Concepts and Theories of Human Development

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3 Philosophical Models of Development

Scientists do not initiate their research without implicit and explicit assumptions. Often these assumptions take the form of theories that guide the selection of hypotheses, methods, data analysis procedures, and so on. Scientists use a specific set of rules to determine reality. Through making observations—the fundamental task of scientists—they quantitatively and/or qualitatively measure phenomena objectively under particular conditions. Then, scientists attempt to identify regularities among observations. Such regular, predictable relationships among variables are called *laws*. Finally, a *theory*—a set of statements (e.g., propositions) consisting of defined and interrelated constructs integrating these laws—is developed. Besides integrating knowledge, a theory serves the function of guiding further research.

Even though we can appraise our universe by relying on an empirical approach to knowledge, and can delineate what steps—observations, laws, and theories—are involved, a glance at the scientific literature shows that scientists do not agree about their observations, laws, and theories. This is the case primarily because they make different philosophical assumptions about the nature of the world (Kuhn, 1962; Overton, 1998; Pepper, 1942). Thus, in addition to the relatively empirical facts of science, scientists also hold *preempirical beliefs* or *presuppositions* (Kagan, 1980). These are beliefs that are not open to empirical test.

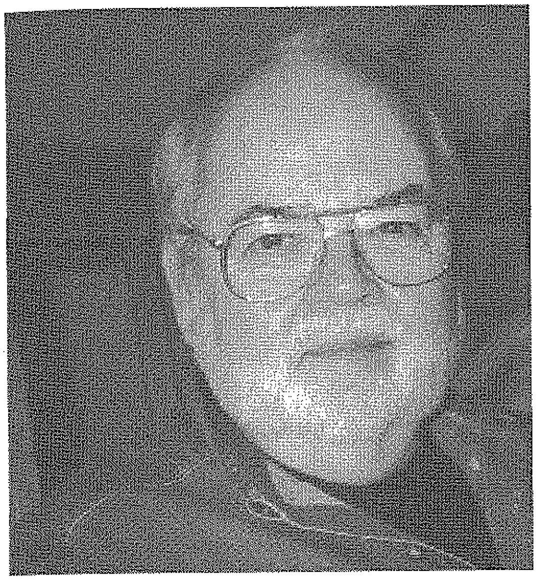
These beliefs may also be explicit or implicit (Watson, 1977). They may take the form of a presupposition about the nature of a specific feature of life—for example, that there is an inevitable connection between early experience and behavior in later life (Kagan, 1980, 1983). In addition, these beliefs may take the form of a more general "paradigm" (Kuhn, 1962, 1970), "model" (Overton & Reese, 1973; Reese & Overton, 1970), "world view" (Kuhn, 1962) or "world hypothesis" (Pepper, 1942). These terms all pertain to a philosophical system of ideas that serves to organize a set, or a "family" (Reese & Overton, 1970), of scientific theories and associated scientific methods.

These philosophical models of the world have quite a pervasive effect on the scientific positions they influence: They specify the basic characteristics of humans, and of reality itself, and thus function either to include or exclude particular features of humans and/or of the world's events in the realm of scientific discourse. Hence, science is relative rather than absolute. Facts are not viewed as naturally occurring events awaiting discovery. According to Kuhn (1962), science

> seems an attempt to force nature into [a] preformed and relatively inflexible box . . . No part of the aim of normal science is to call forth new sorts of . . . phenomena; indeed those that will not fit the box are often not seen at all. Nor do scientists normally aim to invent new theories, and they are often intolerant of those invented by others. (p. 24)

A full understanding of human development cannot be obtained from any one theory or methodology, nor can it be obtained from a cataloging of empirical "facts." The integration of philosophy, theory, method, and research results is required to attain a complete understanding of an area of scientific scholarship. Within such an integration theory and research are given meaning. They are developed and interpreted within the context of a given philosophical perspective. Thus, we need to understand the different philosophical assumptions on which the study of development can be based. We need to examine the models, or world views, that are used today in the study of human development.

