

# WHAT IS A FORM? <sup>1</sup>

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The term *form* is used by different people to mean different things and by the same person to mean different things on different occasions. It can refer to the curved surfaces of a human female or the contours of a crankshaft, to a polyhedron or the style of a man's tennis game. *Shape, figure, structure, pattern, order, arrangement, configuration, plan, outline, contour* are similar terms without distinct meanings. This indefinite terminology is a source of confusion and obscurity for philosophers, artists, critics, and writers. It is an even more serious difficulty for scientists and psychologists. Ambiguity is excusable in the preliminary exploration and discussion of a problem, but it cannot be tolerated when a theory has reached the stage of experimental verification. A more rigorous terminology is very much needed. The psychological problem of how animals and men *perceive* form requires a definition of what it is that is perceived. Experiments in the field of form-perception and constancy of shape can only be decisive if one experimenter knows what the other is talking about.

When the environment of an individual is said to consist of objects, places, and events, a rough threefold classification of "formal" properties is suggested. One ordinarily applies the term *form* to an object, *arrangement* to a place, and *order* to an event. We might agree that the perception of a single object (one delimited by a surface), the perception of a set of objects (a region of space),

<sup>1</sup> This inquiry is connected with a series of experiments on the visual perception of the environment performed under Contract AF41 (128)-42 between Cornell University and the USAF School of Aviation Medicine.

and the perception of what happens to objects (movement and sequences in time) are three distinguishable problems each of which deserves a terminology of its own. The terminology with which this paper is concerned is the first. The only kinds of visual form we shall undertake to deal with here are those associated with or derived from physical objects. Perhaps the simplest kind of shape is that embodied in an isolated object. If so, the effort at definition should begin with this kind.<sup>1</sup>

Even in this limited sense there seem to be at least three general meanings for the term form. There is first of all the substantial shape of an object in three dimensions. Second, there is the projection of such an object on a flat surface, either by light from the object or by the human act of drawing or the operation of geometrical construction. Images, pictures, drawings, and outlines are examples of form in this second sense. Third, there is the abstract geometrical form composed of imaginary lines, planes, or families of them. In this last sense of the term, form is

<sup>1</sup> There are, of course, many other formal properties of the environment even beyond those listed, such as the expression of a face, the composition of a painting, and the structure of a family. All these are unquestionably perceived, but they are so complex that the task of the psychologist is probably one of exploratory experiment rather than attempting to make exact definitions. Some psychologists in the tradition of phenomenology have tried to describe these higher-order varieties of form. The *overall* quality of a picture or a poem which makes it "good" would not be made any more intelligible, however, by imposing a terminology on critics of art and literature. The writer is only proposing that we be precise at a simple level where it may be profitable.

said to be farthest removed from "substance." The reservation should be noted, however, that geometrical forms are presented to students as perfectly substantial black marks on white paper.

If one simply puts the question, How do we perceive form? without distinguishing between these three meanings of the term, a clear answer can hardly be given. Nevertheless, the problem of form-perception in psychology has usually been put in this way. What are the main solutions to the problem of form-perception? One kind of answer is to suppose that man simply has a form-sense. This is in effect no answer at all. It is still accepted, however, especially among ophthalmologists and physiologists. An alternative kind of answer is to assert that man somehow *learns* to perceive form. This answer is also widely accepted among some psychologists, although no one has been able to show just how this learning might occur. A third and more sophisticated answer is that of the Gestalt theorists who propose the general formula that the excitations on the retina are converted into forms by a process of organization in the brain, and who look to the general "laws of form" for an explanation of form-perception.<sup>2</sup> All these answers seem to take it for granted that a form is simply a form and that since everyone knows what the term means there is no need to specify it. Whether the form referred to is a physical thing or is an abstract property of a

physical thing is not clear. Experimenters sometimes refer to a *form*, which implies that it is concrete, and at other times to the *form of a thing*, which implies that it is abstract. The only way to discover what they mean is to examine what they put in front of the observer's eyes during the experiments. In the vast majority of studies of form-perception it is artificial deposits of one or another sort on a paper surface. The theories of visual form, on the whole, have been based on evidence obtained with outline drawings.

