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Chapter 7

Gestalt Psychology

Gestalt psychology was born with Max Wertheimer's (1880–1943) paper (1912) on apparent movement. The paper was a report of work by Wertheimer, Wolfgang Köhler (1887–1967), and Kurt Koffka (1886–1941), the cofounders of the new school. Like most new schools, Gestalt psychology cleared away some of the old problems in psychology and pointed the way to new ones. Its rejection of the artificiality of much of the psychological analysis of the day led to a collateral concern for problems closer to everyday-life experiences. The problem of the organization of elements into wholes and the laws of such organization were emphasized. The Gestalt type of examination and explanation of perceptual phenomena, such as afterimages and apparent movement, was begun. Learning theorists were forced to consider Gestalt principles, such as organization and insight, in the formulation of their theories. We have already seen Thorndike's belongingness as an example of such a concession to Gestalt principles.

Gestalt psychology was and is especially prone to be misunderstood. It was the product of European culture (see Table 7–1, which lists the names of the most important persons in the school), with its credo originally published in German. Fortunately, Gestalt psychology had founders who remained active in psychology. The sojourns of the three founders in the United States after they fled Nazism helped to clarify the Gestalt position and to make its principles available in

English. The early misunderstandings are beginning to dissipate. Köhler's book (1947) has been especially helpful. For example, he has pointed out (p. 168) that Gestalt psychology does not reject analysis in general. Many American psychologists had felt that the Gestalt derogation of artificial introspective analysis implied a rejection of all analysis. Köhler has also pointed out that the Gestalt opposition to quantitative statements was a prescription for psychology because of its youth, not an objection to the ultimate desirability of such formulations.

This improved understanding of the Gestalt position and the interaction of Gestalt psychology with the more Americanized brands have resulted in the general acceptance of several fundamental Gestalt ideas even in the relatively unfriendly climate of American psychology. An acceptance of the Gestalt point that there are wholes which lose much of their identity and importance by an analysis into parts has helped make the study of relatively unanalyzed, global variables more respectable in experimental psychology. The size of the unit of analysis is now seen as arbitrary and a matter of convenience. This position is quite different from the Watsonian theoretical tendency to reduce every molar act to chained reflexes, using only relatively molecular units of analysis. An "atomistic reductionism" is no longer the exclusive concern of psychology. If the psychologist does analyze situations into a number of simpler variables, he recognizes the need for what may be called *combination laws.* These combination laws specify the relationships between the several simple variables and tell how they combine in the production of the final behavior. It is no longer considered sufficient to specify the relationships between single independent variables and the dependent variable, "other things being equal." Situations can be completely understood only when we know how the several relevant variables interact. The Gestalt point that new phenomena are created *(emerge)* in complex situations is accepted.

The Gestalt emphasis on phenomenology makes it difficult for present-day users of introspection to ignore the phenomenological contents of experience, that is, the direct, naïve reports of untrained observers. Since the phenomenological report contains meanings directly, it is no longer necessary to quibble about stimulus errors, which presumably arise from prior knowledge about the stimuli. The report, with its meaning, can be accepted as such. Since the wholes given in phenomenological experience are assumed to be legitimate phenomena in their own right, there is less concern with an attempt to break every experienced whole into its constituent elements. The concept of constancy in perception has been re-thought. The old concept, which was based on constancy in response when local stimulation varied (as when you move away from a person and the retinal image changes, and yet the person continues to appear to be the same height), was no longer meaningful. The Gestaltists insisted that *local* stimulation should not be expected to coincide with *local* response, for both are parts of a total field whose influence would be expected to change the nature of the response to every local stimulation present. Thus the person should be *expected* to remain the same perceptual height, being part of a field which retains many of its relationships

view is that the senses exist for getting information; they have evolved as effective systems for carrying out this function. One desirable property in an information-gathering system would be to have it extract constant features from the flux of experience. Along these lines, Gibson (1966) says: "Above all, it should be remembered that the informative variables of optical structure are *invariant under changes in the intensity of illumination and changes in the station-point of the observer*" (p. 242). If one considers the infinitude of changes in illumination and station-point that take place during the life of a human being, it is clear that a system which preserved the results of such changes would very quickly find itself overloaded. From this point of view, it becomes clear that the structuralist concern with the analytic details of local stimulation was misguided if scientific interest is to be focused on the same things that are important in the life of the organism. The organism, in order to function through a reasonable lifetime, must be constructed so that it focuses on invariants, and these invariants turn out to be fairly complex, relational properites of wholes. Thus efficient stimulus definition must be molar stimulus definition.

THE ANTECEDENTS OF THE GESTALT MOVEMENT

When one speaks of antecedents of modern psychological systems, Wundt comes readily to mind. He was the villain against whom the systematists rebelled, and his role was necessary. His elementaristic position was a target for Gestalt psychology just as it was for functionalism and behaviorism. However, he was an antecedent in a more direct sense; his principle of creative synthesis was an early concept that implied some recognition of the difference between wholes and the sum of their parts. This concept was much like John Stuart Mill's mental chemistry. Both men recognized that new characteristics might emerge from the combination of elements into wholes. Neither, however, did enough about his notion to satisfy the founders of Gestalt psychology.

Franz Brentano, whom we have discussed in relation to Wundtian psychology (Chapter 4), believed that psychology should concentrate upon the process or act of sensing rather than upon the sensation as an element. He used introspection, but his introspection tended toward the naïve phenomenological variety. He considered Wundt's introspection artificial and strained. Thus he anticipated the Gestalt method of introspection and made the direct, naïve expression of experience respectable. However, he did not recognize the emergence of new phenomena with increasing complexity.

Carl Stumpf (1848–1936) was another antecedent of Gestalt psychology, but he bore a very peculiar relationship to its founders. Köhler (1920) dedicated a book to Stumpf, from whom he had received his Ph.D.; Koffka was also a student of Stumpf, as was Kurt Lewin, a developer of a kind of Gestalt psychology. Wertheimer got his degree with Külpe at Würzburg, but studied with Stumpf and was associated with him for years at the University of Berlin. Yet Stumpf, so closely associated with these four chief figures in Gestalt psychology, denied having any direct systematic influence on the new movement (Hartmann, 1935, p. 32). It seemed that Stumpf was positively anxious to disown any influence.

of colors by recourse to the combination of sensations of color with some other elements, as the Wundtians would have. Rubin did not begin his work until 1912, the year the Gestalt school was founded. He developed the distinction between figure and ground in his phenomenological investigation. He noted that commonly part of the total stimulus configuration stands out, while part of it recedes and is more amorphous. He produced several demonstrations in which the figure and ground can be reversed. He did not publish until 1915; the Gestaltists pounced on his work immediately and appropriated it to their system, since it was another instance of evidence which required the consideration of the totality of stimulation for its explanation.

