

Gyorgy Kepes

the new landscape
in art and science

Paul Theobald and Co.

II

IMAGE FORM SYMBOL

Image-making was basic in enabling the human mind to grasp the nature of our surroundings. Isolating sensed forms was our first step in resolving a chaos of impressions into an articulated world. Visual images were formed of clearly defined entities—people and things—excised from the stream of sense experience. Men developed perceptual images according to the boundary lines which isolate objects visually from their surroundings.

Making pictures was the next step. Perceptual images were brought out of men's heads and communicated as outline drawings.

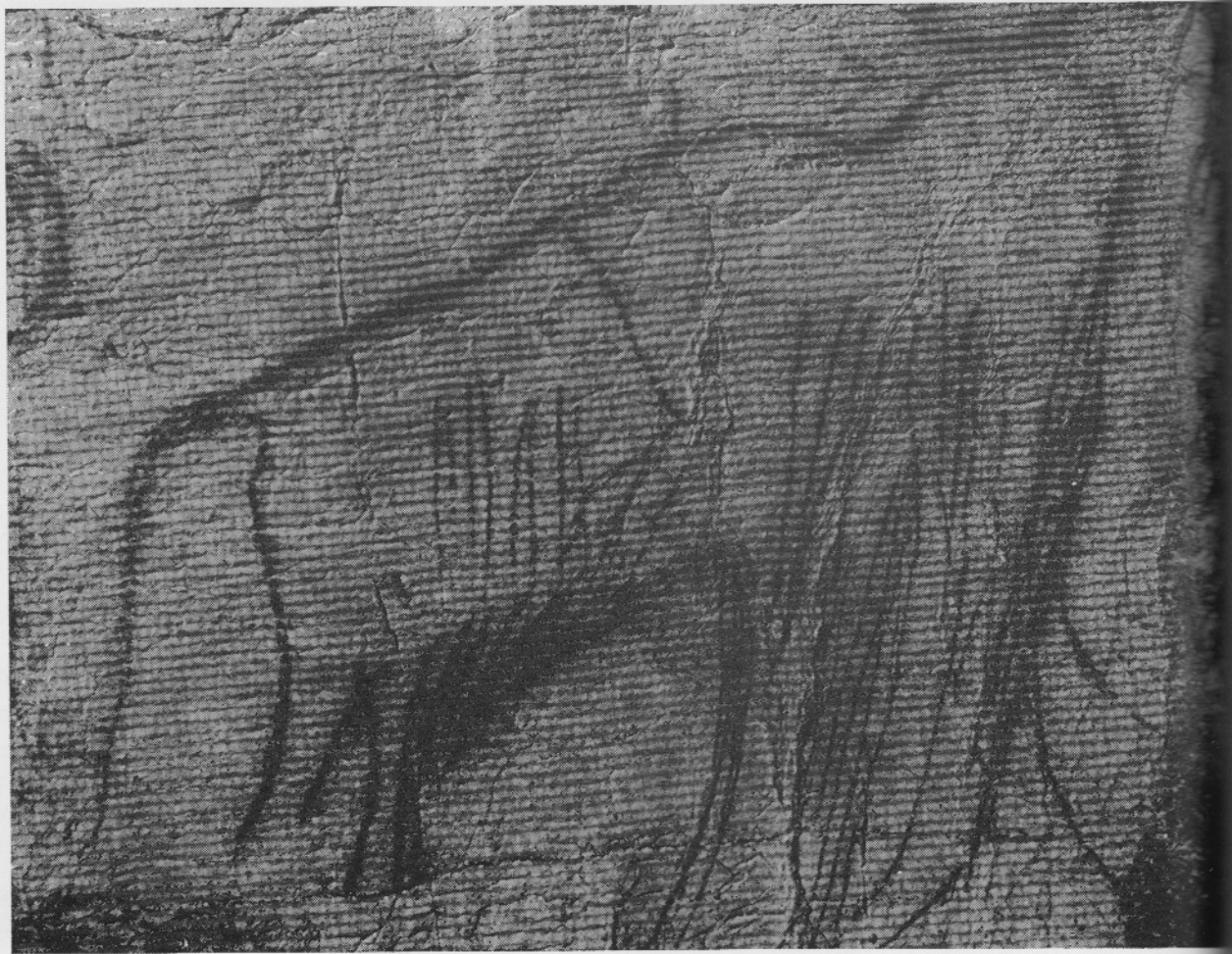
Outline is used abstractly in the earliest human record of graphic communication. In perception, the figure contained by its own boundary line is part of a larger visual field, is colored, rounded, soft or hard, and exists in deep space. In the early cave drawing, the outline is all—there are no interior details to complete the figure, no background to orient it in space. A three-dimensional object has been converted to a two-dimensional pattern. Many different experiences of an animal have been combined and reconciled; a composite experience is communicated. The creative faculties of early man have constructed what was clearly regarded as the animal's permanent, most characteristic aspect. We are given a symbol.

The side view is characteristic for Mediterranean cultures, both prehistoric and historic. Other cultures with fewer ties to the Western world chose views which are less familiar to us and, therefore, more easily read by us as symbols. In the Pacific Basin, animals are represented flattened out like fur rugs—with four legs, body, head and tail all shown together. Through such abstraction, sensory images become intellectual concepts. Intellectual life emerges from the life of the senses in this first movement from particular to general.

Abstraction is the basis of conceptual thinking. When we abstract from a situation we select certain factors as key; we discover in a simple and finite set of relations the essence of the infinitude of relations that contained them. In the fish-like but warm-blooded and viviparous whale we recognize a fellow mammal, not a fish; we regard the fins and fishtail as insignificant, the reproductive system as essential.

We approach abstract thinking as we sharpen our perception and learn by observation to distill invariant aspects of nature from shifting, complicated visual events. We distinguish the moon, animals, trees as *figures*—sensed forms—against the background of what they are not. Physiologically, we receive our strongest visual impression at the contour line, the boundary between figure and background. Thus, our visual images of objects are defined by the contours.

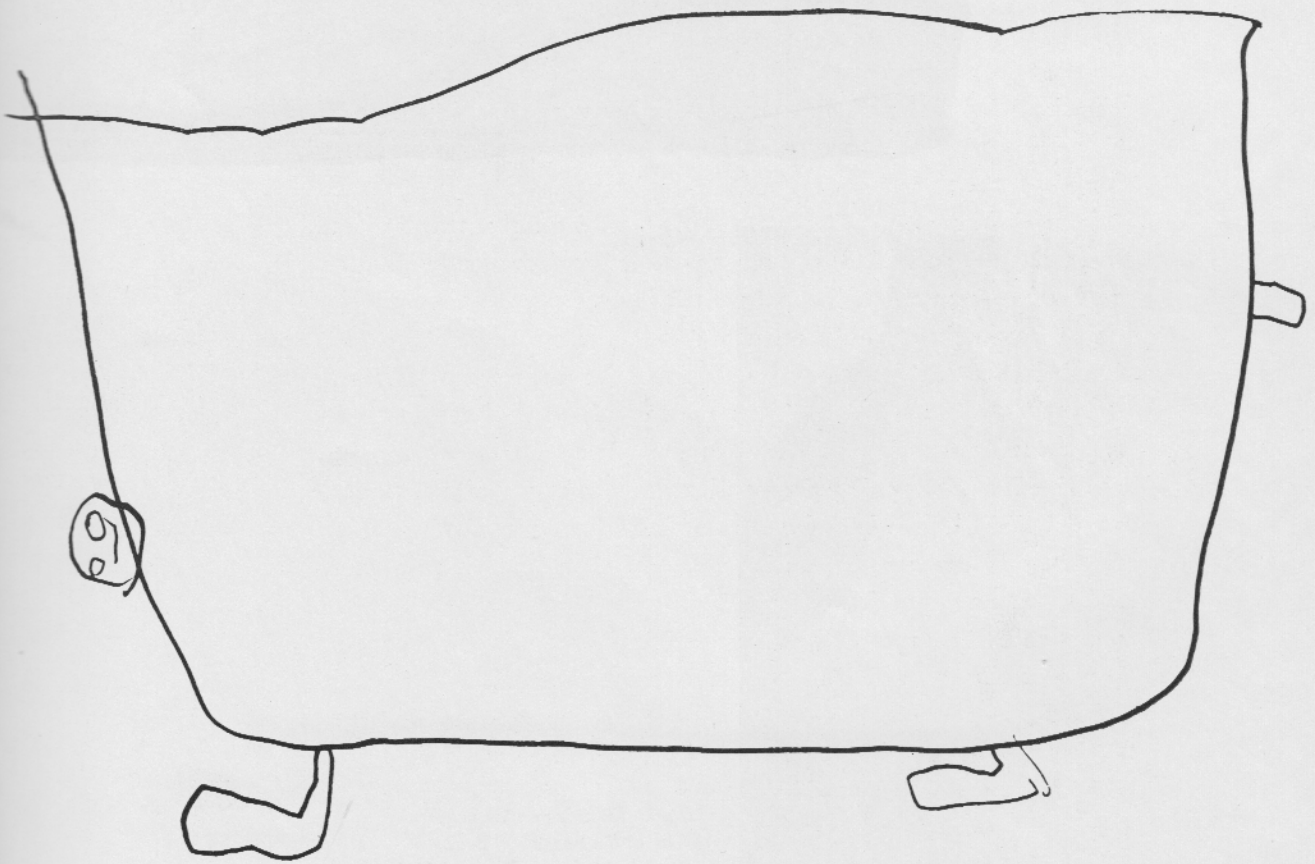
When a figure is an irregular three-dimensional form—like the body of a human being—we are not confused or led astray by the shifting contour that never remains the same for a moment. We are made to see these endlessly changing aspects as persistent forms. In our heads, we build images of the moon, of animals, of trees, choosing from our remembered perceptions the contours which are significant to us. Perception of the boundary line enables man to populate his inner world with the forms and patterns which correspond to the outer world's objects. He begins to understand relations with greater clarity, developing his capacity to control his environment.