It will be argued here that drawings are particularly inappropriate objects with which to begin a study of the perception of form. A drawing is a human production never found in a natural environment; it is complicated by being a thing with which men communicate with one another; it is not a simple presentation to sense-organs but a *representation* or a substitute-object. As a stimulus for perception it is convenient, but it is far from being the primary or fundamental stimulus which psychologists have usually taken it to be.

The reasons for supposing that the primary kind of form is a drawn form would make a long chapter in the history of scientific thought. A main reason, however, is the classical assumption that two-dimensional vision is immediate, primitive or sensory, while three-dimensional vision is secondary, derived, or perceptual. One must first see a plane form before one can see a solid form. This notion is connected with the argument that the three-dimensional properties of things can have no correlates in a two-dimensional retinal image, and that the three-dimensional properties must therefore be reconstructed by the mind or the brain. The writer has suggested elsewhere that this argument is a fallacy (1). So far from plane vision being primary and solid vision secondary, it is the other way around:

<sup>2</sup> The original laws of visual organization were formulated by Wertheimer (8) on the basis of observations with spots, lines and outlines, and their implications were developed by Koffka (4). The effort of Köhler to explain form-perception (5, 6) appears to be a search for laws of electrical current flow in the brain rather than laws of perceived form. Köhler believes, however, that these will ultimately prove to be the same, on the basis of his hypothesis of "isomorphism" between cortical process and phenomenal percept.

There is overwhelming evidence to show that solid vision is primary and that plane vision is acquired only with training and by adopting a special attitude. The impression of a visual *world* may well prove to have a straightforward explanation; the impression of a visual *field*, however, is a very sophisticated kind of seeing and its explanation is far from being simple.

It is possible to revise the traditional view that our visual sensations are two-dimensional and our perceptions are three-dimensional. When the doctrine is thus turned upside down it may appear strange on first inspection, but its intelligibility is much improved. The existing theories of form-perception aim first at two-dimensional form. If they fail to be convincing, the reason may be that three-dimensional impressions which have the property of shape are actually easier to account for than two-dimensional impressions which have the property of shape. Perhaps the theories have been off on a false scent.

After a criticism as sweeping as the above, it is only fair to invite some return. A set of definitions and distinctions will therefore be proposed for the main types of visual form. If they are unacceptable, at least they will be clearly so. What are the various intelligible meanings that can be assigned to the term?

1a. *Solid form.* The closed physical surface enveloping a substance of some kind; the margin between two states of matter (usually between a solid and air). The surface may be curved or it may be composed of adjoining flat surfaces with edges; the former type can always be treated mathematically as a special case of the latter when the number of flat segments is very large. Organisms tend to have curved surfaces and to change their form with growth (7); fabricated objects and a few natural objects like crystals tend to have ad-

joining flat faces and to resist transformation.

Objects have solid forms in the sense defined. When we perceive a detached object we also see a solid form—the depth, relief, or modelling of the surface. How we do so is a problem of long standing.

1b. *Surface form.* A flat physical surface with its edges; the face of an object (or one of the faces of a thin sheet of material such as paper). A surface-form always has an orientation which we shall term *slant*. Slant can be defined as the angle of inclination of the surface to the line of sight or, if preferred, to the axis of gravity (2).

Perceiving a surface-form involves perceiving both the slant of the surface and the form of its edges; an impression of form is never obtained without some accompanying impression of the angle at which the surface lies, either frontal or inclined. The problem of shape-constancy, so-called, is better formulated as the problem of seeing shape-at-a-slant.