Meanwhile, others were being beckoned by problems similar to the one so ingeniously solved by the Gestalt triumvirate. In England, G. F. Stout (1860–1944) in 1896 raised questions about the whole-part relationship. He was concerned chiefly with form and concluded (1902) that ". . . an element which is apprehended first as part of one whole, and then as part of another, is presented in two different points of view, and so far suffers transformation" (p. 71). He had stated clearly the Gestalt point that there exist wholes which influence the mode of existence of the parts.

Even earlier, William James in the United States had challenged psychological atomism (1890). He said "The traditional psychologist talks like one who would say a river consists of nothing but pailsful, spoonsful, quartpotsful, barrelsful, and other moulded forms of water. Even were the pails and the pots all actually standing in the same stream, still between them the free water would continue to flow" (vol. I, p. 255). Like the water, the stream of consciousness for James had a reality independent of its atomistic analysis.

Curiously, James also used an analogy that was almost exactly like one used by Köhler many years later:

> In a sense a soap bubble has parts; it is a sum of juxtaposed spherical triangles. But these triangles are not separate realities. Touch the bubble and the triangles are no more. Dismiss the thought and out go its parts. You can no more make a new thought out of ideas that have once served you than you can make a new bubble out of old triangles. Each bubble, each thought, is a fresh organic unity, sui generis. (James, 1890, vol. I, p. 279, footnote)

Had James seen fit to elaborate his point sufficiently, Gestalt psychology might have had an earlier founding.

We have already met another American who was surprisingly close to Gestalt principles, although his point was made relative to quite another empirical area. John Dewey, in his reflex-arc paper (1896), was advocating a field approach, a study of the whole situation in itself, a discarding of the artificial analysis into stimulus and response. The reflex arc was seen to be an organic unity, losing its meaning and reality in the analysis (cf. Chapter 5).

The very atmosphere of thought just prior to the founding of Gestalt psychology seemed to be permeated with the notion of fields, the notion of organic wholes. And thought of this sort was not limited to psychologists and philoso-

phers. For example, E. B. Wilson, a leading biologist, said that the cell must not be regarded as an independent unit, the only real unity being that of the organism.

THE FOUNDING OF THE GESTALT SCHOOL

Max Wertheimer, the oldest of the three founders, was born in Prague in 1880, and studied law there before turning to psychology (Boring, 1950). He studied with Stumpf and Schumann before taking his degree with Külpe at Würzburg. After that, he rather dropped from historical notice for about 6 years; he was apparently "financially independent" so that he could afford to work only wherever and whenever he wished. He bobbed back to the historical surface in 1910, with his arrival at the Psychological Institute in Frankfurt am Main. He had obtained a toy stroboscope upon leaving the train, and made some observations in his hotel room; then he went to the institute to find more subjects. Schumann, his friend from Berlin, was there. He gave Wertheimer a tachistoscope, and two other graduates of Berlin—Köhler and Koffka—were soon helping Wertheimer study apparent movement. No doubt the young assistants were happy to help the aged Wertheimer, who was then 30, by serving as subjects. The three of them afterward had long discussions of the results of their research. The phenomenon which gives us motion pictures had long been difficult for psychologists to interpret. In essence, the problen was how to explain, using sensations as elements, the perception of movement which arose from a series of stimuli, none of which moved.

Wertheimer worked with two slits, one vertical and the other inclined 20 or 30 degrees from the vertical. When light was thrown first through one slit and then through the other, the slit of light appeared to move from one position to the other if the time between presentations of the two lights was within the proper range. Wertheimer worked out the range within which movement was perceived. The interval of around 60 milliseconds was optimal. If the interval between presentations was longer than about 200 milliseconds, the light was seen successively first at one, then at the other position. If the interval was too short, 30 milliseconds or less, both lights seemed to be on continuously. Wertheimer gave one type of movement the name *phi*; he wished to give it a name that would emphasize its independent character as a phenomenon in its own right. It was a phenomenon which could not result from the summation of individual stimulations, for certainly an elementarist could not argue that the addition of a second stationary stimulation to a first stationary stimulation could yield, by summation, a sensation of movement. The founders of Gestalt psychology were perhaps fortunate in working with an experimental paradigm which made it so crystal clear that the overall situation was critical in determining what was perceived.

Wertheimer's monograph (1912) describing the research contained an explanation of apparent movement so simple, yet so ingenious, that it served as the basis of the new school of psychology. The explanation was essentially that apparent movement does not need explaining! It exists simply as a real phenomenon in its own right, a phenomenon irreducible to simpler sensations of any kind.

An attempt to analyze it into simpler sensations, in the orthodox Wundtian manner, would destroy the reality of the phenomenon as such. Apparent movement would not be found to exist except in situations where prescribed *relationships* between elements held. Wertheimer said, "There is no internal reason why something that is psychologically 'dynamic' should have to be deduced á priori from something 'static' " (Shipley, 1961, p. 1082; translated from Wertheimer, 1912).

This apparently simple beginning of Gestalt psychology was really not so simple as it might now seem. Its principles were completely counter to most of the academic tradition of German psychology. To regard a complex experience as having an existence of its own amounted to revolution. To maintain, as Wertheimer did, that the *primary* data of perception are typically structures *(Gestalten)* was heresy to the German introspectionistic tradition and to its American counterpart, which was flourishing under Titchener. Structures, for these psychologists, were things to be broken down into the elements, which were primary.

In addition, Wertheimer thought that it was legitimate for introspection to use simple, naïve descriptive words. He maintained that local sensations should not be expected to concur with local stimulation because both are part of a field, a whole, which influences the individual parts in a way depending on the structure of the whole.