1. *Young Mammoth Prehistoric Cave Drawing, Perche-Merle, Cabrerets, France* Photograph: Laborie

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Dog, Drawing by Imre Kepes, age three and a half



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Prehistoric Grave Drawing
 Norway

7
Neolithic Vase, Ööcsanád, Hungary
 Peabody Museum, Harvard University

8
Persian Miniature, 1702-03
 The Metropolitan Museum of Art, New York

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Lissajous Figure
 Prof. W. B. Hales, Brigham Young University

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Fragment of Oracle Bone, China, 1700 B.C.
 Peabody Museum, Harvard University



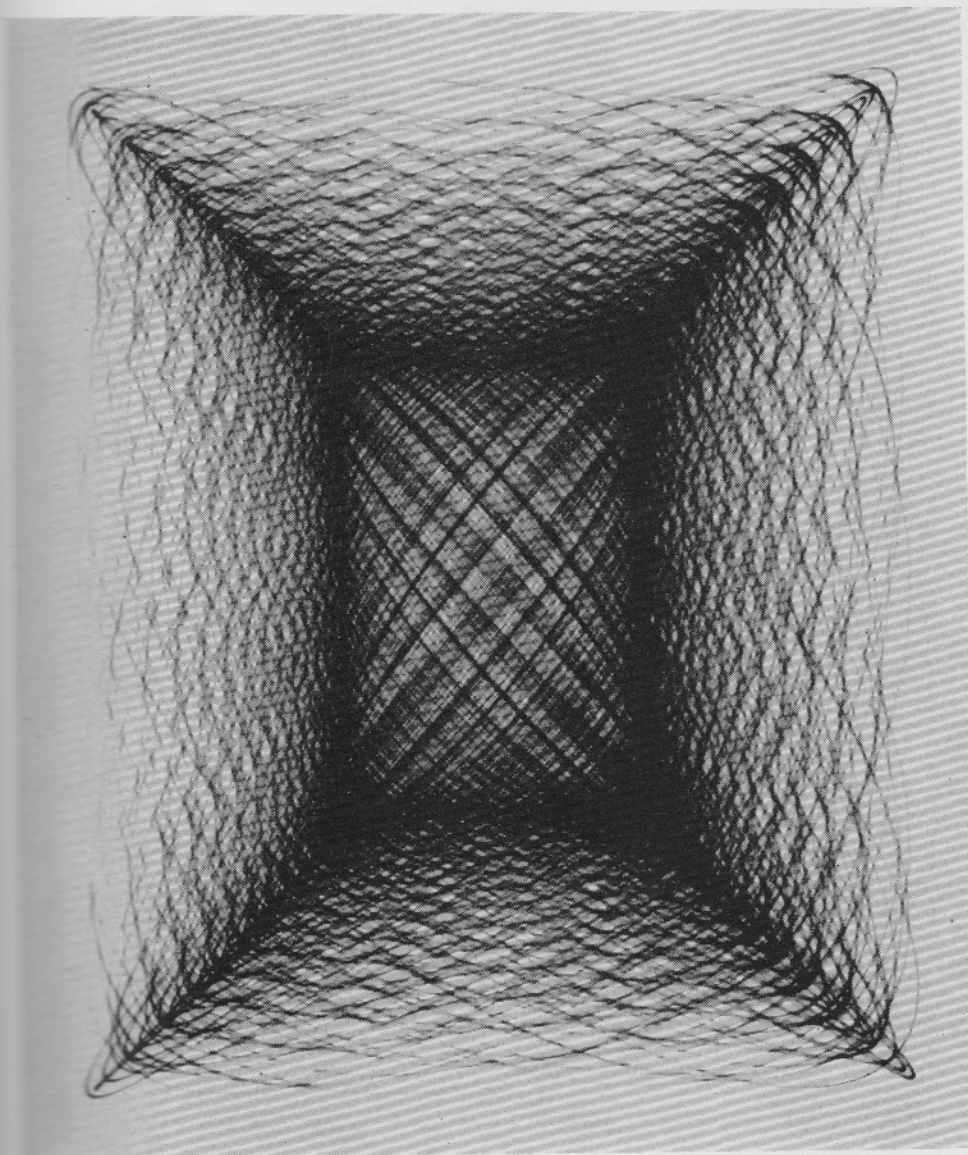
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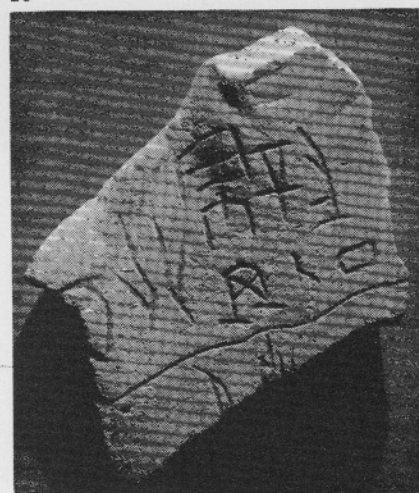


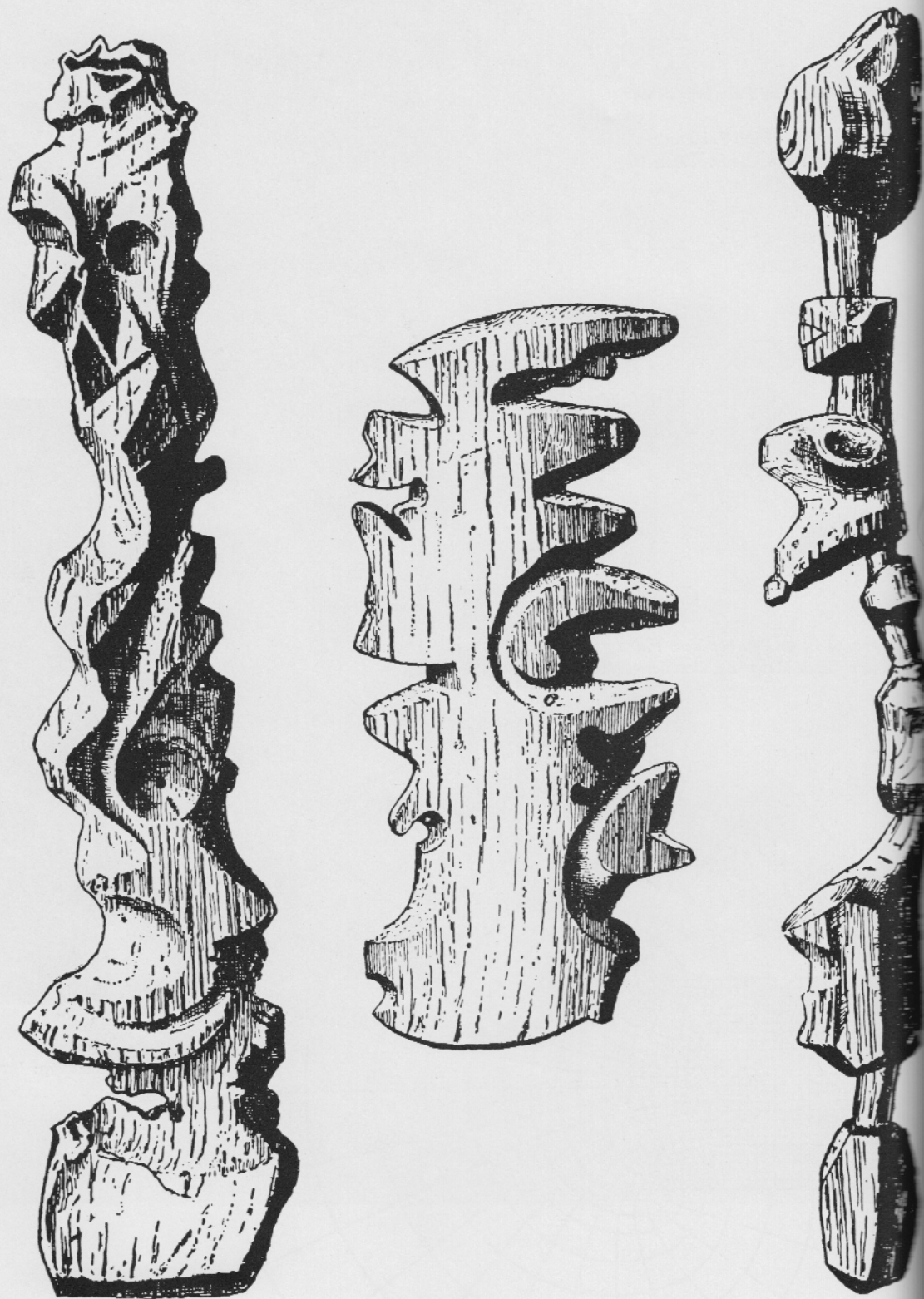
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Defining objects by shape was only one aspect of the role of line, just as separating a thing from its metamorphoses is only one aspect of perception. Once invented, the graphic line could assume a kind of independent life. The movement of the graphic tool across a surface could convey experience of movement and change, abstracting from perception of process and transformation. In the life of the stroke there was more than shape—motion and change were there as well. The growth of the line—its emergence from nothing, its speed, rhythm, length and directional changes—presented another key to the understanding of the world. And prehistoric man could not escape the magic impact of the suddenly emerging line.

