context. It is the context that will decide whether a cross is to be read as a religious or an arithmetical sign or symbol or whether no semantic function at all is intended, as in the crossbars of a window. It may take a powerful and prolonged effort to endow a simple design with a particular meaning, and even the most determined indoctrination may not exclude unwelcome associations. I remember that when Hitler visited Mussolini's Rome and the whole city was suddenly covered with Nazi flags an Italian girl exclaimed in horror: "Rome is crawling with black spiders."

The simple design of the swastika was sufficiently free of other associations to make it acceptable as a carrier of a new meaning. The imposition was so effective that in time the emblem came visually to contain and exude a highly emotional connotation it did not possess before. To be sure, the design was extremely well chosen. It met the ethological requirements of distinctness and striking simplicity. It conveyed the dynamics of the "Movement" by its tilted orientation in space. The black figure in a white and red setting helped revive the colors of the German Empire and thereby appealed to nationalism. In the Nazi flag, red became the color of revolution, and the black was frightening like the storm-troopers' shirts. The swastika had the straight-edged angularity of Prussian efficiency, and its clean geometry was, ironically, in keeping with the modern taste for functional design. For the educated, there was also the reference to the Aryan race evoked by the symbol from

India. The pressures of the social context did the rest. No wonder a recent writer, Jay Doblin, has credited Hitler, "the frustrated artist," with having become "the trademark designer of the century."

What trademarks can tell

Commercial trademark designers cannot rely on the powerful social forces that were at Hitler's command. What makes their task all the more difficult is that in most cases they cannot make their designs self-explanatory. The taste and style of our time associates successful business with clean-cut, starkly reduced shape, and the disorder and rapidity of modern living calls for stimuli of split-second efficiency. The problem is that a pattern of high abstractness fails to specify its referent, whereas the identification of a particular company, brand, institution, idea, is the purpose of advertising. Doblin cites experiments to show that the "logotype," that is, the verbal name or slogan presented in commercial design, is identified by consumers more readily than the trademark. In fact, the presence of the trademark may decrease the number of correct responses to the logotype. Doblin concludes that "from a communications viewpoint a trademark, for most companies, is not only a waste of time but can actually become a detriment." Whatever the validity of this argument, it illustrates the peculiar character of highly abstract patterns.

The inability of such patterns to specify a particular application brings to mind similar findings in experiments on the meaning of music. For example, in order to determine whether the "intentions of composers" can be gathered from their works, Melvin G. Rigg played a number of recordings, taken mostly from classical opera, and asked listeners to match them with descriptions listed on a questionnaire as to their generic mood (sorrowful, joyful), their overall subject category (death, religion, love, etc.), and their specific program (farewell, prayer, Good Friday music, spinning song, moonlight, etc.). The listeners did well at the highest level of abstraction but poorly at the lowest. To conclude from that, as Rigg did, "that the intentions of composers usually do not 'get over' in any specific way to the cultural strata of our population" is to misinterpret the nature of music and its relation to specific program content. The cognitive virtue of music derives precisely from the high level of abstractness at which it depicts patterns of forces. These patterns in themselves do not point to any particular "applica-

tion" but can be made to interpret such instances. Program music, the portrayal of narrative subject matter by sounds, has never been more than an awkward curiosity, exactly because it attempts to depict a particular content through a generic medium. Inversely, in an opera or as accompaniment to a theater play or film, music serves to give shape to the generic inherent in the particular. In the words of Schopenhauer, "music demonstrates here its power and higher aptitude by offering the deepest, ultimate, and most secret revelations about the feelings expressed in the words or the action which the opera represents, and discloses their proper and true essence. Music acquaints us with the intimate soul of the happenings and events of which the stage gives us no more than the husk and body."

Visual images have similar virtues and weaknesses. Just as Saint-Saëns' music cannot hope to identify *Omphale's Spinning Wheel*, trademarks and other such emblems cannot identify a particular product or producer. Identification can only be obtained by what the men in the trade call "strong penetration," that is, insistent re-enforcement of the association of signifier and referent, as exemplified by religious emblems (Cross, Star of David), flag designs (Canada's maple leaf, Japan's rising sun), or the Red Cross. Therefore, to test the value of trademarks independently of the context that ties them to their owners is like evaluating a diagram on the classroom blackboard without reference to the professor's explanatory speech.