Not only did Wertheimer advocate these things, but Köhler and Koffka advocated them vociferously. As Köhler said in his obituary for Koffka:

> Those were years of cheerful revolt in German psychology. We all had great respect for the exact methods by which certain sensory data and facts of memory were being investigated, but we also felt quite strongly that work of so little scope could never give us an adequate psychology of real human beings. Some believed that the founding fathers of experimental psychology had done grave injustice to every higher form of mental life. Others suspected that at the very bottom of the new science there were some premises which tended to make its work sterile. (1942, p. 97)

This last point concurs with one stated brilliantly by James and cited in Chapter 4 (see p. 89).

With such cheerful revolutionists, the movement gained momentum. There were many in Germany, as in America (e.g., Helson, 1925, 1926), who were dissatisfied with the artificiality and paucity of results of the older psychology. Gestalt psychology quickly gained support from them. Many psychologists were happy to find a way to avoid the proliferation of elements needed to explain each new complex experience. They did not believe that the legitimacy of the phenomenological approach, or of emergent real phenomena, could any longer be denied. This was the primary assumption of the developing school. Let us look further at the set of tenets developed by the new psychology.

THE TENETS OF GESTALT PSYCHOLOGY

The Whole-Part Attitude

Examples Illustrating the Problem The attitude of Gestaltists toward wholes is one of the most difficult to grasp in all psychology. We must therefore

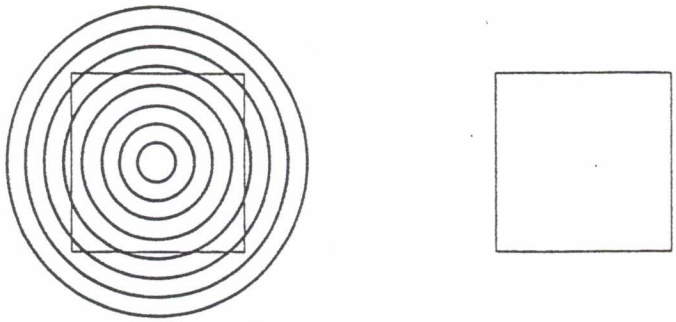

Figure 7-1 An illustration of the dependence of perception of a part upon the pattern of the whole. *(Adapted from Orbison, 1939, p. 42.)*

devote the most careful attention to it. Certainly the distinction they make between a whole and the sum of its parts is not new. The Chinese sage Lao-Tse is said (G. W. Hartmann, 1935, p. 9) to have expressed in 600 B.C. the notion that the sum of the parts is different from the whole. Also Skinner (1938, p. 29) has contended that the question of whether the whole is different from the sum of its parts is a pseudoproblem. On the other hand, Weiss (1967) has entitled a long and beautifully illustrated article "$1 + 1 \neq 2$ (One plus one does not equal two)," and there is no doubt whatever that he considers it a meaningful problem. Many have been concerned with it, and it may justify as much investigation as that other long-lived puzzle, the mind-body problem, in order to find out whether it is a profitable question to ask.

Max Wertheimer had this to say about the whole-part problem as it occurs with respect to the given in experience (Wertheimer, 1938): *"The given is itself in varying degrees structured* (Gestaltet), *it consists of more or less definitely structured wholes and whole-processes with their whole-properties and laws, characteristic whole-tendencies and whole-determinations of parts. Pieces almost always appear as parts in whole processes"* (p. 14).

Wertheimer is of course pointing to the importance of structure, but he is doing more than that. Even an associationist or a structuralist could accept that. Wertheimer is indicating a kind of logical *priority* of the whole. Consider an example provided by Orbison (1939) and reproduced here as Figure 7-1. The two squares are "objectively" identical in size, with all sides straight. Yet in perception the structure of the whole makes them appear as different parts. It does not make sense to a Gestaltist to say that the two squares appear first as parts, and then make up different wholes. The very nature of their existence as parts is determined by the wholes.

Analogies from other fields which demonstrate the importance of structure and the difference between wholes and the sums of parts are common. One of the oldest and most familiar is water, which is quite different from a simple mixture of its elements, hydrogen and oxygen. Water has emergent qualities, that is, qualities that emerge only in the combination of its elements. We can know about the characteristics of the compound, water, only by studying water directly; the

characteristics could not, at least until very recently, be predicted by a knowledge of the characteristics of the elements alone. Although new advances in theories and techniques of wave mechanics have made it possible to make such predictions, it can be argued that the advances could not even have occurred in the absence of observations of wholes.

C. S. Smith, a materials scientist, in a review of the status of his own field, makes several statements which indicate that physical scientists are increasingly being forced to recognize the importance of organized wholes in their study of materials:

> The main characteristic of today's science of materials is a concern with properties and the dependence of properties upon structure. This is exactly where the story began. The history of materials has been a long journey in search of knowledge in strange and difficult terrain, finally to return to the familiar scene with vastly better understanding. . . . Matter cannot be understood without a knowledge of atoms; yet it is now becoming evident that the properties of materials that we enjoy in a work of art or exploit in an interplanetary rocket are really not those of atoms but those of aggregates; indeed they arise in the behavior of electrons and protons within a framework of nuclei arranged in a complex hierarchy of many stages of aggregation. It is not stretching the analogy much to suggest that the chemical explanation of matter is analogous to using an identification of individual brick types as an explanation of Hagia Sophia. The scientists' laudable striving to eliminate the evidence of the senses has sometimes produced a senseless result. (1968, p. 638)

To eliminate any doubt that Smith is talking about the whole-part problem, look at a later excerpt:

> The immense understanding that has come from digging deeper to atomic explanations has been followed by a realization that this leaves out something essential. In its rapid advance, science has had to ignore the fact that a whole is more than the sum of its parts. (1968, pp. 643–644)

Polanyi (1968) has strongly argued that biology is not reducible to physics and chemistry since the existing morphology of an organism, which provides the boundary conditions within which the physical or chemical laws operate, is physically and energetically indistinguishable from other no less probable morphologies that have not happened to come into existence. This argument is valid and applies even to the much simpler aggregates of the materials engineer.