Graphic recording of man's inner linear visions was a high point in human inventiveness. Delineations stood for things just as verbal utterances did. Only slight further abstraction beyond the decisive elimination of interior details was needed to make a delineation stand for a word—and to invent writing. Communicated images of patterns and relations led to verbal expression of them, to the growth of ideas basic to religion, philosophy and science. Without delineation of figures, science could never have come into existence. Without graphic communication, science could never have achieved important growth.

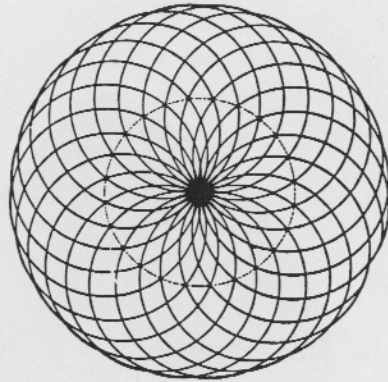
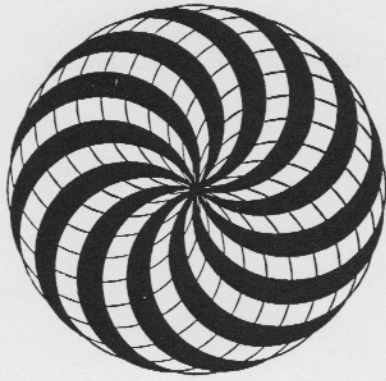
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Greenland Map. Wooden map made by the natives of east coast of Greenland. They are inclined to enlarge the scale as they approach the better known places. 10th Annual Report of the Bureau of Ethnology. 1888-1889.

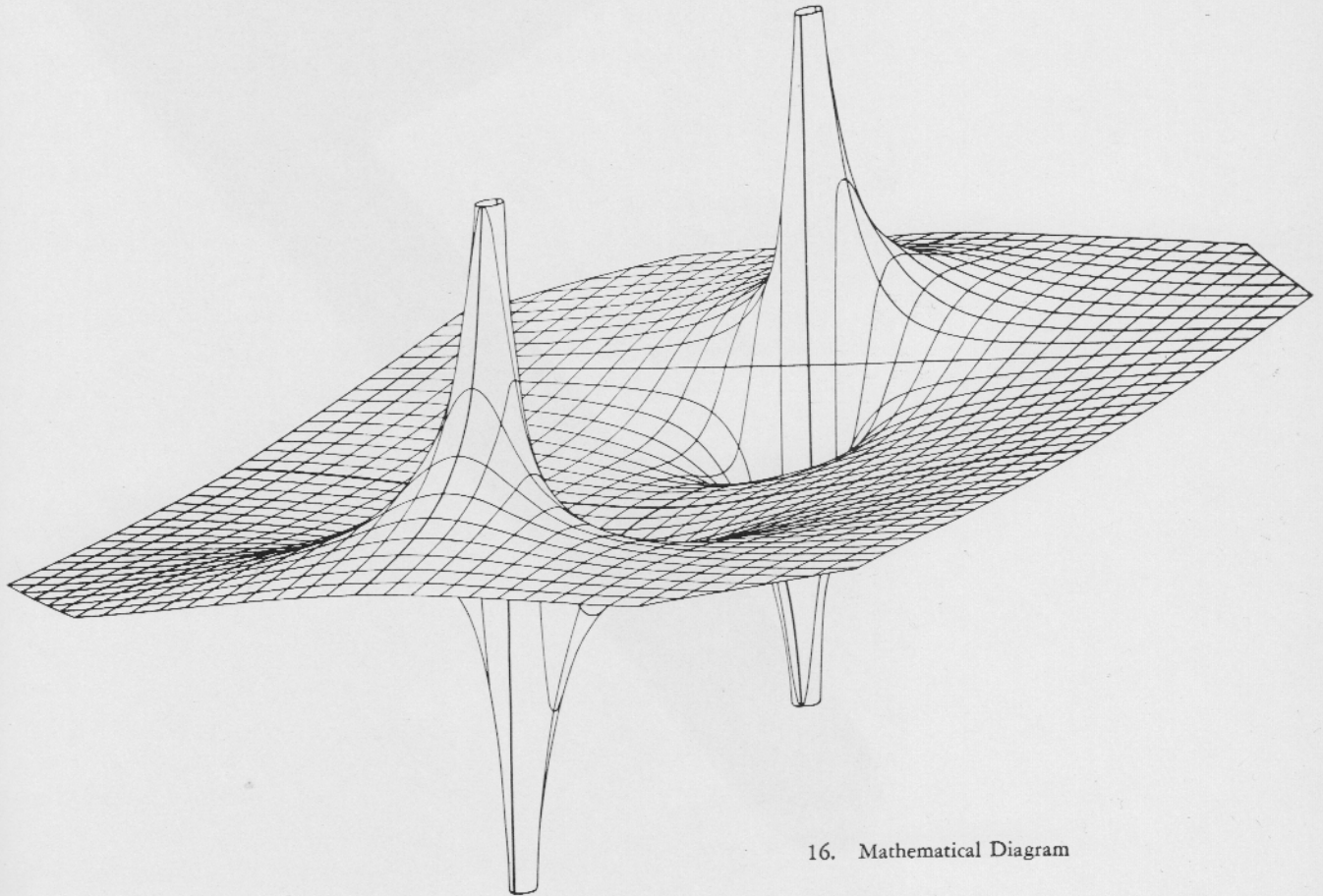


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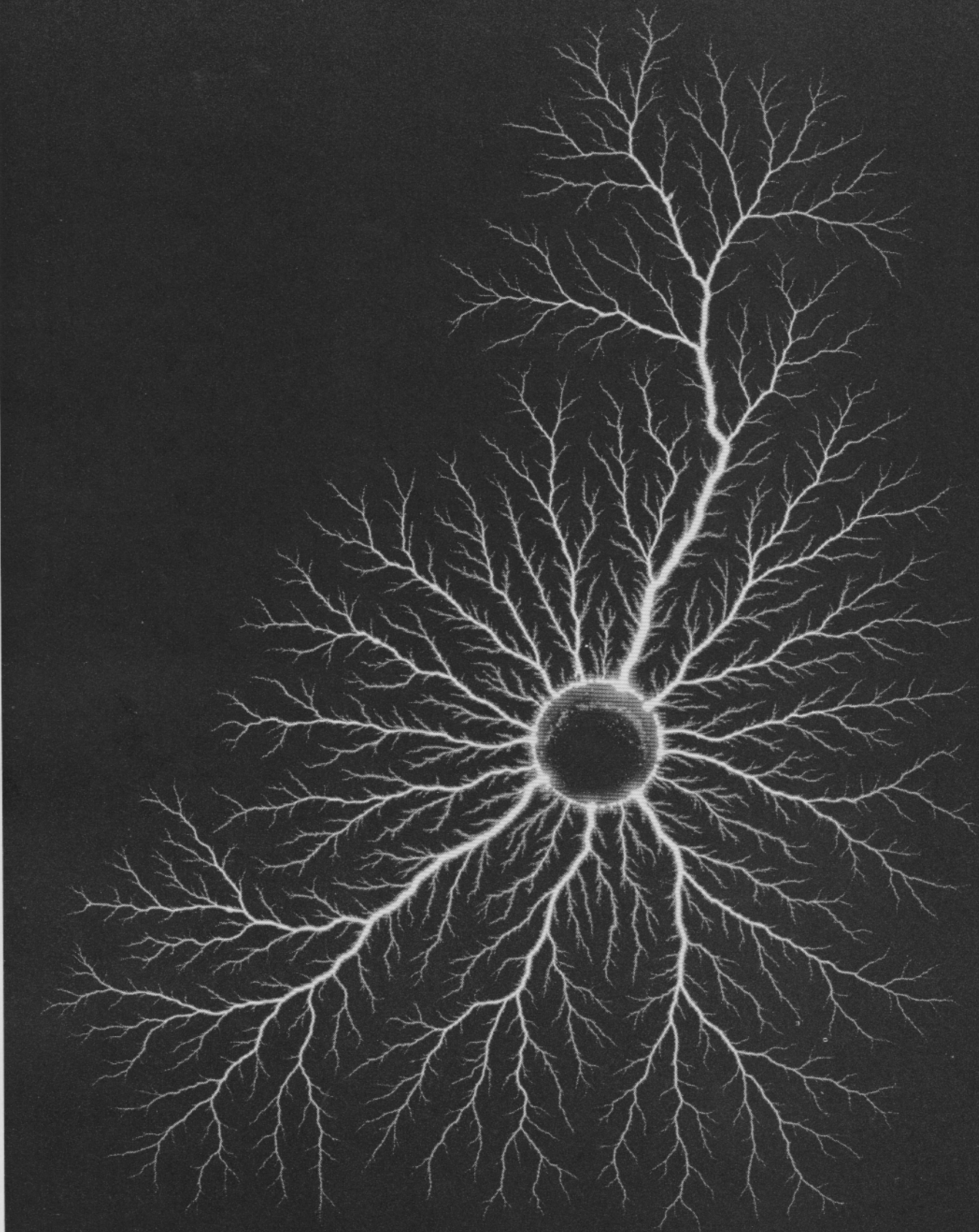
Variation of a single geometrical motive.
The movement of a circle whose center
is carried along the circumference
of another circle.