If the modelling of a solid form is reducible to the varying slants of its faces, a solution for the problem of how we see slant ought to provide a solution for the problem of depth and relief. The slant of a surface is a physical variable which is simpler to define and easier to manipulate than is the modelling of an object.

2a. *Outline-form.* Physical tracings made with ink, pencil, or paint on a surface, which geometrically represent the edges of a surface-form or the margins of a solid form. These tracings have a finite thickness; they are drawn lines rather than the theoretical lines of geometry. They have two margins instead of the one margin exhibited by the edge of an object.

The perception normally aroused by an outline-form is quite unlike the outline itself. The paper surface is scarcely seen and a different surface seems to

emerge within the outline. The paper surface appears to become "background" and to recede while the inclosed surface seems to take on "figural" qualities and to stand out (4). This, however, is a sophisticated report. Most observers perceive an object and do not see tracings on a surface at all. When you press the question, however, they tell you that they do not literally see a physical object but a picture of it. Hence the perception is not like that of a solid form.<sup>3</sup>

2b. *Pictorial form.* Any representation of a physical object on a surface by drawing, rendering, painting, photography or other means. This would include outlines, silhouettes, plan-views, engineering drawings, and perspective drawings; it extends to transparencies, images projected on a screen, motion pictures and in short, to the vast variety of things we call pictures. One feature is generally to be found—a frame, usually rectangular, edging the surface on which the representation appears. A pictorial form is normally presented to the eyes with the surface perpendicular to the line of sight, that is, at a zero slant.

Some pictures represent other physical properties of an object in addition to the margins and surfaces of the object, such as color, texture, shading, and motion. A color photograph or a 16th century Dutch still-life are examples. If a sufficient number of variables has been incorporated in the deposits of pigment or dye on the surface, an instructive result may be achieved by an in-

<sup>3</sup>A corollary of this definition is that the figure-ground phenomenon has been derived from the perception of outline-forms, not from a study of all forms or of all perception. The universality of the phenomenon as ordinarily described is therefore questionable. It is one of the most convincing tenets of Gestalt theory in its battle with elementarism but whether it will serve as the fundamental basis for a complete theory of perception is not so certain.

genious experimenter. He may fool an observer into believing he sees a real object instead of a picture. When it is carefully arranged that the picture is seen through an aperture so that the frame is invisible, the head is motionless, and only one eye is used, *the resulting perception may lose its representational character.* This may be termed a "peephole situation." In these circumstances, a pictorial form is equivalent to a solid form or, as we say, the observer has the illusion of reality. It may be noted that his retinal image closely resembles the one he would have in an actual peephole situation with a solid form.<sup>4</sup> What this demonstration brings out is the fact, often forgotten, that a pictorial form *as ordinarily viewed* induces a quite different type of visual perception from that of a solid form.

Any pictorial form, including the special case of a simple outline form, has been defined as a representation of an object. We therefore need a definition of a representation. How is one made? The fundamental types are (a) the plan and (b) the perspective of a surface-form.

2c. *Plan-form.* Outlines indicating the plan-projection or "plan-view" of the edges of a surface form. A plan-view is exemplified by an engineering drawing. It does not involve a transformation. The terms projection and transformation will be defined later.

2d. *Perspective-form.* Outlines indicating a perspective-projection or "perspective view" of the edges of a surface form. This always involves a transformation (relative compression or foreshortening). We say that such a drawing shows the object *in perspective*.

<sup>4</sup>Other techniques of pictorial viewing which aim at the complete illusion of reality, notably stereoscopic movies, are impressive but fail to achieve this end. As long as the frame is visible, a picture will look like a picture.

It is true that, after training, adults can visualize the perspective-form of an object they see without having a drawing or picture in front of them. This training is what enables artists to *make* perspective drawings without using special optical or geometrical techniques. Children, in general, cannot do so. This ability to visualize a thing on a picture-plane is probably what lends plausibility to the unfortunate doctrine that we have sensations of form mediated by a "form-sense." The assumption is that the retinal image of a three-dimensional object is a perspective picture in two dimensions and that hence the resulting sensation must be a perspective-form in two dimensions. The doctrine is then faced with the knotty problem of how the sensation can be converted into a three-dimensional perception.