Köhler's *Die physischen Gestalten* (1920) is a relatively clear statement of the Gestalt view of the whole-part relationship, although such a complex problem with so many facets is never really simple. Here Köhler said in part:

> Let us consider under what conditions a physical system attains a state which is independent of time (i.e., a state of equilibrium or a so-called stationary state). In general we can say that such a state is reached when a certain condition is satisfied for the system *as a whole*. The potential energy must have reached a minimum, the entropy a maximum, or the like. The solution of the problem demands not that forces or potentials assume particular values in individual regions, but that their total arrangements relative to one another in the whole system must be of a certain definite

> type. The state of process at any place therefore depends in principle on the conditions obtaining in all other parts of the system. If the laws of equilibrium or stationary state for the individual parts can be formulated separately, then these parts do not together constitute a *single* physical system, but each part is a system in itself.
>
> Thus an electric circuit is a physical system precisely because the conditions prevailing at any given point are determined by those obtaining in all the other parts. Contrariwise, a group of electrical circuits completely insulated from each other constitutes a complex of independent, single systems. This complex is a "whole" *only* in the mind of one who chances to think of it as such; from the physical standpoint it is a summation of independent entities. (Köhler, 1920, as translated in Ellis, 1938, pp. 18–19)

Weiss (1967) gives several commonplace examples of complexly interrelated systems best regarded as wholes. One is a spider web. Changes made by the spider near the center of the web have effects that literally *can be seen* to reverberate throughout the web, as when a garden spider vibrates its web in response to an intruder. Multiple interconnections between all parts of the web can be seen to account for its action, but these interconnections defy analysis into parts—hence, "the whole is different from the sum of the parts."

As a contrasting type of example, consider a collection of 500 marbles scattered on a floor. Assume that an outside marble hits one of the collection. Multiple hits would follow, provided the mass and velocity of the first marble were great enough. Nevertheless, this "system" is quite different from the first one, and the changes in marble position would seem to be potentially analyzable into a collection of interactions between individual pairs of marbles. In contrast, the spider web provides no place for sinking in our analytic teeth and constitutes a real system rather than the kind of pseudosystem provided by the marbles.

Implications for a World View G. W. Hartmann has pointed out that there are two extreme views of the physical world and the role of systems in it. One view is that the world is composed of independent additive parts whose total constitutes reality. The other view is that everything is related to everything else, and there are no independent systems. The Gestaltists held neither of these extreme views, although they leaned toward the latter. They recognized that there are systems which may be considered independent for practical (including practical scientific) purposes. Hartmann has concluded (1935): "Both evils are avoided as soon as one recognizes that *the laws of science are the laws of systems,* i.e., structures of finite extent—a generalization applicable to both physics and psychology" (p. 42).

The Gestaltists, then, wished to extend these ideas about physical systems to psychology. They maintained that in biology and psychology as in physics, there are phenomena whose character depends on the character of the whole field. In visual perception, for example, the thing seen was thought to be a function of the total, overall retinal stimulation rather than of the stimulation of any specific local point. Unfortunately, the nature of the psychological field is not always clear.

In 1955, at the American Psychological Association meeting in San Francis-

co, the physicist Robert Oppenheimer (1956) said he had no idea what a "psychological field" could mean. The statement drew laughter and applause from the audience of American psychologists. Apparently many of them did not know either and felt either that there is no such thing or that it is an overworked and ill-defined concept. Yet Köhler's analogy, quoted above, seems simple and reasonable enough. The real question is whether or not the application can meaningfully be made to psychology. Let us examine this question: "What meaning can wholes, systems whose parts depend on the whole, or fields, have in psychology?"

One of the key issues is the determination of what constitutes an isolated system. The Gestalt contention has been that fields or systems are widespread in psychology and that the elementaristic analysis of structuralism or behaviorism destroys the meaningful relationships these fields might have in psychological laws. At the same time, the Gestaltists have not denied that the proper use of analysis is necessary. How can we determine whether a particular field can be further analyzed without destroying the very relationships we intend to study? It seems that the only way to do so is by attempting both analysis and the use of the unanalyzed field in the construction of psychological laws. The decision about which method should be used will eventually be made on a pragmatic basis. If the molar, Gestalt approach leads to more useful laws, and if no further analysis is necessary, then this approach will be adopted for the particular purpose. On the other hand, if this approach does not succeed, further analysis may be indicated.

A very important tool for determining the degree and kind of system one is dealing with is factor analysis. If various measures of system behavior can be taken, the matrix of intercorrelations may reveal significant aspects of the system's structure. There seems to be a trend in Germany for present-day psychologists to return to some of the qualitative Gestalt problems using multivariate analysis. Thurstone, though certainly not a Gestaltist, was well known for his multivariate analysis. Gulliksen says of him:

> Neither could the experimenter hope to learn very much from an experiment involving only two or three variables. For the last 25 years of his study, Thurstone typically investigated 40–60 variables at a time in order to get good leverage on the interrelationships among them. It may be said that this is the greatest legacy he has left us: the emphasis on both accurate experimentation and accurate analyses in the multivariate situation that is essential to psychology. (1968, p. 800)

Modern mathematical techniques for studying dynamic systems involving several variables demonstrate that Köhler was quite correct in his contention that equilibrium conditions depend upon some condition in the system as a whole. These mathematical techniques are quite powerful when they can be applied. Specifically, some systems can be represented by a set of linear differential equations. The coefficients of the equations can, in turn, be represented in a matrix. It is then characteristics of the *matrix as a whole* that determine whether or not the system will be stable and, if it is, what kind of stability it will manifest. Thus some

of the Gestalt contentions have a very precise interpretation, and the contentions are correct.

The Gestalt psychologist proceeds on the assumption that the unit of description should be chosen by the organism being studied; that is, the organism's responses determine what constitutes a meaningful whole. For example, if in a study of perception an observer reports that he sees a tree, then "tree" will become a unit of description, rather than some combination of greens, browns, textures, and the like. For this particular analysis, the tree as perceived will be assumed to be a reasonably isolated system and a meaningful unit of analysis. The acceptance of phenomenological description implies an acceptance of the units decided upon by the phenomenological describer.

Many times, the unit is chosen that seems most natural to the scientist, who will simply make a phenomenological decision. For example, one may decide to choose as a response unit any depression of a bar by a rat. This is the unit of response that seems most useful to the scientist. Since people make science, some such method seems inevitable. The Gestaltist, in voluntary acceptance of phenomenological description, has recognized that knowledge will always depend in part on the nature of the perceiving organism and at the same time has decided to live graciously with that limitation.