Since the early 1970s, Hayne W. Reese and Willis F. Overton have written a series of essays (Overton, 1984, 1991a, 1991b, 1991c, 1991d, 1994a, 1994b, 1994c, 1998; Overton & Reese, 1973, 1981;



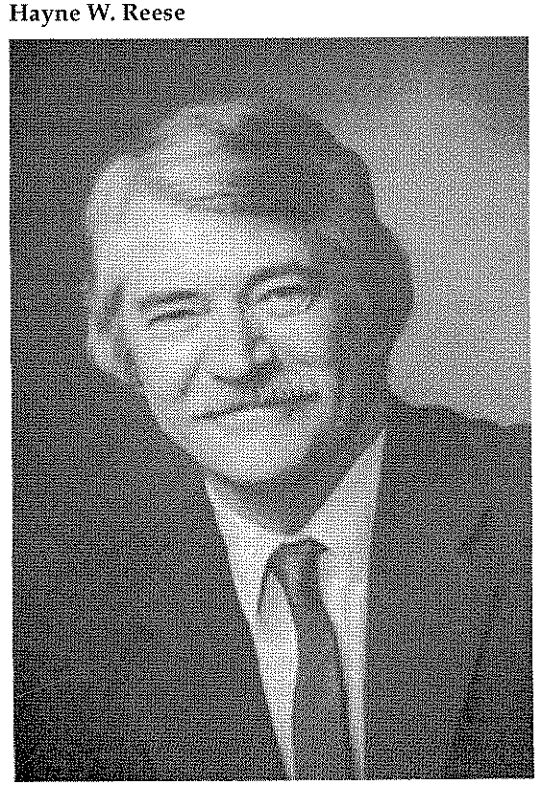
Willis F. Overton

Reese, 1982, 1993, 1995; Reese & Overton, 1970) that explain the ways in which theory and method are influenced by philosophical issues pertinent to the study of human development. For instance in chapter 1, we reviewed Overton's (1998) discussion of "split" versus relational issues in philosophy. We saw how the former type of concept was linked to theories which involved the separation of nature- and nurture-related processes; within such split conceptions one process (nature or nurture) is regarded as "real," or at least of primary influence, and the other type of process is seen as pseudophenomenal or derivative (in regard to influencing development). In turn, Overton (1998) explained how theories associated with relational philosophical ideas (e.g., developmental systems theories such as developmental contextualism; Lerner, 1991, 1996, 1998b) took an integrated view of nature and nurture processes, and saw them as fused and reciprocally interactive over the course of life.

Prior to Overton's (1998) discussion of split-versus-relational ideas in philosophy, Overton and Reese (1973, 1981; Reese & Overton, 1970) focused their attention on the import for theory and method in human development of two world views—the mechanistic and the organismic—which, historically, have been central in influencing theories of development. Although, as we shall discuss later in this chapter, many theories of development associated with mechanism and organicism were *similar* in adopting split views of nature and nurture, Reese and Overton significantly advanced the understanding of human development by describing the different "families" (related, or consonant, groups) of theories and methodological traditions associated with mechanistic- and organismic-related theories.

The work of Reese and Overton was seminal in promoting, among other developmental psychologists, an interest in exploring the potential role of other world hypotheses in shaping theories of development. For instance, as noted in chapter 2, Riegel (1975, 1977a, 1977b) discussed the potential use of a "dialectical" model of development, and Lerner (1984, 1985; Lerner, Hultsch, & Dixon, 1983; Lerner & Kauffman, 1985, 1986), as well as Reese and Overton (Reese, 1982; Overton, 1984; Overton & Reese, 1981), discussed the ways in which a "contextual" world hypothesis (Pepper, 1942) could be used to devise a theory of development. As I noted in Chapter 2, the dialectical model emphasizes syntheses among the conflicts arising from the interactions among variables from different levels of analysis (e.g., the inner–biological, individual–psychological, physical–environmental, and sociocultural; Riegel, 1975, 1976a, 1976b). We saw in Chapter 2 that

Hayne W. Reese



contextualism stresses the continually changing context of life, the bidirectional interactions among individuals and the context, and that the timing of these interactions shapes the direction and outcome of development (Pepper, 1942).