2e. *Nonsense-form.* Tracings on a surface (a pictorial form) which do not specifically represent (are not a projection of) a recognizable object. A drawing may be meaningless because (a) the projection is crude or inaccurate or (b) the tracings are accidental, like a child's scribble or the contours of an ink-blot, or (c) the tracings have a plan or system not *designed* to be a projection of a recognizable object. These latter are what modern artists often construct and call *abstract forms*, but they should be distinguished from the abstract geometrical forms to be defined later. They are also called non-objective forms or non-representational forms, and these terms are better. It should be noted that a drawing may also be meaningless for a quite different reason, because, although it is an accurate projection of an object, the object is not recognizable to the observer. Biological drawings and mathematical constructions are often of such a nature.

The fact is that nonsense-forms are never nonsensical; they are never actually meaningless to an observer, but

are simply unspecific or ambiguous. The perceiver discovers a succession of objects in the picture or, if not objects, then surfaces, edges, and fanciful constructions which are often aesthetically interesting.

We come next to the genuinely abstract forms of geometry. They are certainly not substantial surfaces and edges although they are just as certainly connected with these things. They are also not tracings on paper, although they are represented or symbolized by such. They are in a class by themselves.

3a. *Plane geometrical form.* An imaginary closed line on an imaginary plane. A geometrical line has no width and a geometrical plane has no thickness. A geometrical line is indicated or suggested by a substantial tracing on a substantial surface, but the two should not be confused. Geometrical lines and planes can be specified by the equations of analytic geometry more accurately than they can be drawn on paper. For the practised mathematician equations are often preferable to drawings. Geometrical forms are infinitely variable and only a very few special cases of them have names. Words like *triangle*, *rectangle*, *square*, *circle* stand for only the most familiar geometrical forms.

3b. "*Solid*" *geometrical form.* An imaginary closed surface in an imaginary space of three dimensions. The forms of solid geometry are, of course, no more solid than the blue sky. They are the prototype of all ghosts. They are, in fact, the ghosts of objects just as planes are the ghosts of surfaces, lines the ghosts of edges, and points the ghosts of particles. We can conceive a geometrical form but we cannot see it in the same sense that we see an object, for the form is an abstract property of many objects.

3c. *Projection. Projected form.* A

geometrical form on one plane which is in an exact correspondence with a form on another plane, the correspondence being defined as point-to-point or one-to-one. The relation between a form and its projection is physically exemplified by an object and its shadow (silhouette) or an object and its pin-hole-image, that is to say by optics. If the planes of the two forms are parallel, the forms are geometrically similar or congruent, like scale-drawings or plan-views; if the planes are not parallel, one form is a perspective-transformation of the other.

Conceived thus, a given plane geometrical form is only one of an infinite set of perspective-transformations. The physically analogous fact is that when an objective surface-form is projected on another surface by light, the differing orientation of the form to the surface yields a set of different perspective-forms. The *psychologically* analogous fact, one might suppose, would be that when a surface-form is viewed at different angles of regard, the perceiver obtains a set of different perspective-impressions. The difficulty for psychology is that under ordinary circumstances he does not; instead he obtains a constant percept of the surface-form with a varying impression of slant.

#### *The Problem of Form-Perception*

The above definitions provide a terminology which can now be applied. Returning to the original question of how we perceive form, the obvious reply must be, what *kind* of form? The question must be divided into three or more questions. Solid or surface forms, pictorial forms, and geometrical forms—these at least must be treated separately.