GESTALT PSYCHOLOGY AND PHYSIOLOGY

In his 1912 paper Max Wertheimer had no sooner said that apparent movement need not be explained in terms of its "elements" than he turned to an explanation in terms of presumed underlying physiological events. He suggested that when the temporal relationships were within the right range, excitation from one object jumped over to the excitation generated by the object next presented. Thus Gestalt psychology revealed its deep interest in physiology at the very beginning.

Unfortunately, all too often physiology served a purely hypothetical role. In the absence of direct observation, it was easy to hypothesize just the physiological "field" needed to "explain" the observed results. In physics, a field is simply an inference made directly from the movements of particles within a portion of space. From Oppenheimer's remarks, cited earlier, we may infer that field does not always mean exactly the same thing in psychology that it does in physics. If it did, we would have in both cases a mathematical description which would predict the phenomena in question, and that is all we would have. The physical field has only these mathematical properties; it has no existential properties.

In psychology, a similar situation *may* obtain. By *perceptual field,* the careful psychologist may mean nothing more than certain antecedent-consequent relations and the verbal or mathematical description of a state of affairs which would allow the derivation of the observations. The concept of field is most likely to be used where the consequent (verbal report or other behavior) does not depend in a point-to-point fashion upon the local characteristics of the stimulus. If field is used in this strict sense, as a mathematical device for describing relationships, there is a considerable kinship between psychological and physical fields. Of course, if the psychological field does not allow predictions, it is essentially mean-

psychology. Their feeling was not that quantification is illegitimate or unnecessary, but that it is often premature. They have held that psychology should first concern itself with important qualitative discoveries. The attitude toward quantification *as such* was not negative, but the attitude toward quantification *for its own sake* was quite negative. The feeling is summed up in Köhler's statement (1947) that ". . . one can hardly exaggerate the value of qualitative information as a necessary supplement to quantitative work" (p. 49). He went on to say, of his own work on learning: "Everything that is valuable in these observations would disappear if 'results' were handled in an abstract statistical fashion" (p. 50). It is not often that an opportunity arises to point out an analogy between the attitude of the Gestalt psychologist and that of the operant conditioner, but here we find an exception!

Koffka (1935, pp. 13–15) gave a more thorough and sophisticated treatment of quantification, making essentially the same points. He destroyed the antithesis felt by some to exist between quantity and quality, concluding that ". . . the quantitative, mathematical description of physical science, far from being opposed to quality, is but a particularly accurate way of representing quality" (p. 14). Koffka would therefore agree that psychology must eventually express its laws in quantitative form in order to reach maximum precision.

EMPIRICAL STATEMENTS

Principles of Organization

The best-known empirical statements made by the Gestalt psychologists are the principles of perceptual organization put forth by Wertheimer (1923). These principles are typically given a demonstrational type of proof, and that precedent is followed here. Hochberg and McAlister have commented on the status of the laws of organization (1953): "Empirical study of the Gestalt principles of perceptual organization is, despite their great heuristic value, frequently made difficult by their subjective and qualitative formulation" (p. 361). Thus, if readers sometimes have difficulty in understanding the following laws, they need not feel that the inadequacies are all theirs; even the more emphasized perceptual factors, outlined below, are lacking in precision of statement.

1 *Proximity.* Elements close together in time or space tend to be perceived together. For example, the lines in Figure 7-2*a* tend to be seen as three pairs of lines rather than in some other way.

2 *Similarity.* Like elements tend to be seen together in the same structure, other things being equal, as in Figure 7-2*b*.

3 *Direction.* We tend to see figures in such a way that the direction continues smoothly. This factor is illustrated in Figure 7-2*c*.

4 *Objective set.* If one sees a certain type of organization, one continues to do so even though the stimulus factors that led to the original perception are now absent. Consider the series shown in Figure 7-2*d*. As one looks at the dots progressively from left to right, one tends to continue to see the pairs of dots as on the left, even thought on the right the proximity factor no longer favors this organization.

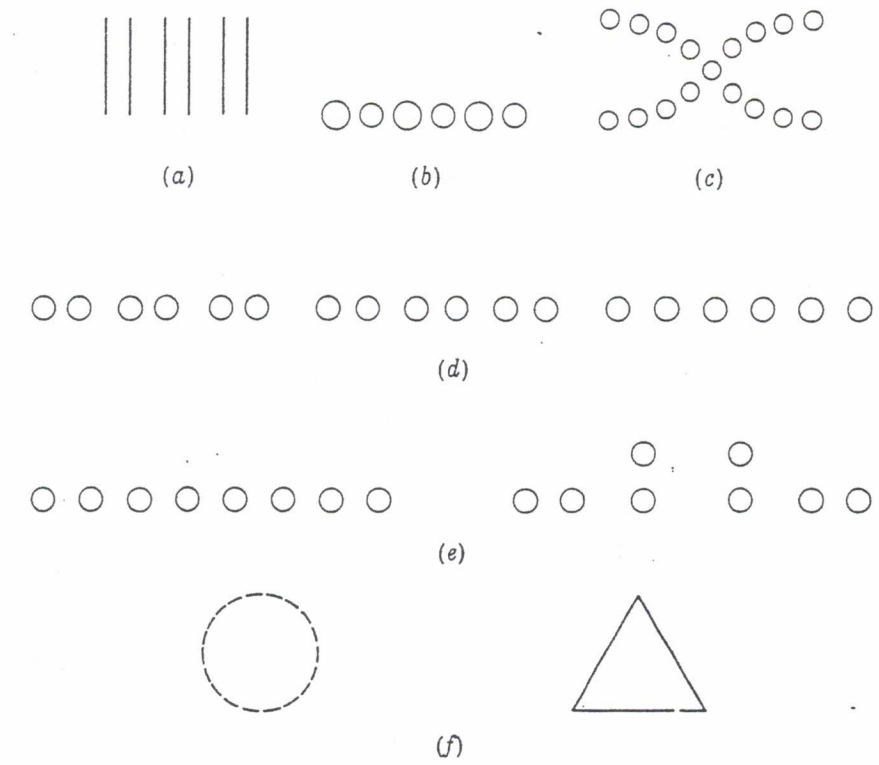

Figure 7-2 Examples of perceptual factors in Gestalt psychology.