As Overton (1984) has made clear, however, these latter models (i.e., the dialectical and the contextual ones) do not readily provide a useful set of ideas for the derivation of scientifically adequate theories of development *unless* they are integrated into mechanistic or organismic conceptions. Indeed, as both Overton (1984) and Lerner and Kauffman (1985) argue, and as we again note later in this chapter, the dispersive nature of the contextual world hypothesis does not provide a useful frame for understanding the systematic, organized, and successive (or progressive) character of change that is the defining feature of development (see Chapter 1; Ford & Lerner, 1992). Thus, although Pepper (1942) claimed that it was not philosophically permissible to "mix metaphors" and combine mechanistic, organismic, and contextual world views, I believe one may do just this. Arguing on the basis of criteria of usefulness (e.g., in regard to developing statements that, in comparison to those of other positions, account for more variance in developmental data sets, lead to more novel discoveries than do ideas associated with other positions, or integrate a broader range of phenomena pertinent to development than is the case with other positions), Overton (1984) and Lerner and Kauffman (1985) advanced the notion of combining organicism and contextualism to frame a new approach to developmental theory. Overton (1984) pointed out the possibility of integrating contextualism with either mechanism *or* organicism to produce such a new theory. Similarly, Reese (1993; Hayes, Hayes, Reese, & Sarbin, 1993) discusses ways in which mechanism and contextualism are related. However, I shall argue that the mechanistic view has too many conceptual limitations for use as a model for development. In fact, I will explain that a key conceptual problem is that mechanistic theories of development inevitably follow a split view of reality, and, thus, involve a false division between nature and nurture processes (Overton, 1973, 1984, 1998). I will argue for a synthesis of organicism and contextualism (as did Overton, 1984), and will suggest that, just as contextualism needs organicism to enhance its use, so does organicism need contextualism. To begin to develop this argument, it is useful to turn to a presentation of the mechanistic, the organismic, and the contextual models.

THE MECHANISTIC–PHILOSOPHICAL MODEL

Pepper (1942) noted that each of the "world hypotheses," or philosophical models, he described (formism, mechanism, organicism, and contextualism) could be associated with a core, or root, metaphor—a concept which captured the essence of the philosophy. In mechanism, the root metaphor is a machine. As explained by Reese and Overton (1970), the mechanistic–philosophical model

> represents the universe as a machine, composed of discrete pieces operating in a spatiotemporal field. The pieces—elementary particles in motion—and their relations form the basic reality to which all other more complex phenomena are ultimately reducible. In the operation of the machine, forces are applied and there results a discrete chain-like sequence of events. These forces are the only efficient or immediate causes; purpose is seen as a mediate or derived cause. Given this, it is only a short trip to the recognition that complete prediction is in principle possible, since complete knowledge of the state of the machine at one point in time allows inference of the state at the next, given a knowledge of the forces to be applied. (p. 131)

As summarized by Anderson, this philosophical position states that "the workings of our minds and bodies, and of all the animate or inanimate matter of which we have any detailed knowledge, are assumed to be controlled by the same set of fundamental laws, which except under certain extreme conditions we feel we know pretty well" (1972, p. 393). A key assumption of the mechanistic position is that the events of all sciences can be uniformly understood by the same set of laws.

For instance, proponents of this viewpoint often hold that physics and chemistry are the basic natural sciences; they often believe that the laws of these two disciplines are the one set of fundamental laws alluded to by Anderson (1972). That is, although several different meanings of the term *mechanism* have been used by philosophers and scientists, one major version of the mechanistic position is an interpretation of biological (or psychological) phenomena in physical and chemical terms (von Bertalanffy, 1933). This interpretation provides an apt illustration for our discussion, and we focus on it to explain the position.

In this interpretation, it is the laws of chemistry and physics—the rules that depict the mechanisms by which atoms and molecules function—that are the fundamental laws of the real world. Everything involves atoms and molecules; nothing exists in the natural world that is not basically made up of these things. If one understands the mechanisms by which atoms and molecules combine and function, then one understands the laws basic to everything. The mechanics of chemistry and physics then become the ultimate laws of all events.

These basic laws that govern all natural events and phenomena, whether organic or inorganic, are held to apply to all levels of phenomenal analysis. Consistent with Nagel (1957), we define a *level* as a state of organization of matter, or life, phenomena. For example, chemistry, with its particular set of concepts and principles, represents one level of organization, while psychology, with its own set of terms, represents another. One can describe behavior at its own level or in terms of the principles of another level. We can study how children at various age levels develop the ability to perform in certain situations (e.g., on classroom tests) by attempting to discern the social relationships (between teachers and students) and the psychological factors (e.g., cognitive ability or motivation) involved in such behavior. Alternatively, these very same behaviors may be described and studied at another level. The children's performance certainly involves the functioning of their physiological systems (e.g., the central nervous system and the endocrine system), a lower level (in the sense of underlying the behavioral level) of analysis. Ultimately, of course, the functioning of their physiological systems involves the functioning of the atoms and molecules that form the basic matter of living, organic material.