*Perceiving surface-forms.* If the psychologist can explain how we see a given face of a solid object having a certain form at a certain slant, the explanation

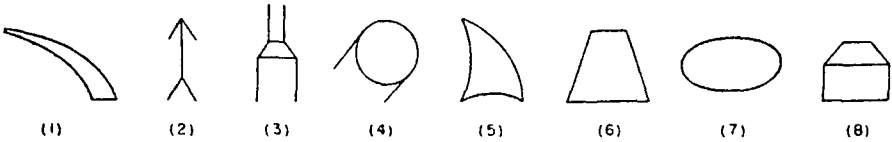
of how we see the whole object in three dimensions can be derived. This is the problem of shape-constancy. It has usually been assumed, in thinking about shape-constancy, that seeing a form without slant was simpler than seeing a form with slant. Since the retinal image is flat, there is supposed to be a retinal form, a two-dimensional form, or a "pattern-stimulus," which initiates the process of perception. But what could this retinal form possibly be? It is clearly neither a substantial form nor an abstract geometrical form. Perhaps it is a pictorial form—the "retinal picture" of commonsense psychology. Nothing, however, could be more mistaken. A picture is something to be looked at. The retinal image could only be a picture if there existed a perceiver behind the eye to look at it. The retinal image is none of the kinds of form defined; *it is in fact not a form at all*. It is a complex of variables of light-energy, definable in terms of steps and gradients but not in terms of physical edges, geometrical lines, or graphic outline (1). Ordinarily there is a dual complex of energy (a pair of images) on a bifurcated receptor-surface (a pair of retinas). We do not see our retinal images; we see an object, and the process is mediated by the images. The images as such may prove to be definable in terms of *order* (perhaps the kind of order exemplified by the number-series) but not *form*. The writer believes that the retinal images should be conceived as a kind of "ordinal stimulation" (1, Chap. 5).<sup>5</sup>

In order to understand the perceiving

<sup>5</sup> In connection with the analysis of visual images in terms of variables, it is interesting to note that closed geometrical forms are variables when one considers their perspective transformations, and that different kinds of geometrical forms (e.g., triangle, square, circle) can probably be specified in terms of variables, although little mathematical effort has been expended in this direction

of a surface-form, therefore, the problem is to specify the variables of stimulation which elicit the perceived properties of the object—the slant of the surface together with the form of its edges. Both the surface and its edges are specifically given in retinal stimulation but they are not represented there. The pair of images is a correlate but not a copy of the object. The nearly constant appearance of these edges at differing

Take for example an outline-form, *i.e.*, a line drawing on paper. It is almost impossible to avoid seeing the properties of a surface-form having edges which stand out from the background. This “piece of surface” may have a form and a slant quite different from the form of the tracings and the slant of the paper. This last fact is so important that an experimental demonstration of it is worth reporting.



slants in the case of ordinary naive perception will probably prove to be simply a by-product of the specifying of this stimulation. The dependence of phenomenal slant-shape upon the impression of slant may then be clarified.

*Perceiving objects mediated by pictures.* The question of what and how we see when we look at a picture of some kind is quite different from the question formulated above. The process of object-perception is surely simpler than the process of picture-perception. Despite the fact that men have been making drawings for thousands of years and during the past century have invented a variety of displays which our ancestors never dreamed of, we know very little about what happens within us when we see a picture. This much is certain, however. Pictures are *on* a surface whereas substantial objects *are* a surface. Moreover pictures *stand for* substantial objects in addition to *being* substantial objects. An outline-form, a painting, a photograph, or a radar screen-picture are each a sign of something else. What the observer ordinarily perceives is the object, place, or event represented, and this fact poses a special problem of perception.

The outline-forms illustrated, drawn on cards, were shown in succession to an observer with the instructions, “Tell me what you see *on the card*. Keep looking at it, and if what you see changes describe it also.” For each card the verbal descriptions were recorded and later classified. Every *O* reported two or more perceptions within 60 seconds and some had as many as seven. Ten *O*s were used.