5 *Common fate.* Elements shifted in a similar manner from a larger group tend themselves to be grouped, as in Figure 7-2*e*.

6 *Prägnanz.* Figures are seen in as "good" a way as is possible under the stimulus conditions. The good figure is a stable one. For example, as shown in Figure 7-2*f*, gaps in a figure are frequently closed because the resulting figure is more "pregnant" (subprinciple of closure). A good figure is one which cannot be made simpler or more orderly by a perceptual shift.

Wertheimer recognized that the laws of organization were far from final or even completely stated. He suggested by implication some of the work that needed to be done to improve them (1923, as translated in Ellis, 1938): "What will happen when *two* such factors appear in the same constellation? They may be made to cooperate; or, they can be set in opposition. . . . In this way, it is possible to test the strength of these factors" (pp. 76–77).

Koffka, writing 12 years later still could say (1935): "A measurement of the relative strength of these factors would be possible, as Wertheimer has already suggested, by varying these relative distances" (p. 166).

This kind of situation is, unfortunately, a common one in psychology. The effective variables, or at least some effective variables, are often known, but the exact functional relationships relating the effective independent variables to the

dependent variables concerned are not known. The Gestaltists proceeded in just the way they criticize in others. Demonstrations were constructed wherein the individual factors can clearly be shown to operate, *other things being equal.* The laws of combination of the factors, their relative strengths, and even precise definitions of the meanings of the variables were and are missing.

Learning Principles

Gestalt psychologists have not worked nearly so extensively in learning as in perception. However, they have done some highly suggestive studies. Köhler's *Mentality of apes* (1925) was based largely on his study at the anthropoid station at Tenerife in the Canary Islands, where he had been marooned during World War I.

It was natural that Köhler saw the problem-solving process in quite a different way from the way the behaviorists and associationists or even the functionalists saw it. Gestalt psychology is based on the premise that perception is determined by the character of the field as a whole. What is more natural than that the Gestaltists should explain learning and problem solving in an analogous fashion? That is just what Köhler did. Problem solution for him became a *restructuring* of the perceptual field. When the problem is presented, something necessary for an adequate solution is missing. The solution occurs when the missing ingredient is supplied so that the field becomes meaningful in relation to the problem presented. For example, one of the chimpanzees in Köhler's experiment was given two sticks which could be joined, enabling him to reach a banana that could be reached in no other way. After many futile attempts to reach the banana with one stick by itself, the chimp gave up and continued to play with the sticks. When he accidentally (or at least idly) joined the two sticks, he immediately reached out and got the banana. The missing perceptual ingredient for the solution had been supplied. The perceptual field had been restructured.

The Gestaltist would want us to notice that the missing *ingredient* in the solution was not a missing *element.* All the elements were always present, but they were not "seen" in the right way. Our very language, in using the word seen in this context, tells us what a close analogy exists between perception and problem solving.

Just as "good" perceptual figures are stable, so learning, once achieved through this insightful restructuring, is stable. The Gestaltists regarded some kinds of learning as requiring a single trial, with the performance being easily repeatable without further practice.

Much Gestalt work has concerned problem solving rather than learning. The two areas are distinguished roughly. Problem solving involves the combination of already learned elements in such a way that a solution is achieved. Learning is usually concerned with the acquisition of relatively simpler, more discrete responses. The distinction is to some extent arbitrary, as is certainly clear from Köhler's experiments with apes, which could be considered either learning or problem solving.

Wertheimer's *Productive thinking* (1945) suggested effective methods for problem solving. He applied the Gestalt principles of learning to human creative

thinking. He said that thinking should be in terms of wholes. One should take a broad overview of the situation and not become lost in details. Errors, if inevitable, should at least be good errors, errors with a possibility of success, not blind errors made without regard to the limitations of the situation as a whole upon acceptable solutions. Just as learners should *regard* the situation as a whole, so teachers should *present* the situation as a whole. They should not, like Thorndike, hide the true solution or the true path and require errors. One should not be required or even allowed to take a single blind step, but rather should always be required to keep the goal and the requirements for success in view.

Very modern techniques of programmed, or individualized, instruction usually are designed to eliminate errors, in accordance with Wertheimer's suggestion. These techniques are not based on Gestalt theory, but on repeated experiences with what works best. One could even, with a mighty stretch, point out that "errorless discrimination" as developed by Terrace (1966) is a very effective way to teach simple sensory distinctions, and it, too, is designed to eliminate errors. The mighty stretch is needed in relating this to Wertheimer's suggestions because the Terrace situation is clearly much simpler than the situations Wertheimer was treating.

Duncker (1945) performed an extensive Gestaltist analysis of the problem-solving process. He analyzed the factors in the situation and in the problem-solving procedure which determine difficulty of solution. Like Wertheimer, he believed that the tendency of the subject to narrow the possible solutions is one of the most serious obstacles to successful performance. He devoted a great deal of attention to discussion of fixedness of response. Errors were regarded as helpful in the sense that thinking does not regress to the original ideas about possible solutions when leads are found to be false. Thus errors direct further responses, serving a positive function as well as simply being eliminated. The requirements of the problem situation "ask for" a solution with the required attributes; that is, responses are determined by the total situation, the problem field. Duncker's classic monograph contains many ingenious ideas and examples, but has the usual Gestalt characteristic of being largely nonexperimental and programmatic.

The Gestaltists have generally emphasized the *directed* character of behavior in problem-solving situations. Thorndike emphasized trial-and-error learning, as though the behavior of the animal in the situation were blind and random. Köhler and Wertheimer pointed out the blindness of Thorndike's situation. They believed that the random nature of the activity inhered not in the animal but in the situation. A good solution is possible only if the whole situation is available to the animal. In Thorndike's puzzle-box situation, only the experimenter can see the overall situation. The animal is *reduced* to trial and error by the situation, but to say that learning in general is by trial and error is itself an error.

