any given time is an inverse function of its concern with such fictitious matters as thinking, perception, emotion, and the like.

Given this initial affirmation, the historiographic task then becomes simply that of recounting the successes that psychology has achieved down through the ages in shucking off these ill-conceived concerns. As it happens, these successes have been rather few and far between. Thus, as Kantor portrays it, psychology had some promising "naturalistic beginnings" in Greek classical antiquity. From these, however, it all too soon "departed in the Hellenistic period when psychological interests were cultivated by the Christian Church Fathers." This waywardness persisted right up until the 17th century, which is when psychology, spurred on by successes within the other natural sciences, at long last began to grope its way back toward the true path. Indeed, only in the present century has psychology finally found its way back to the straight and narrow path of natural science, and even now it has only succeeded in placing one foot upon it. The other foot, alas, is still dragging along in the unscientific mud. Thus, as Kantor sees it,

> [even though] the psychological field is no longer completely dominated by the transcendental tradition centered about or allowing extraspatial or supernatural factors, which cannot be tolerated by any science, it is still not entirely emancipated from nonscientific ways of thinking. Psychologists still today concern themselves with 'sensations,' 'emotions,' 'experiences,' and other transspatial constructs.

Let it be recognized, then, that these volumes are heavy with polemic. This, however, should not dissuade one from reading them, for as we have said they are the result of an honest and entirely competent historiographic effort. Moreover, they give good expression to an important psychological point of view which, in less competent hands, is apt to seem rather crude and sophomoric. This, of course, is the Watsonian view that mental states and mental processes have no reality "in terms of natural science." The considerations that prompt Kantor to hold this view may be briefly summarized as follows: (i) "Sensations," "emotions," "experiences," and the like are mere theoretical constructions; (ii) moreover, they are bad theoretical constructions—bad because they are fictitious, fictitious because they are "transspatial." Of the criticisms that might be lodged against this line of reasoning, we need say only a word: (i) To the dentist, a patient's toothache is indeed a mere theoretical construction—a thing inferred from the patient's behavior and the state of his teeth. To the patient, however, it is not a theoretical construction at all, as may be readily appreciated by anyone who has ever had a toothache. The same point may of course be made about any of the "phenomena of mental life." (ii) "Transspatial" and "extraspatial" are mere epithets. Insofar as they mean anything at all, they denote a priori restraints to which no natural science of the present century could reasonably submit. It is true that a toothache is not "spatial" in quite the same way as a chair is. But neither, we are told, are any number of the arcane matters with which certain of the other sciences unblushingly concern themselves. If it were to be widely held that "transspatial" and "fictitious" are synonymous, then we should all perforce go back to being good Galileans and Cartesians.

RICHARD LOWRY
Department of Psychology,
Vassar College,
Poughkeepsie, New York

Köhler's Perception

The Task of Gestalt Psychology. WOLFGANG KÖHLER. Princeton University Press, Princeton, N.J., 1969. viii + 166 pp., illus. $6.50. Herbert Sidney Langfeld Memorial Lectures, 1966.

Wolfgang Köhler, who died in June 1967, was the last remaining member of the original Gestalt school of psychology. Köhler was born in Estonia of German parents and was brought up in Germany, to become by 1921 the director of the Institute of Psychology in the University of Berlin. He resigned in 1935, after defying Hitler and all his works, to settle in the United States. He grafted a German tradition onto the very different stem of American empiricism, at that time flowering with J. B. Watson's behaviorism. Gestalt psychology was a strange graft, generally appearing more alien than symbiotic; but the contrasting colors of the two blooms emphasized their special features.

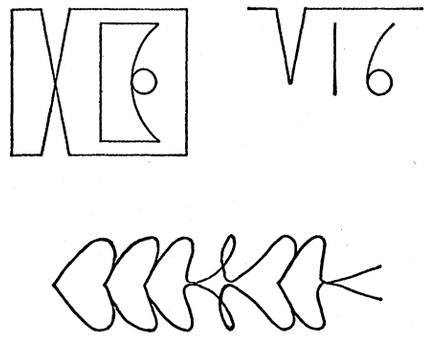
Köhler's main works are: *The Mentality of Apes* (1917), in which he described "insightful" behavior, solutions occurring suddenly rather than by overt trial-and-error; *Gestalt Psychology* (1929); *Dynamics of Psychology* (1940); and many papers, originally appearing in *Psychologische Forschung*, mainly concerned with problems of perception. The present book is a series of four lectures—delivered at Princeton in 1966—posthumously edited by Solomon Asch, Mary Henle, and Edwin Newman, and introduced with a useful historical essay by Carroll C. Pratt. The lectures discuss the early contributions of Gestalt psychology to perception, physical analogies for describing brain function, and experiments on d-c cortical recording, and include a delightful description of the classical observations of the "genius" chimpanzee Sultan and the active but less "insightful" Rana engaged in reaching bananas from movable boxes. This study was undertaken over 50 years ago and has been discussed by psychologists ever since. It takes on a fresh significance now that "intelligent" machines begin to have similar ability: What is it to build "insight" into a machine? Are psychological theories adequate to tell us?

In these lectures Köhler seldom goes back on his earlier statements or adds anything significantly new. Rather, he surveys with some satisfaction past achievements of the school of which he was so eminent a member. But is there cause for satisfaction? What remains of importance from the vast wordage of Gestalt writings? Certainly Köhler's observations of chimpanzee problem-solving are a foundation stone of ethology. The Gestalt rejection of mosaics of stimuli or sensations (not always clearly distinguished by Köhler) and the emphasis on interactive perceptual effects involving large units, was demonstrated by simple experiments with patterns of dots. We would not, however, now accept that the significance of these effects was correctly appreciated by those who pointed them out.