At no time did any *O* describe anything like black deposits or marks or traces on a white surface. All the terms and phrases used fell into three other classes: *lines and angles*, *geometrical figures*, and *solid objects with physical surfaces*. The first two kinds were very infrequent; the great majority of terms referred to objects. Evidently what every *O* saw “on the card” was seen with what might be called the pictorial attitude. The physical objects reported were highly variable, differing from one *O* to another and successively for the same *O*. They could be divided into two sub-classes: (1) objects for which the outline-form was a plan-view, and (2) objects for which it was a perspective-view. With only one or two exceptions, *every observer saw every*

*outline-form in each of these two ways.* The first drawing could be a horn or a road curving up a hill, the second an arrow or a tent-roof, the fourth a pulley with rope or a cannon-muzzle, the sixth a truncated pyramid or a carpet on the floor, and so on. It is obvious that a single outline-form may elicit perceptions of two quite different solid forms. The form of a surface with its edges (e.g., the carpet) may be very different from the outlines representing the edges of such a surface (e.g., the trapezoid).

It should now be clear why outline drawings are not appropriate stimulus-objects with which to begin the study of form-perception. They are habitually taken to stand for something other than what they are and, more important, what they stand for is often equivocal. An outline, representing as it does only the edges of a surface, may stand for any *object which projects that particular outline*, including some very queerly shaped surfaces. For instance, a given trapezoid, or a trapezoidal pencil of light-rays, may stand for a square at a given slant but it may also stand for any of an infinite set of different trapezoids at other different slants. Conceiving the matter in this way, it is only to be expected that the perceiving of outline-forms is fluid, changeable, and seems to have a spontaneous character. The perceptions they arouse are unstable because they are equivocal representations. It is not necessary to infer that the stimulus-distribution is unstable, nor to suppose that it moves in the direction of equilibrium or "good form." Nearly all the research on form-perception has utilized outline-drawings as stimuli. If it be granted that these are actually *pictures of forms*, the research is irrelevant to the problem. A genuine psychophysics of form-perception will have to deal with "shape-slant," i.e., with transformations of form which co-vary with degrees of slant. In con-

trast with an outline drawing, a pair of retinal images of the usual sort contains stimulus-variables for the perception of slant (2). Only in "peephole situations" are these stimulus-variables so impoverished that the perception of slant becomes ambiguous.

*Visualizing geometrical forms.* To the question of how we perceive form in the third general meaning of the term, the answer is probably that geometrical forms are not perceived at all. Geometrical forms have no stimuli or, more exactly, are not in psychophysical correspondence with stimuli. They are not seen directly like substantial forms, or indirectly like represented substantial forms, but instead are conceived or abstracted from innumerable past seeings of both. Not much is known about the process of abstraction or concept-formation, but it is fairly certain that a child can identify a simple object at a very early age, a represented object at a later age, and a concept at only a much later age. The geometrical forms we are talking about are conceptual or general. It must be remembered that the geometrical triangle referred to in a theorem is a triangle in general, not just the particular form in the geometry textbook.

What kind of forms *are* the drawings in the textbooks then? One might be tempted to say they are pictorial forms, but this would not be strictly correct. Outline-forms do not represent geometrical forms in the way that they represent the edges of surface-forms, or objects. A geometrical drawing may be said to signify a whole set of projective transformations. A set of transformations is even more ghostly than a single geometrical form. An outline taken in this sense is more nearly a symbol than it is a picture. The relationship of *standing for* is more dependent on an arbitrary convention, and therefore on learning, than it is in the case of a pic-



ture. Consequently an outline-form presented to an observer without any other indications of the object represented is even more ambiguous than it was made out to be in the last section. In addition to being equivocal as a picture, it is a symbol for a bevy of geometrical ghosts. To assume that it constitutes a simple "stimulus" for perception is completely misleading.