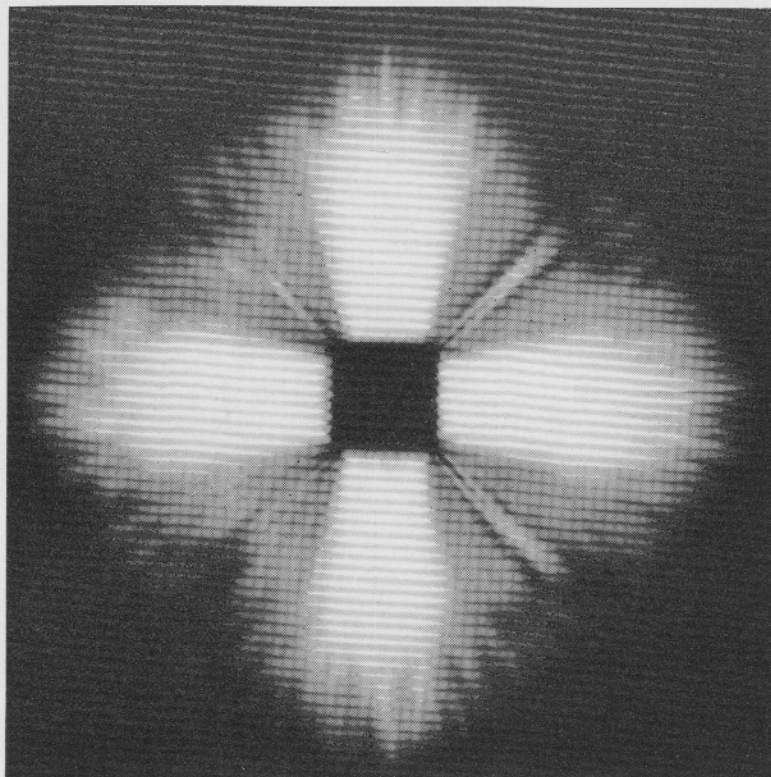
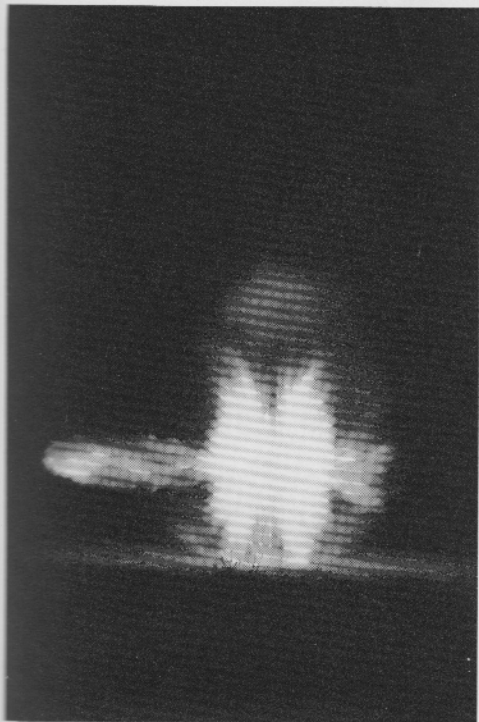
Herman V. Baravalle

Scripta Mathematica Vol. XVIII.1



16. Mathematical Diagram

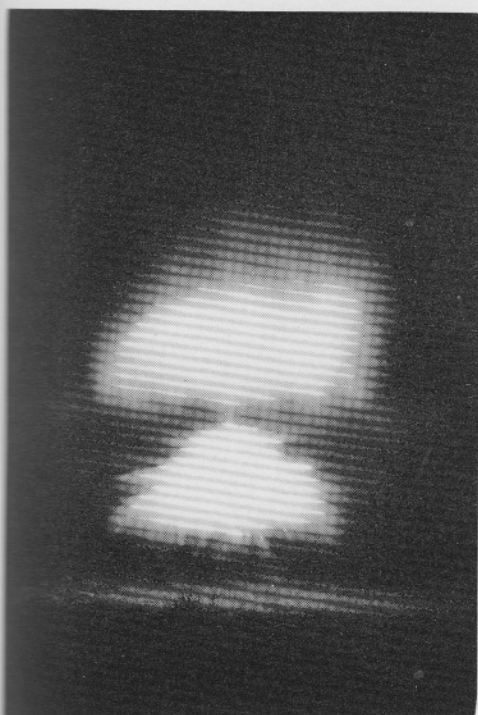




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3/4 Inch Stick of Pentolite Exploding

The five microsecond exposure was made by means of magneto-optic shutter
Devised by Prof. H. G. Edgerton, Massachusetts Institute of Technology
Photograph: Aberdeen Proving Ground



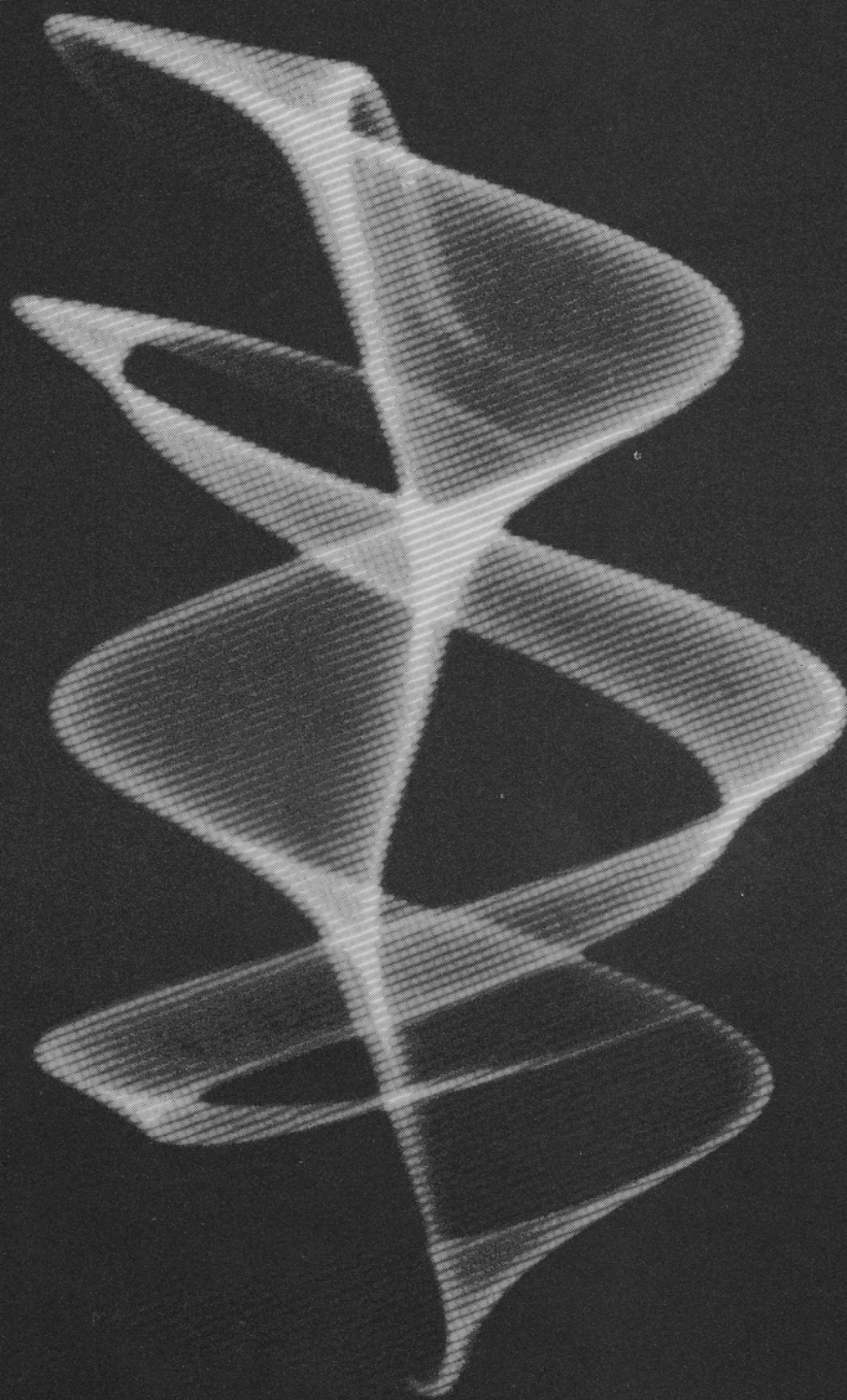
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Detonation Patterns