These other levels—psychology or physiology—are only "derivative." That is, *in reality,* they are nothing more than levels derived from combinations of the constituent elements, the atoms and molecules governed by the laws of chemistry and physics. Hence, the split in mechanism between the real- and the pseudo-phenomena of existence is apparent.

By splitting existence into the "real" level versus the "apparent but derivative" levels, mechanists can thus seek to understand psychological and social functioning by reference to the laws of physics and chemistry. These mechanisms represent the most fundamental level of analysis that can be reached. Because this level is invariably involved in any other level, we can certainly seek to understand psychology by reference to chemistry and physics. These basic physical laws are just as applicable to human development as they are to physiology, or for that matter, to any other event or phenomenon in the natural world. Everything living or nonliving is made up of atoms and molecules. Ultimately, then, if we understand the rules by which atoms and molecules function, we can understand the components of all things in the natural world. All we must do to understand biology, psychology, sociology, or the movement of the stars is to bring each down to its most basic constituent elements, to the most fundamental level of analysis: the physical–chemical level. The events and phenomena of all sciences—of everything in the natural world—may be uniformly understood through the mechanisms involved in atoms and molecules.

Proponents of the mechanistic–philosophical viewpoint would not seek to explain the phenomena of human development per se; this is not the appropriate level of analysis. Rather, they would attempt to reduce these phenomena of physiological, psychological, and social functioning to the fundamental level of analysis—the laws of chemistry and physics. The basic epistemological point of this mechanistic position, then, is *reductionism.* That is, to gain knowledge of a level of phenomenal organization, the route to take is to reduce the phenomena of a given (higher) level to the elemental, fundamental (lower, or molecular) units that comprise it.

Thus, it is believed that there is nothing special about the complex pattern of events we call physiological, psychological, or social functioning. In the final analysis, these events involve the functioning of the very same atoms and molecules that are involved in the workings of a liver, a kidney, or a shooting star. Thus, like everything else, physiological, psychological, or social phenomena are governed by the laws of chemistry and physics and, upon appropriate reduction, may be understood in terms of those laws. From this standpoint, then, if we knew enough about chemistry and physics, we could eliminate the sciences of human development, physiology, psychology, or sociology completely. For example, Homans (1961) proposed a stimulus–response view of social functioning that attempted to reduce the phenomena studied by sociology to the elemental units of classical and, especially, operant conditioning. In turn, Wilson (1975) proposed a genetic reductionist view of social functioning (termed *sociobiology,* discussed in Chapter 13) which was aimed at eliminating the need for the sciences of psychology, sociology, and even anthropology. Thus, as pointed out by Bolles (1967, p. 5), this reductionistic assumption involves "the doctrine that all natural events have physical causes, and that if we knew enough about physical and mechanical systems we would then be able to explain, at least in principle, all natural phenomena."

Reductionism directly implies a *continuity* position. No new laws are needed to explain the phenomena of a given level of study; rather, the same exact laws apply at all levels. Since natural phenomena at any and all levels can be reduced to the phenomena of the fundamental physical–chemical level, these same laws are continuously applicable to all levels of phenomena. Since no new, additional, or different laws are needed to account for or to understand the phenomena that may be thought to characterize any particular level, continuity by definition exists. As we have seen, psychological or social functioning may be reduced to the level of chemistry and physics *because* the latter level is invariably present in anything that exists.

What this means, then, is that the "real" laws governing any and all events in the world are really the laws of chemistry and physics. There is again, then, a split: The only real laws are those that pertain to the "to-be-reduced-to-level" (i.e., chemistry and physics). "Laws" about other levels do not reflect the reality of the true, causal phenomena of the natural world. In essence, the mechanistic position holds that in the final analysis one must inevitably deal with certain fundamental laws in order to completely, accurately, and ultimately understand any and all living and nonliving matter in the natural world. And, as Anderson (1972) has commented, once this concept is accepted:

> It seems inevitable to go on uncritically to what appears at first sight to be an obvious corollary of reductionism: That if everything obeys the same fundamental laws, then the only scientists who are studying anything really fundamental are those who are working on those laws. In practice, that amounts to some astrophysicists, some elementary particle physicists, some logicians and other mathematicians, and few others. (p. 393)

Because of the belief that reductionism will lead to fundamental knowledge, and because of the associated postulation of continuity in the laws and mechanisms that are involved in an appropriate consideration of natural phenomena, two events may ultimately occur. First, the phenomena in the world labeled psychological or social would no longer be a focus of scientific concern; these phenomena are not fundamental—they must be reduced to be appropriately understood. Second, the people in the world labeled physiologists, psychologists, sociologists, or human developmentalists would no longer be necessary; these people are not studying fundamental phenomena of the natural world.