Perhaps the Gestaltists' works suffered somewhat from pollution by a stifling metaphysics; at any rate the Gestalt rejection of analysis, or explanation in terms of logically simpler concepts or defined underlying mechanisms, makes their theories no more than occasionally suggestive. Worse, it is far too easy to raise serious difficulties, questions which they should

surely have raised themselves and attempted to answer. Here Köhler's last lectures are disappointing, for no veils are lifted. Köhler's isomorphic brain fields, for example, are suspect on logical grounds, quite apart from Lashley's famous experiment with the implanted gold wires (not mentioned in these lectures) which should have distorted the fields but apparently did not. If we suppose that a circle is represented as a circular brain trace, then—apart from the difficulties of how the rest of the nervous system has access to this trace without having to see it with an inner eye, leading to infinite regress—are we supposed to believe that the brain trace of a traffic light changes from red to green? How are touch and temperature and music represented? These are supposed to obey Gestalt interactive laws, but can the Gestalt kind of representation possibly apply to them? If shape, why not music in the brain? Again, to argue that physically intermittent movement which appears the same as continuous movement (phi) "clearly proves" (p. 39) the existence of such interacting processes is to omit the strong possibility that velocity is coded early in the visual system (as we now know it is in the retina of frog and rabbit) and transmitted as velocity signals which continue unimpaired through small gaps in time or space. Some tolerance to intermittency is all that is logically required (though there may be more to the matter), and yet phi is a foundation observation of Gestalt theory, supposed to *demonstrate* isomorphic traces. Another such is autokinetic movement. This apparent movement of a stationary light is supposed to demonstrate directly the presence of internal and shifting reference frames. The argument is that since all movement is relative but nothing external moves in the autokinetic situation, there must be something internal—reference frames—which moves. But this is to ignore the vital distinction between veridical and disturbed observation. A neural system transmitting velocity information would be expected to transmit false velocity signals, giving an *appearance* of movement though all is stationary, if its calibration is upset. Surely by regarding the senses as transducers and as instruments for making decisions on data, at least such mistakes can be avoided.

An emphasis on innate principles permeates all Gestalt writing. The kind



Figures used by Köhler to demonstrate that "the principles according to which visual objects are established differ from the processes which the empiristic explanation, the explanation of learning, makes one expect" (*The Task of Gestalt Psychology*, p. 51). The figure at the upper left seems "not at all familiar. But it contains one part with which we are all well acquainted," shown at upper right. The lower figure consists of a common word resting on its mirror image.

of evidence accepted as establishing the primary importance of innateness in perception would hardly be accepted now but is repeated in these lectures. Köhler presents figures that "contain" other, familiar figures which however are not recognized. He argues that the difficulty in seeing the figures proves that "past experience cannot be the main factor responsible for the appearance of objects in visual fields" (p. 52).

Clearly there is something important here, though we may question its relevance to the innate-versus-learning controversy. Köhler goes on: ". . . one should not simply call [such objects] 'wholes.' Surely they *are* wholes rather than mere regions within a general mosaic of local sensations. But we should always add an adjective, namely 'segregated' or 'detached' wholes. For . . . objects appear in the visual field only if their boundaries are visually preserved." He goes on to say that the processes which make "unitary" objects "emerge" were insufficiently emphasized in early Gestalt psychology. This extraction of objects now assumes the greatest importance in the very difficult problem of making intelligent machines accept raw data from the surrounding world without having to be fed only with what is relevant. It turns out that certain typical characteristics of objects, such as closure of contours, have to be provided, or programmed in, before seeing machines can identify objects from backgrounds. Exceptional situations (including such complications as shadows) can fool the machine, as they can fool us, though we are at present more subtle. The old illusions and the newer "impossible figures" take on profound importance in this context, for they reveal the assumptions that are accepted to make the problem generally tractable. The same line of thought allows us to reconsider the basic Gestalt emphasis on perception as being of "wholes." It turns out that a computer program attempting to extract particular shapes by a rigorous point-to-point analysis is far too slow. Rather, it seems necessary to fit what may be termed partial templates to key features—to establish with just sufficient precision the presence or absence of features used for object identification. Once they are identified, redundancy in space and in time reduces the information needed to maintain perception of the ever-changing positions and orientations of objects. Without such simplifying assumptions, cartoons would be meaningless to us; indeed it is surprising how little attention cartoons have received as experimental material for revealing just what is necessary for recognition of familiar objects.

The Gestalt school grew from German metaphysics and always resisted the precise analysis of empirical science. It may however be that Köhler, Wertheimer, and the rest saw from their simple introspective experiments with lines and dots key features of the brain's perceptual programs, which we are beginning to build into machines that are inadequate when designed according to the rigorous empiricism that was their first inspiration. If the truth is that Gestalt theory reflects the brain's partial analysis of data, we may use insights of Gestalt theory to solve problems of artificial intelligence, to design seeing machines by making them similarly nonrigorous if detailed analysis takes too much time. This is far removed from the aims and hopes of the original Gestalt school, but it is more than possible that Köhler would approve of the application of his insights to problems in physics and engineering—instead of, as so often in psychology, the other way round.

R. L. GREGORY
Bionics Research Laboratory, University of Edinburgh, Edinburgh, Scotland