Night Photograph, Lawton, Courtesy of T. C. Poulter
Stanford Research Institute

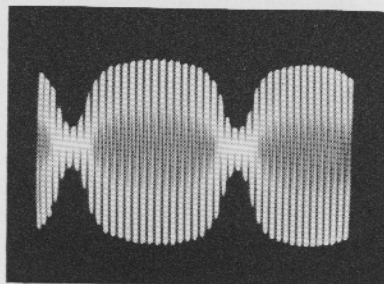
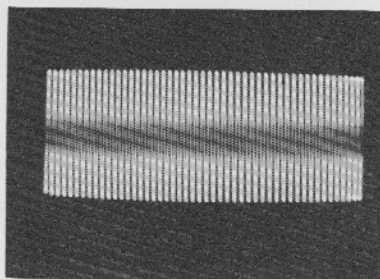
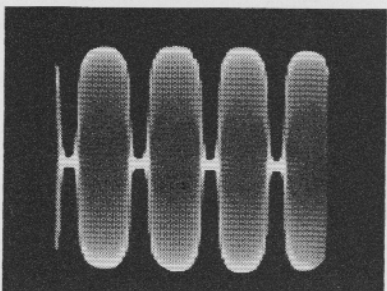
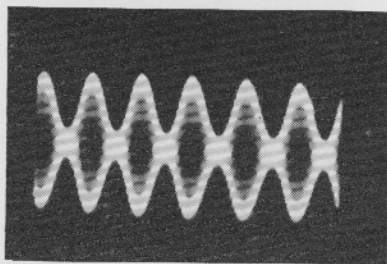
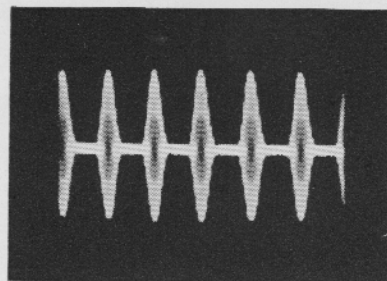
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Lichtenberg Figure, Pattern of Electric Sparks. Prof. A. R. von Hippel, Massachusetts Institute of Technology

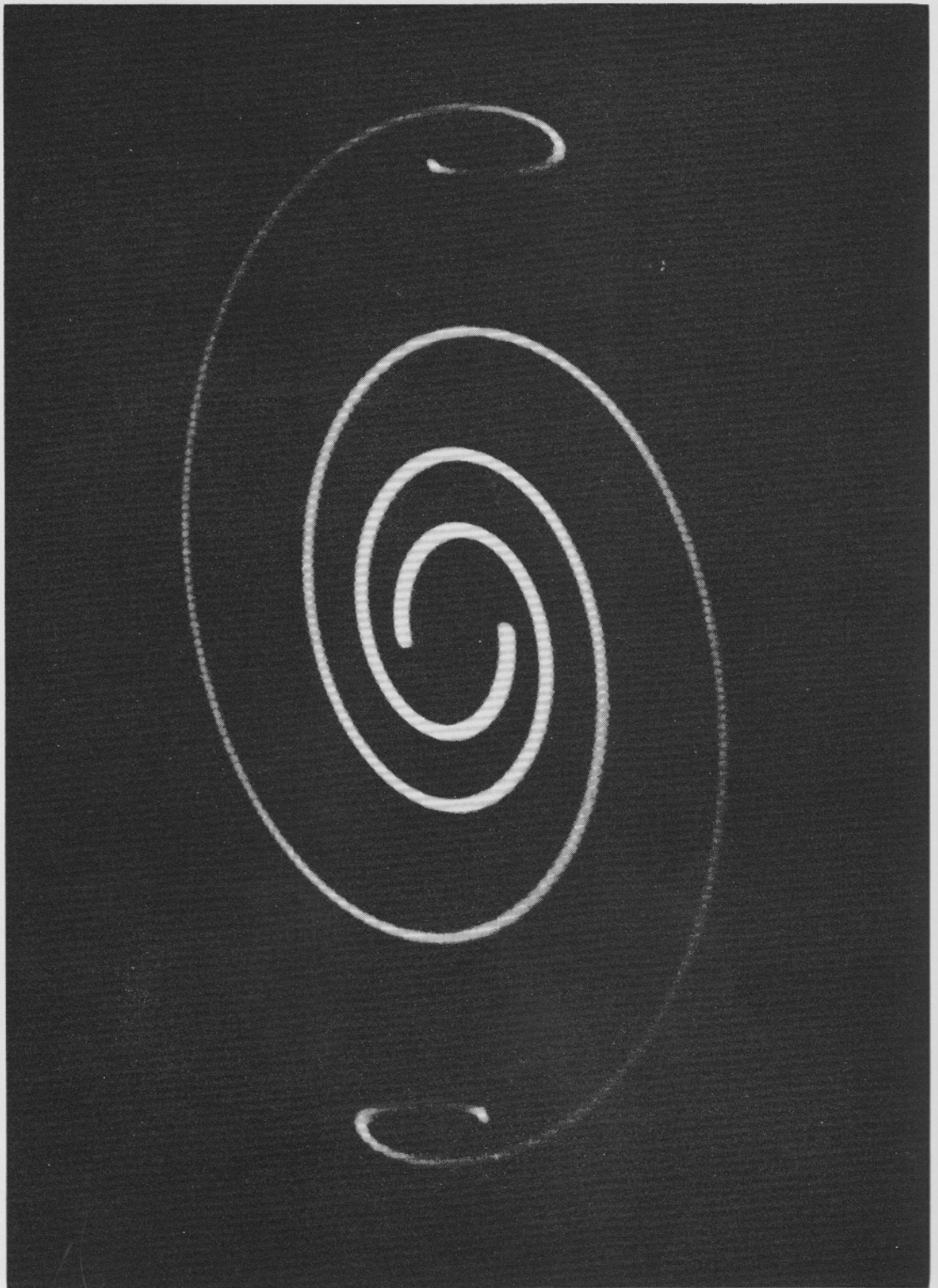


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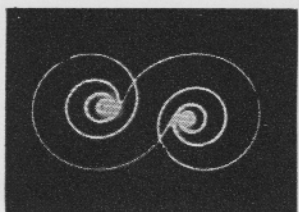
Cathode-Ray Oscilloscope Patterns



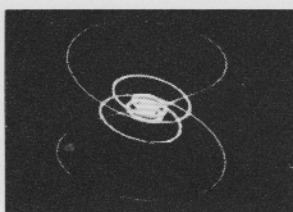
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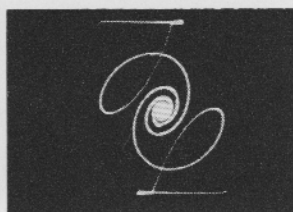
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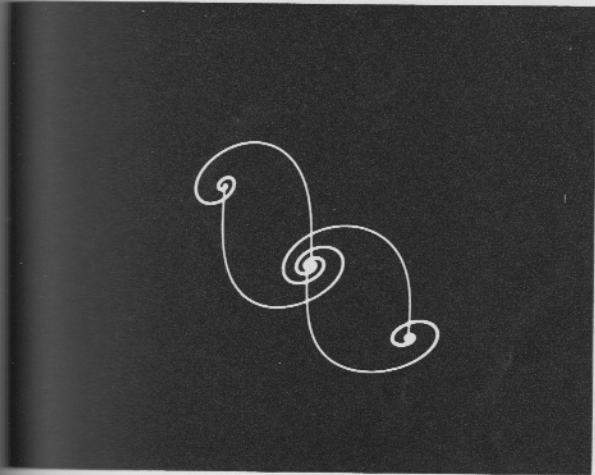
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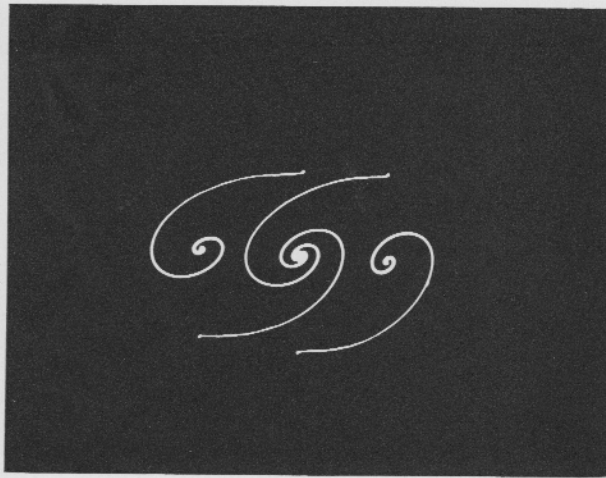
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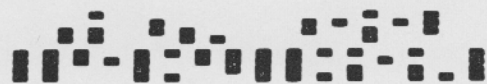
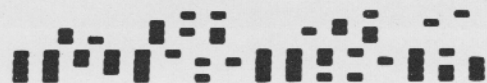
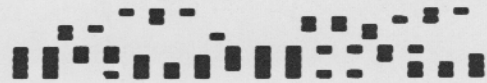
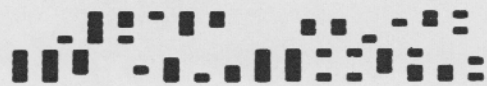
Oscilloscope Patterns of an Analogue Computer
Courtesy Marc Campbell, G. Philbrick Research