Thorndike, a favorite Gestalt target (see Chapter 3), had stated that learning is a gradual process of elimination of errors with the accompanying fixation of the correct response. The Gestaltists said that more frequently, learning is not gradual at all, but is rather a process involving insight. We might think of insight as a sudden shift in the perceptual field. There seems to be no basic theoretical

reason why the Gestaltists should say that the perceptual shift should be sudden rather than gradual, but Köhler's empirical observations indicated to him that sudden learning does occur. Four behavioral indices of insight learning are usually cited: the sudden transition from helplessness to mastery, the quick and smooth performance once the correct principle is grasped, the good retention, and the immediacy with which the solution can be transferred to other similar situations involving the same principle. Once the sticks had been joined to reach the banana, they would be joined in other situations for reaching other objects if insight were truly involved.

The disagreement about whether learning is continuous, as Thorndike thought, or sudden, as the Gestaltists stated is typically the case, gave rise to the continuity-noncontinuity controversy in learning. According to the continuity position, each trial or reinforcement contributes some increment of response strength. This assumption is denied by the noncontinuity position, which emphasizes sudden discontinuous increments, such as are associated with insights, rather than a slow building up of strength.

This controversy, like many such controversies, is no longer regarded as answerable in a simple yes-or-no fashion. Both continuous and discontinuous improvements in performance occur. A complete learning theory will define all the variables affecting learning and give their functional relations to performance. Both continuous and discontinuous learning curves will be possible, depending upon the values of each of the effective variables over successive trials.

Spence (1940) has shown that Hull's theory, which treats *learning* as continuous, can predict sudden increments of *performance* if the constants in his equations are chosen properly. Then, if there is a sudden shift in a parameter like hours of deprivation from one trial to the next, there will be a sudden increment in performance. The Gestalt assertion is just that such sudden changes can occur, although presumably as a function of other variables besides shifts in deprivation. The Gestalt learning theorist is now faced with the task of writing the equations needed to make a Gestalt learning theory as sophisticated as its competitors, which can now predict the same phenomena. The occurrence of insight, however, is not as critical as some of the more basic tenets of Gestalt theory.

Insight involves structuring, or restructuring, the situation as a whole. Thus it is predicted, from Gestalt theory, that there will be occasions when an animal will respond not absolutely to the local stimulus but to a relationship between stimuli. This is exactly the situation that is said to hold for perception, where the perception accords with the whole field rather than with the local, elementary stimulation. So behavior should depend on the situation as a whole.

The transposition experiment is an example of this principle. An animal is trained to respond to the darker of two gray cards; food is always found behind it. The traditional associative explanation of what has happened in training is that the dark card is now associated with reward, so that the animal approaches it. The lighter card has no association with reward, and it is not approached. However, when the dark card is put with a still darker card, the animal under some conditions chooses the new darker card, even though responding to it has

never been reinforced. Koffka (1935) said that in looking at the two cards, a *step* is perceived from lower to higher brightness, and the animal responds to the lower step. Thus, the whole field must be considered in making predictions.

Spence (1937b) has derived the observed relational responding by introducing gradients of generalization of reinforcement from the reinforced card to other values of gray and of inhibition from the lighter card to other values. If the generalization curves are given appropriate shapes, the animal should respond to the new card, according to associative principles. The significant aspect of Spence's transposition demonstration is that it not only allowed for prediction of the Gestalt phenomenon, but also predicted and found failures of transposition when the test stimuli were too different from the training stimuli. The original Gestalt account could not handle these failures.

Hearst (1968) has showed that empirically derived gradients of inhibition and excitation *can* be used to predict discrimination behavior successfully. Even so, the general Gestalt point is again made—that the combination of simple elements presents a complexity requiring new laws for its description (in this case, new equations describing generalization gradients and methods for combining them).

Krechevsky (1932) noted that animals tended to persevere over a number of trials with systematic responses. For example, the animal might respond in terms of a position habit and then suddenly shift to a choice of the brighter of two stimuli. These consistent tendencies he called *hypotheses,* by analogy with a situation in which a human being tries out various alternative solutions until the correct one is found. This finding lent some support to the Gestalt contention that animals were not responding blindly or randomly in their solution of problems. Spence (1936) observed that *hypothesis* is just a name for a persistent response tendency whose history of reinforcement we do not know. Harlow (1951) pointed out that the typical paradigm for insight learning is one in which we do not know the past experience of the animal with the component parts of the problem. Insight did not occur in some experiments in which the subjects were animals without such previous experience.

Levine (1970) has demonstrated that human subjects who are led into generating misleading hypotheses may persist for 100 trials or more in making errors. If these subjects were responding in terms of a simple reinforcement theory, the problem should be solved immediately; the answers can be very simple, for example, "The black card is correct, and the white card is incorrect." Levine's experiments convincingly indicate that human beings, at least, often behave in a way more consistent with a Gestalt view of learning than with more behavioristic alternatives.

Thus Gestalt psychology has pointed to interesting phenomena in the field of learning, but it has not worked out many detailed answers, and the experimentation carried out has often lacked any control of critical background factors that might influence the outcomes. The Gestaltists' theorizing has been highly general, and their explanations usually ad hoc.

Lewin is a case in point. He is a field theorist, and his is the most sophisti-

cated of the field theories of learning. Even so, examination of the theory (Estes, 1954) has revealed that its usefulness is severely curtailed because of its failure to make specific predictions capable of verification or disproof. If the most sophisticated of the Gestalt learning theories suffers from this evaluation, the less sophisticated ones suffer still more from a lack of any predictive power. Lewin's theory will be treated in greater detail in Chapter 11.

GESTALT PSYCHOLOGY AS A SYSTEM

Definition of Psychology

The Gestaltists tended to define psychology as the study of the immediate experience of the whole organism. They intended to include all the areas of psychology within their scope, but they began with perception and emphasized perception more than the other areas. Thus the Gestaltists and those following them have tended to pay more attention to the relationships between antecedents and perception than to those between perception and behavior. They contrast markedly with the behaviorists, who skipped the way station of perception to study the relationships between antecedents and behavior directly.

Postulates

We present here only the few postulates that we feel are most basic, and even these are divided into a primary and a secondary set. The reader can find a more complex list in Helson (1933) or in the original sources.