What would replace psychology, sociology, and, in fact, all sciences other than the "fundamental" ones, would be a consideration of the basic mechanisms of the physical–chemical level of analysis. To understand every event and phenomenon in the natural world one must understand the mechanisms of physics and chemistry. This statement highlights another major attribute of the mechanistic position. Adherents of this position conceptualize the functioning of the components (the atoms and molecules) of the most fundamental level of analysis within the framework of a machine. As we have seen, according to this model, biological or psychological phenomena are only seemingly complicated constellations of physical and chemical processes. In principle, once we know the mechanisms of physical and chemical functioning, we know all we have to know about the world. In other words, because the fundamental level of analysis functions mechanistically, all the world is seen as functioning mechanistically.

Since physics and chemistry are machine-like sciences, all that must be done in order to move from one level of analysis to another is to specify the mechanism by which the basic elements of physics and chemistry combine. Since the molecular (physical–chemical) laws apply at the higher (physiological, psychological, or social) level, it is necessary only to discern the mechanisms by which these molecular elements are quantitatively added. In other words, to go to a higher level, all one must do is add these elements to what was present at the lower level.

If, by analogy, the nervous system was made up of 10 oranges, the circulatory system of 18 oranges, the respiratory system of 6 oranges, etc., all that would be necessary for moving up to the psychological–behavioral level would be to add all the oranges together. Thus, the only difference between levels is a quantitative one, a difference in amount, size, magnitude, and so on.

The mechanistic position is diagrammatically illustrated in Figure 3.1. Two levels of analysis are represented; Level 1, for example, could be the biological level, and, Level 2, the psychological level. Both are comprised of the same basic thing, in this case, oranges. To move from one level to another all one must do is add more oranges. Thus, between the two levels there is a continuity in the basic elements that make up each level; each level can be reduced to the same basic elements.

In summary, when the mechanistic philosophy of science is used as a framework from which to

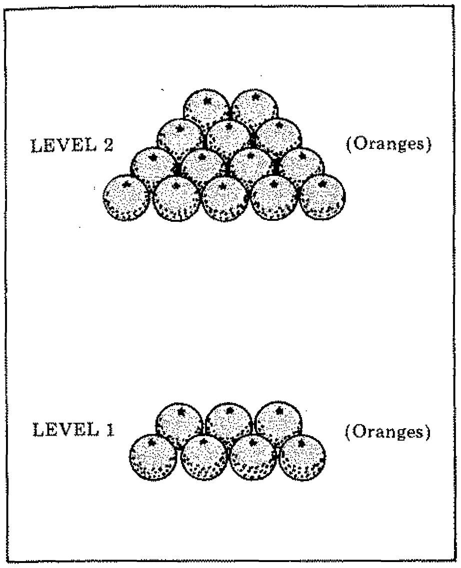


FIGURE 3.1
Mechanistic position: Each level is comprised of the same basic elements.

devise a theory of development, adherents of the mechanistic model would view psychology, sociology, or human development as branches of natural science (e.g., see Bijou, 1976; Bijou & Baer, 1961). They would seek to reduce the phenomena of psychological or social functioning to basic mechanical laws (e.g., stimulus–response relations, as in Bijou & Baer, 1961, or Homans, 1961, or to the combinations of chemicals involved in the activity of genes, as in Plomin, 1986; Rowe, 1994). They would attempt such reductions because they believe that these laws continuously apply to all phenomenal levels. In this view, the phenomena of psychology or sociology are not unique in nature but are, rather, controlled by the laws that govern all events and phenomena in the natural world. The position thus holds that there are basic and common laws that govern all things in the universe. Neither biology, psychology, sociology, nor any science (other than physics or chemistry), for that matter, really has its own special laws; in a basic sense, all sciences—and more important, all events and phenomena in the real world—are controlled by a common set of principles. It is believed that the phenomena, or events, that all sciences study can be uniformly subsumed (unified) and understood by one common set of natural-science principles (see Harris, 1957).