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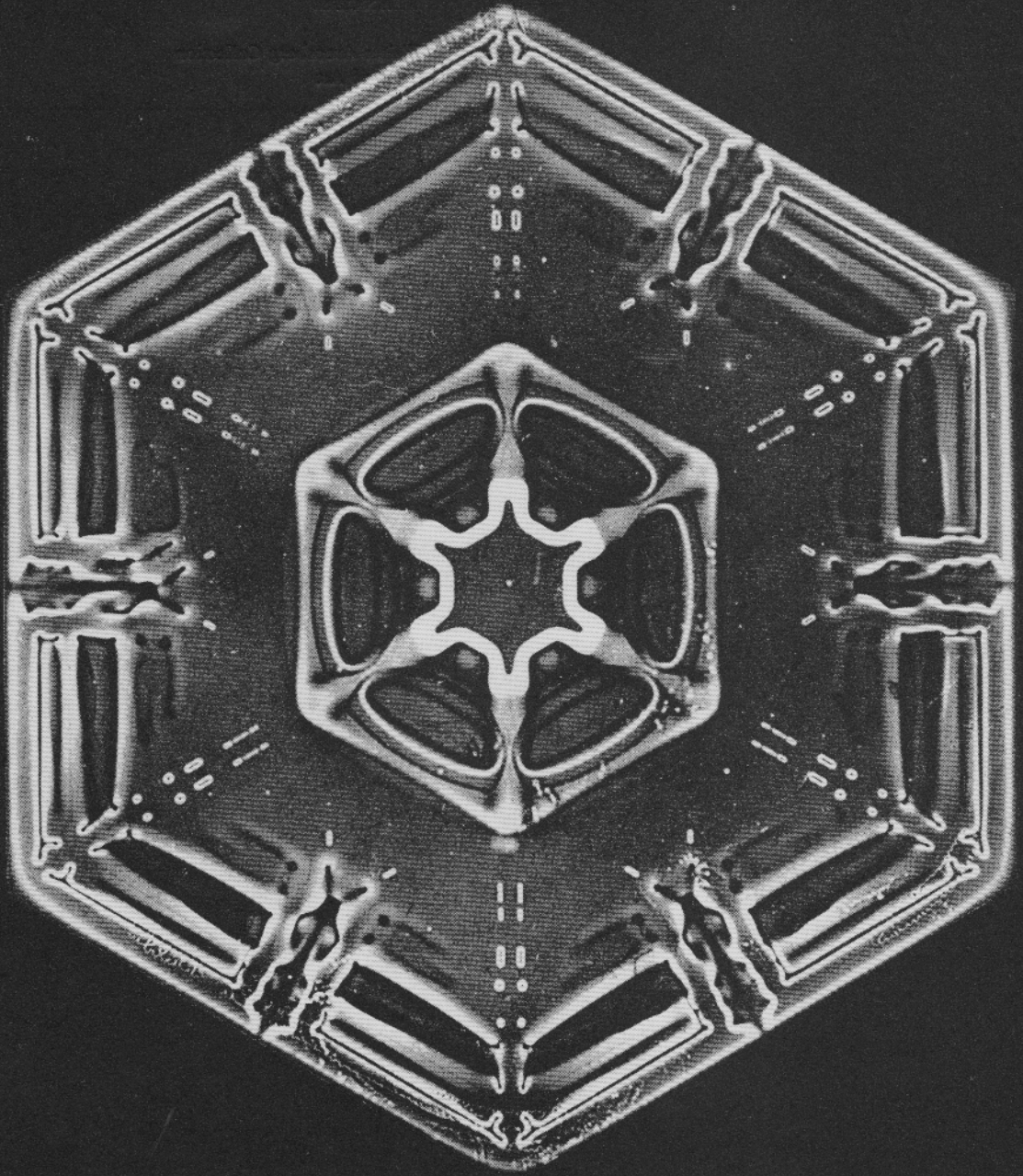


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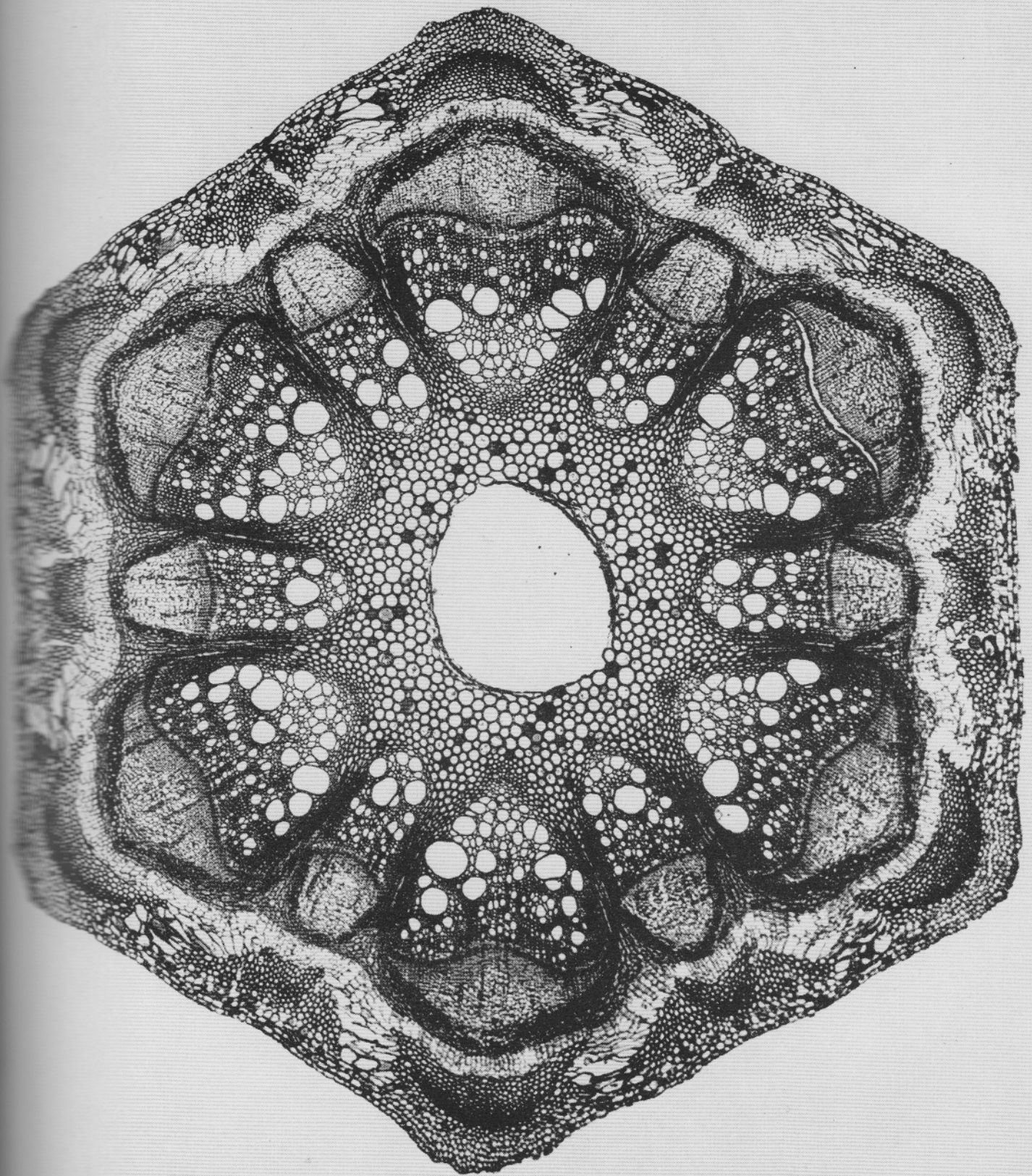
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Print from a Reader Recorder Tape



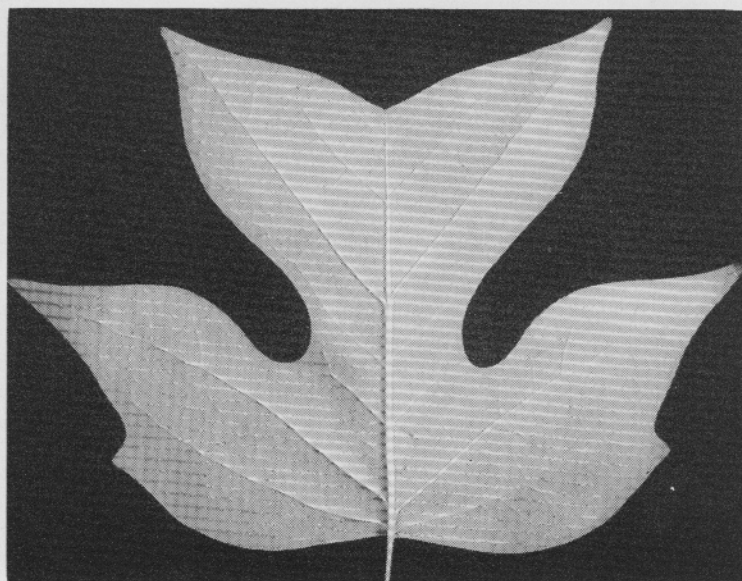
268 *Snow Crystals*. Photomicrograph: W. A. Bentley

269 *Cross Section of a Twig*
Photomicrograph: Prof. I. W. Bailey. Harvard University