The color blue a lady is wearing may be experienced by an observer as an essential feature of her personality; but that color by itself may in no way invoke the image of the lady. Thus, a good trademark can strengthen the individual character of its wearer by a striking sensory supplement without evoking that reference by itself. When I meet the trademark designed by Francesco Saroglia for the International Wool Secretariat (Figure 46) I may not identify it, because its supple, flexible, smooth shapes portray a very generic quality. It has an elegance deliberately chosen to counteract the connotation of stodgy tweeds, but it is not specific to wool. In the proper context, the simple design focuses on these essential and desirable properties in a tangible, concentrated fashion, helpful to the intended message.

A good modern trademark interprets the character of its wearer by associating it with sharply defined patterns of visual forces. The

well-known emblem of the Chase Manhattan Bank designed by Chermayeff and Geismar may serve as an example (Figure 47). The inner square and the outer octagon produce a centrally symmetrical figure, conveying the sense of repose, compactness, solidity. Closed like a fortress against interference and untouched by the changes and vicissitudes of time, the little monument is built of sturdy blocks defined by parallel straight edges and simple angles. At the same time, it has the necessary vitality and goal-directedness. The pointed units contribute dynamic forces which, however, do not displace the figure as a whole but are confined within the stable, directionless framework. The antagonistic movements compensate



Figure 46

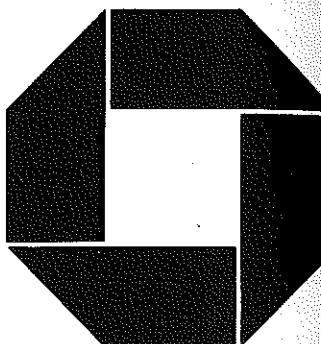


Figure 47

each other to an overall enlivened stillness or add up to the steady, contained rotation of a motor. Furthermore, the four components are tightly fitted into the whole but at the same time preserve an integrity of their own, thus showing multiplicity of initiative, executed by elements, whose individuality is limited, however, to a difference of position in the whole. In addition, the figure is usefully ambiguous in the connection of the four elements. Seen as right-angular blocks with a corner clipped off, the four fit each other like bricks in a wall. Seen as four symmetrical prisms they overlap each other and thereby interlock. The delicate balance between adjoining each other and interacting with each other by cooperative clasp further illustrates the nature of the internal organization.

To some extent, so highly abstract an image will always have the chill of remoteness. It cannot give the sensuous fluffiness of wool conveyed by a good color photograph or realistic painting. It cannot show the bustle of the bank, its people, its splendid halls.

On the other hand, it need not limit itself to the mere identification of relevant structural properties. Any design has dynamic qualities, which contribute to characterizing the object. Simple shapes can evoke the expressive qualities of suppleness or vitality or harmony. This sort of evocation is indispensable in art. The emblems here discussed dwell curiously between art and the cognitive functions of mere identification and distinction. An emblem may be a perfectly acceptable analogue of the referent for which it stands, and yet it may not intend to evoke its dynamic impact or not succeed in doing it.

This is particularly evident when the referent has strong emotional connotations. Figures 48 and 49 give two examples, the one

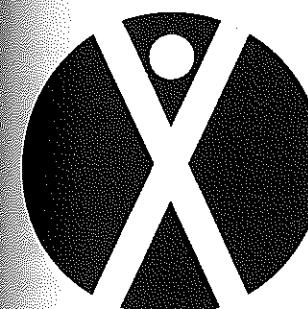


Figure 48



Figure 49

Ernst Roch's proposal of an emblem for the Canadian World's Fair of 1967, the other designed by Saul Bass for the Committee for a Sane Nuclear Policy. Both are most distinctive and display attractive intelligence in reducing the objects they depict to simply defined visual patterns. Roch's design, in which Leonardo's famous drawing of the Vitruvian man reverberates, was intended to illustrate the theme of the exhibition: Man and His World. Bass shows protective hands trying to contain an atomic explosion. While both designs focus on essential elements of their subject matter with great precision, Roch's terrestrial globe does not attempt to convey a sense of vastness, and there is no real reaching, embracing, or upholding in the arms, no power in the straddled legs. Similarly in the Bass emblem, the exploding fragments have little destructive power, and the hands may not look actively protective to some observers.

This reduction of expressive dynamics to a mere hint may be exactly appropriate. The principal function of an emblem is not

that of a work of art. A painting or piece of sculpture is intended to evoke the impact of a configuration of forces, and the references to the subject matter of a work are only a means to that end. Inversely, a design, meant to serve identification and distinction, uses dynamic expression mainly for this principal purpose; just as the three strokes of the Chinese character for "mountain" hint not only at peaks but also at their rising and thereby make the reference a bit more lively. Of course, even the most sober and neutral design can unleash violent passion through the meaning associated with it. But the dynamics inherent in a visual object—in a Baroque painting, for instance—is one thing; the emotions released by it—such as by hammer and sickle—are quite another.