Thus, the basic characteristics of the mechanistic position are as follows:

1. It is a *natural-science* viewpoint.
2. It is a *reductionist* viewpoint.
3. It is a *continuity* viewpoint.
4. It is a *unity-of-science* viewpoint.
5. It is a *quantitative* viewpoint.
6. It is an *additive* viewpoint.

Translating the Mechanistic Philosophy Into a Theory of Development

As I have briefly illustrated, when the mechanistic model is transformed, or translated, into a set of ideas pertinent to human development, a reactive, passive, or "empty-organism" model of humans results (Reese & Overton, 1970). From this perspective, the human is inherently passive; his or her activity results from the action of external forces, ones placed *on* the person through environmental stimulation or *in* the person through genetic inheritance. In either case, it is not the individual's own action that is the basis of his or her development. Rather, it is the force of nature (genes) *or* nurture (the stimulus environment) that is the real basis of the behavior of the developing person.

For example, in one behavioristic instance of this mechanistic position, stimuli are held to evoke a response from a passive organism. The works of Skinner (1938), Bijou (1976), Baer (1982), Bijou and Baer (1961), and Gewirtz (1961) are representative of this position. These authors try to formulate the determining mechanisms of human behavioral development according to a natural-science model (Bijou & Baer, 1961). They attempt to discern the empirical (observable) and quantifiable parameters of environmental stimulation that fit this model (Gewirtz & Stingle, 1968).

As is discussed in detail in Chapter 10, the nature, mechanistic–developmental theory of Rowe (1994) claims to eliminate the need for "socialization science" by reducing all psychological and social phenomena to genes. Viewing behavior as a quantitative addition of discrete elements that combine, analogously, in the mechanical manner of chemistry and physics, nature or nurture mechanistic theorists appropriately look to elements other than the individual as the source of human development. A machine is passive until extrinsic energy activates it. Human beings, viewed as machines, are also passive until environmental stimulation (nurture) or the genes inherited at conception (nature) causes them to act. Thus, human development becomes just the historical, "mechanical mirror" (Langer, 1969) of environmental stimulation or genetic determination. Moreover, as Reese and Overton (1970) explain, *changes* in the "products of the machine," that is, changes over time in the behavior of organisms, do *not* result from phenomena intrinsic to their "own" (individual) level (i.e., their psychological, behavioral, or social relationship level); rather, again, changes result from (can ultimately be reduced to) alterations in the stimuli impinging on them or the genes placed in them.

Thus, those committed to such a mechanistic position would, in their psychological theorizing, try to explain behavioral development in terms of the principles of classical and operant conditioning (e.g., Baer, 1982; Bijou, 1976; Bijou & Baer, 1961; Gewirtz & Stingle, 1968); the principles of genetic inheritance (e.g., Plomin, 1986; Rowe, 1994); or the purported principles of genetic reproduction (such as gametic potential and inclusive fitness; Dawkins, 1976). Given that much of chapters 10 through 13 is devoted to a discussion of these latter, nature, mechanistic positions, it is useful to illustrate the "translation" of mechanistic philosophy into a theory of human development by focusing on instances of nurture, mechanistic theories.

A Nurture, Mechanistic Theory of Development

All mechanistic theories have a split ontology. They must split nature from nurture and hold that only one of these domains of potential influence is actually real. Since the epistemology of mechanists is to reduce all phenomena to one common constituent level, it cannot be logically maintained that there are two *different* and real levels (sources) of influence on the person's development, nature *and* nurture. Either one level has to be reduced to another (as Rowe, 1994, does when he reduces family and other social influences to the activity of genes), or the other level has to be accepted as materially real but not functionally (efficiently) real (or relevant) in the determination of behavior and development. This latter split is the type typically adopted within nurture, mechanistic theories of human development.

In such viewpoints, humans are, at their core and/or initially in their ontogeny, basically passive entities, awaiting stimulation from the environment in order to act, or more accurately, to respond. How does such stimulation bring human behavior under control?