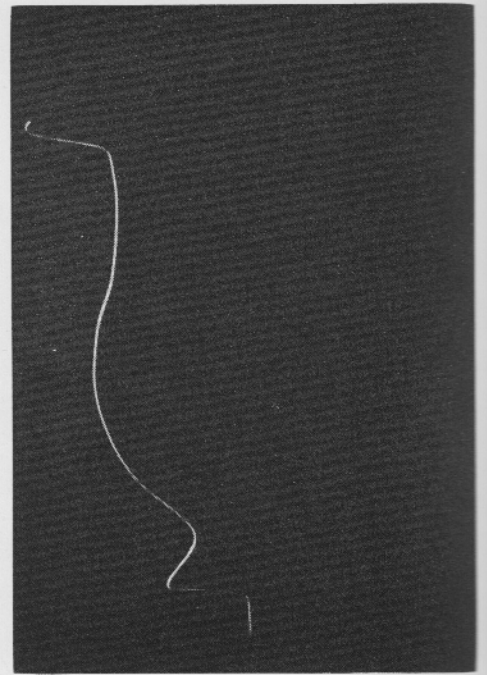


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Mitosis
 Photomicrograph: Prof. R. S. Sanborn
 Massachusetts Institute of Technology



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Liliodendron Tulifera
 Photograph: Tet A. von Borsig





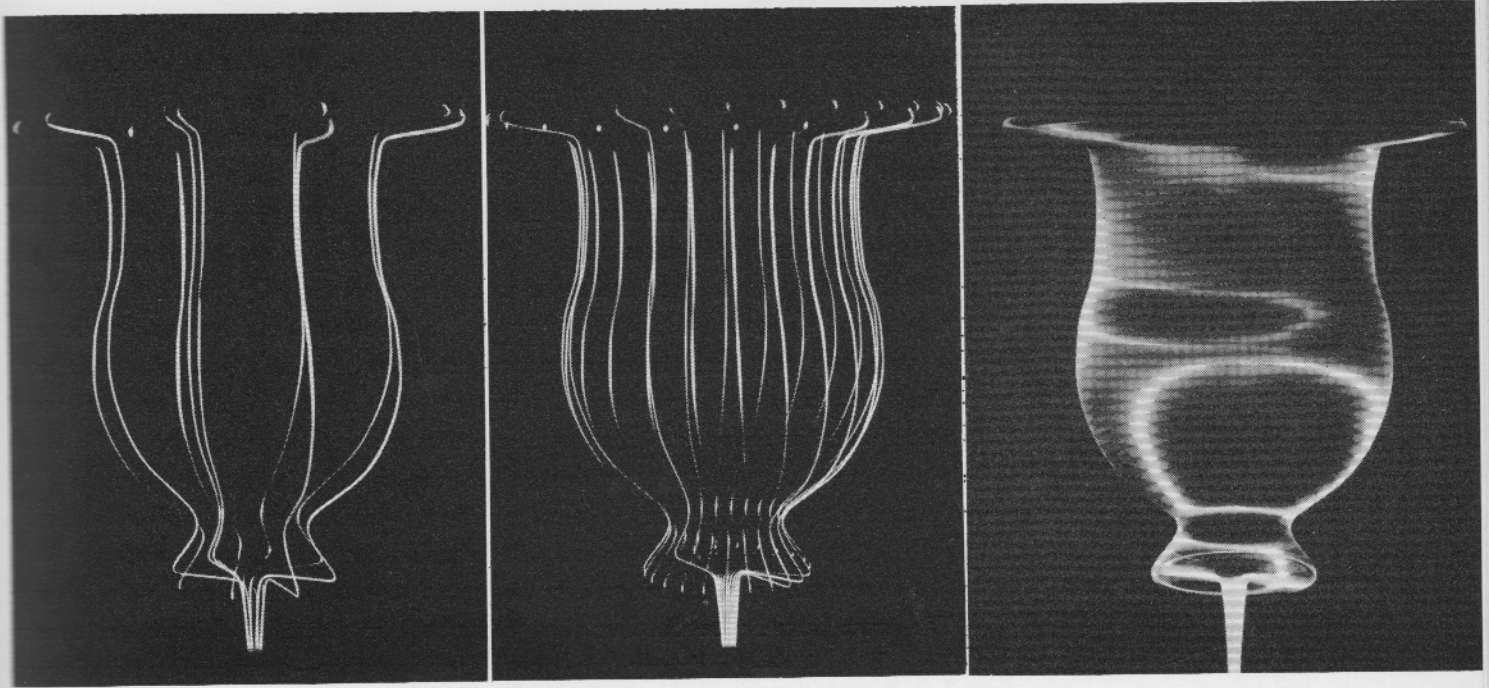
VI

TRANSFORMATION PHYSICAL PERCEPTUAL SYMBOLIC

The world of patterns gives us a new way to see. Perception of the isolated unit becomes subordinate to perception of process relations. The pictures in the last two chapters withhold from us the clues to understanding that are given by objects that we hold in our hands or gauge with our eyes. But they yield their meaning when we recognize their dynamic background, when we perceive the transforming process in the temporary pattern. Looking at the pictures, we find no clear-cut beginnings and ends, no *things*; we see movements in nature. Not only our vision changes but also our outlook.

Our new outlook is itself a pattern. It is a psychological and cultural configuration, a complex, historically evolved attitude of human beings. It is different from the outlook that it replaces; and, by holding it, we ourselves become different. Our inner activity, making new order in the world, reorders us, too. The new coherences we discover are matched by our own gains in coherence. Our new awareness comes from growth, individual and cultural, in sensing, feeling and thinking.

What is the nature of the patterns of transformation? How do we go from one to another? Some insight may be gained by examining the way in which we perceive our surroundings. Visually, we judge our relation to the surrounding world through the shapes, sizes, textures and colors reflected into the retinas of our eyes. But we move and what is around us moves—advancing, retreating, expanding, contracting, growing, decaying. On the retina there is a fluid pattern of changing shapes, sizes and colors: we are able to read these optical metamorphoses. Approaching a "square" shape, we experience a steady increase in size and a continuous alteration of form as our viewpoint changes. Every proportion of rectangle may be seen, all possible variations of parallelograms, even straight lines. We assume, nevertheless, that there is a maintained identity, a persistent object; and thus we establish a connection between us and it. Our orientation did not come from any one of these



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Sequence Photographs of a Wire Contour in Rotating Motion. Photographs: David Shaw

shapes, but from the succession of related shapes, each merging imperceptibly into the next. The continuity of all the shapes allowed us to see the characteristics of our surroundings.

Continuity is thus accepted on the basic unconscious level of perception. On the level of rational thought, we are consciously aware of continuity. Over the centuries, scientific thinking has led us to discard the notion of a fixed, unalterable world for the notion of a world in movement. We have come to accept atomic transmutation, biological evolution, psychological and social change. Yet, in our visual habits, in our specific instances of observing or imagining, we still primarily see isolated entities. Although we know that the oak was once an acorn, the rain a cloud, the butterfly a caterpillar, although we have seen buds burst into flowers, flowers into fruit and fruit into seed, these are things we remember and do not experience directly. Direct perception of transformation evades us. We use shapes and colors to identify objects rather than to mark their comings and goings. We lack a visual vocabulary of change.

Photography has laid a foundation for such a visual vocabulary. "Single frame" motion pictures in films exposed at the rate of perhaps one unit a day instead of sixteen a second, compress our time scale and enable us to observe the growth of a plant as a directly experienced sequence. With unexpected particularity, the undismembering camera records the face that our eyes have read as a persisting form in spite of all changes of expression. Cameras also record the shape of lightning flashes, the propagation of shock waves by projectiles, the contraction of a baseball struck by a bat. With the stroboscopic multiple exposure record of forms in motion, we reach a new visual idiom. We see not only the form itself, but the form's generated movement as still another form—a virtual volume, a space-time trace—and our experience of the original form is enriched by the new forms of transformation.

A glimpse at the degrees and aspects of changes that we can see now—the trans-

lations, transmutations, condensations, distortions, exaggerations, simplifications and other aspects of transformation—may guide us toward the broader perceptual basis needed for clearer understanding of our changing world. We are all familiar with apparent transformation: figures altering in size and shape as they approach us or recede into the distance; with actual transformation: candles melting; with fundamental physical transformation: objects burning. Besides the similarities of constant aspect—squares like squares, circles like circles—we can see the similarities that characterize a change, the persistence of direction, shrinkage, expansion. In the continuities of figures there may be a continuity of form, as when the complete renewal of our body cells changes our substance but not our identity or our recollections. There may also be a continuity of substance, as when clay thrown on the potter's wheel alters its shape and structure but not its material composition.

Awareness of transformation demands recognition of the unity of space and time. Anyone who has ever swung a compass has experienced a drawn circle as a curving path begun and ended, his eye and mind echoing the process of generation.

Awareness of transformation demands awareness of the time-structure of change. We know from experience that change has both its gradual and its sudden aspects. Transformation—the change from one figure to another—occurs by abandoning one threshold and establishing another. It involves going through a nodal point of change. In a figure of revolution this nodal point can be a speed threshold: in the *Optics* ascribed to Ptolemy of Alexandria the author observed that a disk painted in different colors in different areas would present a single color when spun fast enough; Plateau's doctoral dissertation, 1829, stated that "all the world knows that if in the dark a flaming coal is turned rapidly, one sees a continuous circle, as if the coal left in the air a trace of its path." At 0° Centigrade, ice gaining heat changes into water; water, at 100°, changes into steam. A chain reaction occurs when a sample of uranium or plutonium reaches a critical mass. A melody emerges when several sounds are made in sequence, and a chord when two or more sounds are made simultaneously; the separate existence of the components is lost, as with the color disk or the revolving coal. A painter puts brushstrokes on a canvas; at a critical point an image emerges; change goes on, gradually, as he extends his painting, but the major, basic change—the transformation—was sudden, occurring at a nodal point of development. At the threshold of birth a fetus changes to an air-breathing human being. After a dozen years of gradual growth, another threshold is breached; gradual change accelerates sharply, superficial change deepens and major reorganization reoccurs. The child becomes a man or a woman, nubile or bearded, capable of biological reproduction.