*Patterns and textures as distinguished from forms.* The term pattern has so far neither been used nor defined. In psychological usage it seems to refer to (1) a group or arrangement of single objects, or (2) a group of artificial traces on a surface, such as the patterns used to exemplify Wertheimer's laws of visual organization, or (3) a group of natural inhomogeneities on a surface. In the latter meaning, a pattern passes over into being a *texture*. The latter term, in the writer's opinion, should mean an arrangement of visible particles not *on* but *in* a surface—the visible structure of a surface itself. This is important because of the possibility that the optically corresponding texture of the retinal image of the surface is the adequate stimulus-condition (or one of the stimulus-conditions) for the impression of the surface (2). The writer has suggested that the impression of a surface is essential for the perception of determinate visual space (1). The interrelationships between visual acuity, visual texture, surface-perception, and space-perception remain to be defined.

The first and second meanings of the term pattern—a grouping or arrangement—need definition and analysis as much as any of the others, but the task is beyond the scope of this paper. So also do "structure," "sequence" and the higher order varieties of *Gestalten*. The feeling of mystery that attaches to all such words ought to be dispelled, because they will be even more interesting when comprehended.

*Conclusions.* A number of explicit definitions of visual forms have been proposed out of a conviction that psychologists should come down to earth and say exactly what they mean when they talk about form. The suggestion was made that the kind of forms heretofore studied—pen or pencil tracings—is artificial, and as a type of stimulus for perception is equivocal. Such forms are either projections of disembodied edges or symbols for ghostly abstractions. The forms we need to investigate first are embodied in chunks of physical surface. The kind of form for which there exists an unequivocal stimulus is a form imbedded in a surface—that is to say, a shape-at-a-slant. When a form is not imbedded in a surface (and when, as a result, contour-stimulation is not accompanied by surface-stimulation) the resulting percept is ambiguous. Since the slant of the presumed surface is equivocal, the form is also equivocal, and what the observer sees is open to the influence of assumed probabilities, clues, unconscious inferences, the standards of past experience, or the social norms of group life. Since nearly all the experimental research on form-perception has been performed with outline-stimulation alone, we are tempted to conclude that *all* form-perception depends on probabilities, inferences, and norms—in other words, on subjective factors. This conclusion is unwarranted. Important as these factors no doubt are, the primary problem for psychologists is to isolate the invariant properties in visual stimulation which are in psychophysical correspondence with constant phenomenal objects. According to the proposed definitions *solid* forms and *surface*-forms are realities. *Outline*-forms and also *pictorial*-, *plan*-, *perspective*- and *nonsense*-forms are representations which the perceiver takes to stand for realities. For these a special theory of picture-perception is required. *Geo-*

*metrical* forms, both *plane* and *solid*, are abstractions which cannot even be represented, strictly speaking, but can only be specified by symbols. If the definitions are accepted, there is no such thing as form-in-general with the universal characteristics ascribed to it by Gestalt theorists. None of the above forms is a whole which is different from its parts. None is organized in any special sense. None is in the least dynamic. It is possible to understand, however, why these characteristics have been ascribed to visual *Gestalten*. The reason is probably that we have studied only the disembodied varieties of form—*i.e.*, ghost shapes—which are ambiguous representations or equivocal symbols, and which consequently yield fluid, variable, or inconsistent percepts.

If such be the case, the effort to determine what happens in the brain when one perceives form-in-general will prove to be fruitless. Theories such as those of Köhler (5, 6) and, more recently, Hebb (3) seem to be efforts of this sort. At least three separate levels of theory will be required: first, a theory of how we perceive the surfaces of objects—a theory of slant-shape or, in older words, of shape-constancy; second, a theory of how we perceive representations, pic-

tures, displays, and diagrams; and third, a theory of how we apprehend symbols. There is no reason to suppose that the physiological concomitants of all these experiences will be the same; in fact, since pictures and symbols presuppose objects, their physiological explanations will probably have to be found at increasing levels of complexity. When these three levels of theory have been developed, the category of "form-perception" in psychology will have evaporated.

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[MS. received May 4, 1951]