Many mechanistic–behavioristic theorists would suggest that the principles of classical (respondent) conditioning and of operant (instrumental) conditioning can explain it. The former set of principles can account for stimulation-produced responding ($S \rightarrow R$) while the latter can account for response-produced stimulation ($R \rightarrow S$). Given the broad applicability of these types of conditioning in the natural world, they should be able to account for the acquisition of the responses of organisms (Bijou, 1976; Bijou & Baer, 1961). Such mechanistic–behavioristic theorists deal with the generic human being—the general case of humanity. The laws of conditioning are ubiquitous in their applicability to all human behavior and, for that matter, to the behavior of all organisms (see Skinner, 1938). External stimulation provides the material and efficient cause of behavior and development.

From a mechanistic–behavioristic perspective, organisms differ across their life span only in the quantitative presence of qualitatively identical behavioral units (i.e., elements of the behavioral repertoire acquired by the causally efficient laws of conditioning; e.g., Bijou, 1976; Bijou & Baer, 1961). As such, the organism is seen as a host (Baer, 1976) of these elements, and even the most complex human behavior is believed to be reducible to these identically constituted units (Bijou, 1976). The only constraint on behavioral change in a consequent period of life is imposed by past (i.e., antecedent) reinforcement history; that is, the repertoire of behaviors present in an organism at any point in time may moderate the efficiency by which current stimuli can extinguish or otherwise modify any particular behavior in the repertoire. The meaning of "past reinforcement history," however, may be such as to preclude any strong view of the potential for developmental change beyond the earliest periods of life.

From the mechanistic, behavior perspective, no strong (i.e., idealized) view of development is present. Instead, the concept of development is reduced to a concept of change in the elements of the behavioral repertoire; therefore, change is brought about by processes that either add to or subtract from the behavioral repertoire via conditioning. Consequently, change at any point in life becomes a technological matter that occurs with regard to past reinforcement history, and pertains to such issues as management of stimulus contingencies and of reinforcement schedules (e.g., in regard to building up, reducing, or rearranging a behavioral "chain" of stimulus–response connections).

Interindividual differences in response to a stimulus or interindividual differences in intraindividual change may become particularly problematic from this perspective. The only way in which such differences may be accounted for is by reference to differences in past reinforcement history, a history that may be typically uncharted among humans. Indeed, two organisms exposed to the same stimulus history, who nevertheless, react differently to the same immediate stimulus would present a formidable interpretative problem for this perspective (since an internal organizing structure independent of past stimulus history is not part of this model). Thus, since humans from quite similar backgrounds (e.g., identical twins reared together) may not behave in exactly the same way, scientists functioning from this perspective are forced to account for such differences by postulating some unseen but efficiently causal difference in stimulus history, or by arguing that such behavioral differences arise merely as a consequence of errors of measurement. Alternatively, such differences may be ignored.

Given the belief in the continuous and exclusive applicability of, and only of, functional (which in this perspective means efficient, and, in some cases, material; Skinner, 1966) stimulus–behavior relations, *only* the most simplistic view of the context is found in this perspective (e.g., Bijou, 1976). I do not use the term "simplistic" in any pejorative sense; rather, it serves to indicate that, in the behavioristic tradition, one can use only those features of the context—that is, the stimulus environment in the terms of this perspective—that can be translated into stimulus–response units. Features of the context that cannot be translated (i.e., reduced) into such units are invisible in this approach. For instance, sociopolitical historical events or emergent qualitative changes in social structures must either be reduced to elementaristic, behavioral terms or ignored. Moreover, because of a necessarily unequivocal commitment to reduce to efficiently causal antecedents, a strict mechanistic–behavioral position (e.g., the functional–analysis position of Baer, 1982) must be committed to the views (a) that early (indeed the earliest) stimulus–response experience is prepotent in shaping the rest of life; and (b) that, therefore, there can be no true novelty or qualitative change in life. Taken literally, a belief that any current behavior or event can be explained by or reduced to an antecedent efficient cause or a stimulus, means—in behavioral terms—that all of life must ultimately be explainable by the earliest experience of such antecedent–consequent relations. Any portion of "later" life must be explained by efficiently causal prior events. Thus, nothing new or qualitatively distinct can, in actuality, emerge consequent to these initial events.