Gestalt psychology, like behaviorism, seems to have only one really primary postulate which relates to its name and which has finally commanded wide acceptance. This is the postulate related to the whole-part attitude. Any shorter discussion than the one given earlier in this chapter must fail to do it justice, but the following sentences indicate this attitude. The whole dominates the parts and constitutes the primary reality, the primary datum for psychology, the unit most profitable to use in analysis. The whole is not the sum, or the product, or any simple function of its parts, but a field whose character depends upon all of itself.

The secondary postulates, like those of behaviorism, are not necessary to a Gestalt psychology, although the founders made them a part of *the* Gestalt psychology that has developed. The most important of these is the isomorphism principle. A related principle, or perhaps a corollary, is the contemporaneity principle. More specific secondary principles related to the whole-part attitude are the laws of organization. The noncontinuity postulate regarding learning has been discussed as secondary.

None of the Gestalt postulates were entirely new. Even the basic postulate had been anticipated. The thing that made Gestalt psychology new was itself a Gestalt. It was the organization, pattern, or structure of things that Gestaltists said about the whole-part attitude that distinguished their psychology from the philosophical forerunners which had made a case for emergence and from the psychological forerunners which had made a case for phenomenology.

Mind-Body Problem

The Gestaltists, like most psychologists, tried to evade this issue by pointing to the unity of the organism and maintaining that there was no real problem. How-

ever, their recognition of experience and their use of the principle of isomorphism implied some kind of dualism, for isomorphism must be a relation between two different sets of events. Isomorphism itself says nothing about the particular subvariety of dualism that should be chosen. Since the Gestaltists attempted to make light of the problem, and since their whole-part attitude emphasized the emergence of new levels of description, new *aspects* of complex phenomena, the mind-body position that seems most consistent with their general position is a dual-aspect view. This view gives two aspects that can be isomorphic, and yet it allows the statement that there is somehow really only one basic reality seen in two views—that the organism is really unitary and integrated.

Prentice expressed the Gestalt desire to avoid the issue:

> Let me say once for all that the concept of isomorphism is not an attempt to solve the mind-body problem in its usual metaphysical form. It takes no stand whatsoever on the question of whether "mind" is more or less "real" than "matter." Questions of reality and existence are not raised at all. Mind and body are dealt with as two natural phenomena whose interrelations we are trying to understand. . . . It comes nearest, perhaps, to what has sometimes been called the "double aspect" theory, the view that cortical events and phenomenal facts are merely two ways of looking at the same natural phenomenon, two faces of the same coin, as it were. (1959, p. 435)

However, Prentice has apparently not been allowed to have his say "once for all," since R. I. Watson says (1968): ". . . by his statement of isomorphism Köhler was offering his particular solution to the age-old mind-body problem. Isomorphism was his way of integrating the mind with the rest of the world" (p. 448). Obviously, it is not easy to agree on just what kind of stand is required to constitute a mind-body position.

Nature of the Data

Immediate, unanalyzed experience obtained by naïve introspection furnished the bulk of the data for Gestalt psychology. The "given," as they called such experience, was used as data. Behavioral data were also used, notably in the fields of learning and problem solving, but behavioral data were less important because of the larger number of perceptual studies.

Because the behaviorists were making a different point and because they deemphasize experience, it is easy to miss the fact that both schools tended to accept the same types of data and that both schools were making a point that converged on the same criterion for acceptability of data. The behaviorists, although they rejected consciousness, accepted verbal behavior as data when there was consistency and agreement within the given experimental condition. The Gestaltists, although accepting experience and consciousness, rejected a certain kind of analysis of that experience. They retained the given in consciousness. Now, that given was generally very nearly coterminous with the class of verbal behavior which was acceptable to a behaviorist. Wertheimer, when he talked about the given, talked about trees and windows. Watson, when he wished to make the point that consciousness was not part of science, contrasted it with things that were—contents of test tubes, things that he could see and feel and lift. Both were using primarily an object language. A long history of usage has

demonstrated that we can agree about the meaning of such a language. Thus, although the two schools started from quite different points, they tended to accept about the same kinds of data as being of interest in their kind of psychology. The Gestaltists were more tolerant; they could afford to accord a kind of reality to the results of the old introspection, while the behaviorists, whose whole existence was based on this methodological point, could not.

Principles of Selection

For the Gestalt psychologist, every part of the field played some role in perceptual structuring. Thus the problem for the Gestaltist was not so much how the given was selected as how it was structured. Why, out of all the possible alternatives, did the actual structure emerge? One principle was that in a given perceptual whole, part of the perception will be figure, and part ground. Rubin's laws governing the selection of the figure state how this segregation takes place. Wertheimer's laws of organization are also laws of selection in the same sense; they explain the particular form taken by the figure. Neither Rubin nor Wertheimer worked out the laws in great detail, as we have already seen in the case of Wertheimer. J. J. Gibson's later work (1966) has done much more to specify the properties of stimuli which make them available as invariants for the organism's stimulus processing. Maturana et al. (1960) used objective physiological responses to discover some of the properties of stimuli that were responded to by the frog's eye. Maturana and his coworkers found that the frog's eye contains cells that respond only to small curved moving objects within a circumscribed receptive area; that is, these cells "select" only those objects possessing the right *set* of complex properties. Gibson argues that such complex "invariants" are the primary stimuli for most human perception. Such work fits neatly into the Gestalt tradition. None of this leads to a denial of the role of experience in determining which perception or which behavior would be selected. However, it does place more emphasis on the current situation, and it does demand attention to the complex relational properties of the situation in determining response to it.

Principles of Connection

The form of the problem of connection was also different for a Gestaltist. Since elementarism was rejected, one form of the question of connection could also be ignored. It is not meaningful to try to reconstruct wholes by connecting elements which are supposed to be the parts of the whole. The Gestaltists believed that the *bundle hypothesis* was completely fallacious. The bundle hypothesis treated complex perceptions as though they were a bundle of simple perceptions and treated meaning as though it arose from such a bundling. Thus one of the Gestalt principles was negative; it was that the bundle hypothesis is invalid, and therefore one of the problems of connection is an artificial problem arising from an artificial analysis. The laws of organization are not principles of connection, for organizations are not elements connected. The laws state what structures will arise, not what elements will be connected.

It follows that Gestalt psychology would have more to say about how elements would be *related* in a particular whole than about how elements would be