Experience interacting with ideas

Pictorial analogues, I said earlier, fulfill a mediating position between the world of sensory experience and the disembodied forces underlying the objects and events of that experience. A portrait by Rembrandt is a picture, interpreting a particular inhabitant of Amsterdam as a kind of person, characterized by a particular pattern of physical and psychical forces—a man, let us say, battered but upright, vigilant but thoughtful. At the same time, the unknown man from a past century is of lasting interest as a symbol because his image gives animated appearance to those more abstract qualities of oppression and resistance, outward-directedness and inner containment. The same is true for a good "abstract," i.e., non-mimetic work of art. Since it does not portray the external shape of physical objects, it is closer to the pure forces it presents symbolically; but it portrays at the same time the inherent nature of the things and events of the world and thereby maintains its relevance to human life on earth. In sum, every pictorial analogue performs the task of reasoning by fusing sensory appearance and generic concepts into one unified cognitive statement.

How essential it is that these two aspects of the image should complement each other constantly, not only in the arts but everywhere in human thinking, has been pointed out by Goethe in an eloquent passage of his *Theory of Color*:

With regard to figurative speech and indirect expression, poetry has great advantage over all the other ways of language. It can use any image, any relation to suit its own character and convenience. It compares the spiritual with the physical

and vice versa: thought with lightning, lightning with thought, whereby the interdependence of the matters of our world [das Wechselleben der Weltgegenstände] is expressed in the best way. Philosophy, too, in its climactic moments, needs indirect expressions and figurative speech, as witnessed by its use of symbolism, which we have often mentioned, both censuring and defending it. Unfortunately, history tells us that the philosophical schools, depending on the manner and approach of their founders and principal teachers, suffer from employing one-sided symbols in order to express and master the whole. In particular, some of them insist on describing the physical by spiritual symbols while others want physical symbols for the spiritual. In this fashion, subjects are never worked through; instead, a disjunction comes about in what is to be represented and defined and therefore also a discrepancy among those concerned with it. In consequence, ill will is created on both sides and a partisan spirit establishes itself.

There are paintings and sculptures that portray figures, objects, actions in a more or less realistic style, but indicate that they are not to be taken at their face value. They make no sense as reports on what goes on in life on earth, but are intended primarily as symbolic vehicles of ideas. The beholder is overcome by the uncanny feeling of which Hegel speaks with regard to the symbolism of ancient oriental art: "Wir fühlen, dass wir unter Aufgaben wandeln" (We have the sensation of wandering among tasks.) Since the picture does not simply interpret life, the beholder faces the task of telling what it symbolizes. Picasso's early painting *La Vie* is called by Wilhelm Boeck a tribute to the secularized philosophical symbolism of art around the turn of the century. Boeck describes this representation of "Life" as follows:

A barefoot woman is standing at the right, her serious face in profile, with a sleeping infant in the folds of her draped garment. At the left stands the graceful nude of a young couple, seeking each other's protection as though suddenly frightened; the man is larger, with the high forehead of an intellectual, the tender woman is all devotion. They face the mother but their glance is turned inward; engrossed in their own destiny, they do not see her, although the index finger of the man's sensitive left hand points emphatically to the child. Behind the foreground figures we see two painted studies: the lower one shows a squatting nude lost in a reverie; the upper one, a seated couple whose attitude echoes that of the couple standing in the foreground.

Clearly, the painter has undertaken to represent an idea of the kind directly expressed as a theoretical schema, for example, in Keats' sonnet *The Human Seasons* or in the riddle of the Sphinx ("What creature goes on four feet in the morning, on two at noonday, on three in the evening?") Clearly also, the painter treads on dangerous

ground. Explicitly symbolical representations are common in all cultures. But since they take their principal cue from an idea, the style of the presentation must warn the beholder that he is not in the realm of earthly happenings. On the other hand, in this twilight area between diagram and art, there is always the risk of ideas coercing the life of the image. The so-called allegory travesties the task of the symbol by illustrating ideas through standardized clichés. Conceptual norm becomes poverty of imagination. Hence the chilling effect of overly cerebral novels, in which unconsummated theorems are draped over the characters as though they were the dummies of a dressmaker. Hence also the ludicrousness of schematic symbolism in some amateur art, cheap oratory, or dreams. Roger Fry has poked fun at the poor artistic quality of the dreams cited by the psychoanalyst Oskar Pfister, who wished to show that poetic inspiration derives from the same source as do dreams. Here is an example:

A youth is about to leap away from a female corpse onto a bridge lost in a sea of fog, in the midst of which Death is standing. Behind him the sun rises in bloodred splendor. On the right margin two pairs of hands are trying to recall or hold back the hurrying youth.