In a number of ways, the significance of transformation is becoming clearer to us today, influencing our thinking and seeing and leading us toward new techniques and expressions. Design education as synthesized in the theories of the Bauhaus emphasizes the conscious transformation of the properties of materials by deliberate manipulation. Motion picture technique, in its photochemical aspect, presents us with obvious transformations—translating optical patterns into photochemical pattern, then converting latent image into negative image, negative image into positive; in its optical aspect, it converts sequences of still pictures into apparent movement. As an expressive art form, motion picture technique involves the creative use of pattern change, heightening our experience of how things become. The visual idioms of television play a similar role. The rapidly changing visual features of our environment and the rapidly changing habits and attitudes of men compel us to inquire into the meaning of change; the speed at which great events are taking place forces us

to meet new circumstances and adjust ourselves to them. At the very center of our attention is the transformation of man himself.

The new scientific knowledge, from atomic transfiguration to artificial mutation of genes, makes transformation no longer a philosophical issue but a vital experience. Our scientific vistas, our cultural heritage and the force of our contemporary art, reordering our lives, can help bring our sensations, feelings, attitudes and thoughts into harmonious correspondence with the broad movements of nature and society. Such a fundamental individual and social change can only proceed from a genuine optimism, an optimism based on the comprehension of our continual transformation from past to present and present to future. To realize the full potentiality of his resources, contemporary man may draw upon his artistic knowledge of creative transformation and combine it with his new scientific knowledge.

Wang Wei, the T'ang landscape painter, wrote: "Distant men have no eyes; distant trees have no branches; distant mountains have no stones, and they are as fine and delicate as eyebrows; distant water has no ripples and reaches up to the clouds." The ancient Chinese painters were aware that man's visual image of the world undergoes transformation as the relation between the world and him is transformed. They also recognized that the painted image is not the same as the seen image; it is a translated image. An early Chinese master suggested that the top of a painting be done in blue-black and the bottom in brown-black ink. He sensed the different world created by brush and ink within the borders of the silk painting surface, and thus made clear long ago what Helmholtz stated in the scientific language of the nineteenth century: "What he (the artist) has to give is not a mere transcript of the object but a translation of his impression into another scale of sensitiveness which belongs to a different degree of impressibility of the observing eye in which the organ speaks a very different dialect in responding to the impressions of the outer world."

It has been suggested here that the essence of symbol-making lies in the transformation of the ceaseless flow of sense data into clearly defined pictures, words and concepts. Symbol-making is based on transformations, on the changing of substances or the changing of forms. But these transformation changes have not always been understood. Pictures have been identified with the things they represent. Words have been identified with the things or ideas to which they refer. Confusion has grown over the basic fact that images and their references are not identical.

Mondrian, who most consistently departed from optical appearances of things, recognized the agency of transformation when a perceptual image is externalized:

"Not everyone realizes that in all plastic art, even in the most naturalistic work, the natural form and color are always, to some extent transformed. Actually, while this may not be directly perceived, the tension of line and form, as well as the intensity of color, is always increased. Plastic experience demonstrates that the natural appearance of things is not to be established in its natural realism, but must be transformed in order to evoke aesthetic sensation.

"In the course of centuries, the culture of plastic art has taught us that this transformation is actually the beginning of the abstraction of natural vision, which in modern times manifests itself as abstract art . . ."

Today, as in the past, perceptive minds are aware that the key to creative work—both artistic and scientific—is symbolic transformation, the translation of direct experience into symbols which sum up experience in communicable form. Every creative act at any intelligible level operates in terms of these symbolic transformations. It is not the purpose of this book to provide a systematic analysis of this process. It can be said, however, that the traditional concept of an image as a

mirror held in front of nature is now obsolete. From the material presented here we may conclude that the patterns of nature's processes and our pictures of them are not identical and cannot be interchanged. A new vocabulary of visual thinking is suggested, focusing our attention on process and change and pointing to the fundamental significance of transformation.

A prominent feature of contemporary art has been the swift development of creative transformation of the seen world. The external images made by contemporary painters and sculptors are realities manifestly different from palpable experience. In their work we see vivid examples of perceptual transformation of the sensed world. For himself and his fellow-artists, Paul Klee wrote:

"Let me use a simile, the simile of the tree. The artist has concerned himself with this multifarious world and has, let us suppose, more or less come to terms with it on his own. He knows it so well that he is capable of classifying passing phenomena and experiences. I would compare this knowledge of Nature and Life and the endless ramifications through which it is classified, to the roots of the tree. It is from there that the sap rises, flowing through the artist and through his vision.

"He himself is like the trunk of the tree. Afflicted and moved by the force of the stream, he conveys what he has perceived into his work.

"The tree-top expands in all directions and becomes visible in time and space, and the same thing happens with his work. It would never occur to anyone to demand of the tree that its top should be shaped just like its roots. Everyone knows that what is above the ground cannot be just an exact image of what is below. It is obvious that different functions in different elemental domains will cause a considerable disparity.

"But it is just these deviations, which are even necessitated by plastic considerations, that are every now and then not conceded to the artists."

Acceptance of the proposition that the perceived reality of a work of art is not a mirror held to nature can correct our visual thinking. It brings into clear focus what has always been instinctive to creative artists. When a prehistoric sculptor created the Venus of Willendorf, enormously exaggerating the breasts and thighs of Aurignacian womankind, when an Etruscan sculptor translated his notion of bodiless shadow into a wiry and delicate elongated symbol, when similar sculptural forms of attenuated human figures grew from the hand of archaic Greeks, early Gothic masters, Donatello, Lehmbruck or Giacometti, each time there was a trans-

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Tree

Drawing by Judy Kepes, age 7

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Tree of Right or Blazing Tree

Shaker Inspirational Drawing

Seen and Received by Hanna Cohoon, 1845

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Bronze Relief

Benin. The Museum of Dresden

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GUSTAVE COURBET

Winter

The Museum of Fine Arts, Boston

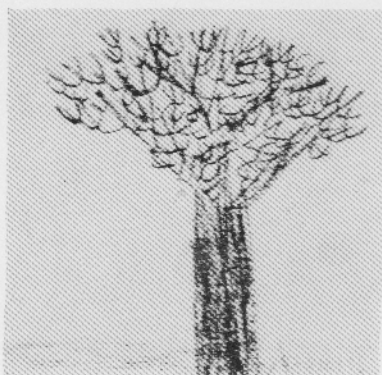
formation of one type of reality into another, influenced by history, by the inner vision of their makers, by the nature of the tools and materials with which they were fashioned. Parmigianino's *Hand* and Fabritius's *View in Delft* show distortion, in terms of extreme projective transformation that yields nothing in violence to Picasso's cubist, Boccioni's futurist and Duchamp's cinematographic, transformations of objects in space.

Concern with the relation between outer and inner reality has made our contemporary culture rich in expressions of fundamental transformation. Psychoanalysts, unraveling the dynamics of our personalities, show us how, without our being aware of the process, the physical realities upon which we hang emotions are transformed into symbols of what we love and fear. Gestalt psychologists have made the perceptual transformation of optical events the object of important research. Recent semantic theories focus upon the capacity of verbal language and schematic scientific expressions to refer to natural events and to the paths we follow in building structures of meaning. Our painters and sculptors, paralleling their own efforts to transform exterior reality into interior reality, have sought to express inner events without aids taken from the predigested outside world of object. By visual and physical patterns that correspond structurally to the patterns of the artist's feelings, Kandinsky, Arp and Miro, among others, suggest the full extent of a dynamic continuity between the inner and outer world.

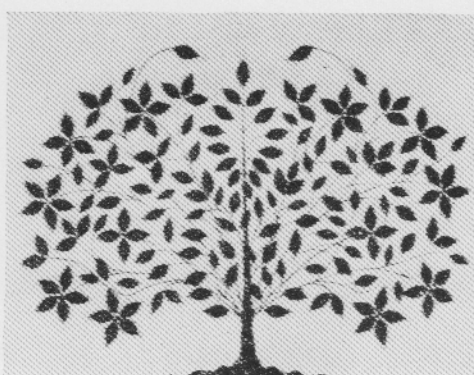
The vistas of the new landscape reinforce the artist's awareness of the role of transformation in experience of the world. Although they bring us our first contact with a nature wider in scope than our gross scale of perception, they are, themselves, patently translated images. They are nature at second hand, not first. But, since the plan and method behind them cling to the most objective recording possible, they are closer to what they are intended to present than is any other form of surrogate or transformed image.

When we look at the new pattern; we know that they are not processes but pictures of processes. We do not regard them as things, as we conventionally do the objects around us, but as aspects of hidden movements. We are aware that they do not include their entire background. We know that they are translations of outer reality. By forging a link between them and the translations from the inner world given us by pioneering artists we will widen our perceptual base to include the full sweep of images of process within us and beyond us.

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