I suspect that the repulsiveness of amateur fantasy, which Freud noted in reactions to daydreams and cheap fiction, is aroused not so much because desires and fears are revealed in their nakedness, but because preconceived ideas and hackneyed imagery are permitted to interfere with the truthfulness of the statement. These products of the mind are cognitively unclean.

Two scales of abstraction

What I have tried to say about the functions of pictorial analogues is summed up in Figure 50. Pictures and symbols depict experience by means of images in two complementary ways. In a picture, the abstraction level of the image is higher than that of the experience it represents; in a symbol the opposite is the case.

While every image connects two specific levels of the two scales, it is most desirable for the particular purposes of art that the whole range of both scales reverberate in each instance of pictorial representation. This means for the Image Scale that although a painting

may be entirely "abstract" (non-mimetic), it needs to reflect some of the complexity of form by which realistic works depict the wealth of human experience. Inversely, a realistic portrayal, in order to be readable, generic, and expressive, must fit its presentation of objects to the pure forms, more directly embodied in non-mimetic art.

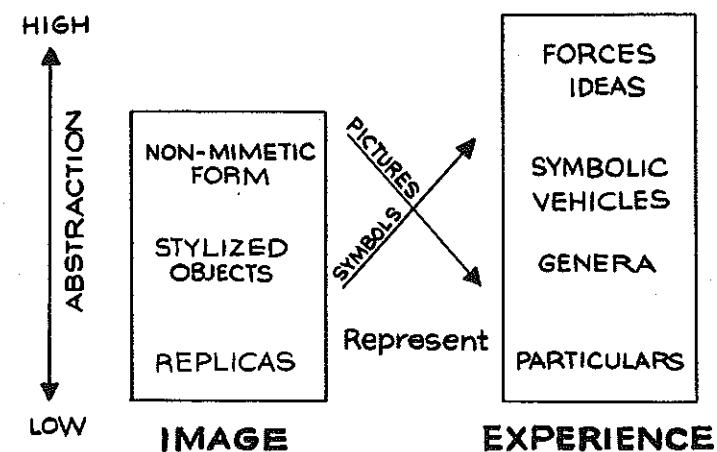


Figure 50

For the Experience Scale this condition demands that while focusing upon the ultimate forces inherent in existence, the mind view them as creating the richness of empirical manifestation; and vice versa, the teeming multiplicity of particular phenomena must be seen as organized by underlying general principles.

This doctrinaire demand will appear justified if one thinks of what happens when the two scales are not fully extended or not fully permeable. Under such pathological conditions, a scale is trimmed or cut through at some level, leaving the mind with a restricted range. Restriction to the bottom of the image scale may lead to the thoughtless imitation of natural objects. At the top end, isolation makes for a rigid geometry, orderly enough, but too impoverished to occupy the human brain, the most differentiated creation of nature. On the side of experience, limitation to the bottom of the scale makes for a materialistic, utilitarian outlook, unrelieved by guiding ideas. At

the top we get anaemic speculation, the purely formal handling of theoretical propositions or norms.

Any such restriction of thought and expression weakens the validity of artistic statements. In an ideal civilization, no object is perceived and no action performed without an open-ended vista of analogues, which point to the most abstract guiding principles; and, inversely, when pure, generic shapes are handled, there reverberates in human reasoning the experience of particular existence, which gives substance to thought.

9.

What Abstraction Is Not

We need and want to rebuild the bridge between perception and thinking. I have tried to show that perception consists in the grasping of relevant generic features of the object. Inversely, thinking, in order to have something to think about, must be based on images of the world in which we live. The thought elements in perception and the perceptual elements in thought are complementary. They make human cognition a unitary process, which leads without break from the elementary acquisition of sensory information to the most generic theoretical ideas. The essential trait of this unitary cognitive process is that at every level it involves abstraction. Therefore the nature and meaning of abstraction must be examined with care.

Our thesis is simple enough. But there is little hope that its positive aspects will be understood and accepted unless a number of misleading conceptions of abstraction are described and refuted.

In its literal sense, the word *abstraction* is negative. It speaks of removal since the verb *abstrahere* means actively to draw something away from somewhere and passively to be drawn away from something. The Oxford Dictionary quotes seventeenth century usage: "The more abstract we are from the body . . . the more fit we shall be to behold divine light." An absent-minded man is "abstracted," and a person having "no idea of poverty, but in the abstract" is understood to be somebody who does not really know. Similarly, to abstract something means to take it away from somewhere, as in this example dating from 1387: ". . . the names of the authors of whom this present chronicle is abstract."