Zukav (1979) explains this feature of mechanistic thinking (in regard to Newtonian physics) by noting that:

> If the laws of nature determine the future of an event, then, given enough information, we could have predicted our present at some time in the past. That time in the past also could have been predicted at a time still earlier. In short, if we are to accept the mechanistic determination of Newtonian physics—if the universe really is a great machine—then from the moment that the universe was created and set in motion, everything that was to happen in it already was determined. According to this philosophy, we may seem to have a will of our own and the ability to alter the course of events in our lives, but we do not. Everything, from the beginning of time has been predetermined, including our illusion of having a free will. The universe is a prerecorded tape playing itself out in the only way it can. (p. 26)

In short, the nurture, mechanistic–behavioral position represents a "translation" into psychological theory of the natural science, efficiently causal philosophy that Zukav (1979) describes in regard to Newtonian physics; that is, the first physical antecedent–consequent relation is transformed into the first, or at least quite an early, stimulus–response connection. Although it is not emphasized in many discussions of mechanistic–behavioral views, such as the functional-analysis perspective (Baer, 1982; Reese, 1982), the early proponents of this view were quite clear in their belief that early experience was prepotent in shaping all of life (see Kagan, 1983).

John B. Watson (1928) argued that "at three years of age the child's whole emotional life plan has been laid down, his emotional disposition set" (p. 45). Moreover, Watson (1924) boasted that:

> Give me a dozen healthy infants, well-formed, and my own specified world to bring them up in and I'll guarantee to take any one at random and train him to become any type of specialist I might select—doctor, lawyer, artist, merchant—chief and yes, even beggarman and thief, regardless of his talents; penchants, tendencies, abilities, vocations, race of his ancestors. (p. 82)

However, what often goes unrecognized is that Watson (1924) knew that this assertion about the efficacy of the application of radical behavioristic ideas in shaping behavior was quite overstated. That is, he admitted that:

> I am going beyond my facts and I admit it, but so have the advocates of the contrary and they have been doing it for many thousands of years. (p. 82)

Nevertheless, Watson, and other behaviorists, in seeking to counter what they regarded as the similarly overstated claims of nativists, continued to insist on the primacy of early experience. For example, Edward Thorndike (1905) contended that:

> Though we seem to forget what we learn, each mental acquisition really leaves its mark and makes future judgment more sagacious . . . nothing of good or evil is ever lost; we may forget and forgive, but the neurones never forget or forgive . . . It is certain that every worthy deed represents a modification of the neurones of which nothing can ever rob us. Every event of a man's mental life is written indelibly in the brain's archives, to be counted for or against him. (pp. 330–331)

Such views constitute a belief that the potential changes able to be induced in the person by later experience are quite limited, and that the potential for plasticity in later childhood, adolescence, and in the adult and aged years is markedly constrained by "early experience," by "past reinforcement history."

The point of the present discussion is to make clear the general nature of the translation of the mechanistic, reductionistic–philosophical position into the psychological theoretical position of such nurture, mechanistic–behavioristic psychologists as Bijou (1976), Bijou and Baer (1961), and Baer (1982). To such psychologists, all behavioral functioning is a consequence of stimulation. To understand behavior at any and all points in development, all one must do is understand the laws by which a person's responses come to be under the control of environmental stimulation.

Scientists functioning from this viewpoint often contend that there are two sets of laws that describe and explain how responses come under environmental stimulation: those of classical and operant conditioning. Because all behavior is ultimately controlled by the stimulus world, and because this world exerts its control through the functioning of a fundamental set of laws of conditioning, all behavior may be understood by reducing it to these same basic laws of stimulus–response relations. All behavior—whether of two different species of animals (rats and humans) or of two different age-groups of children (5- and 15-year olds)—is composed of the same basic stimulus–response elements, and these same basic elements are always associated on the basis of the same laws. Hence, seemingly complex behavior may be understood by reducing it to the same basic constituent elements that make up any and all behavior. Because all behavior may be so reduced, the same laws must, therefore, be applicable to explain behavior at any (animal or human age) level at which it occurs. Continuity in the laws of conditioning, in the rules that account for behavioral functioning, is another aspect of this approach.

Thus, to completely understand behavioral functioning and development, one must simply know the mechanisms by which stimuli in a person's world come to control that person's behavior at all points in the life span. Once these mechanisms are known, one can reduce behavior at different points in life to common constituent elements. In turn, because the same elements comprise behavior at each level, one can account for any differences in behavior between points in the life span merely by reference to the quantitative difference in the stimulus–response relations in the person's behavior repertoire. If behavior is composed totally of the stimulus–response relations a person has acquired over the course of life as a function of conditioning, then the difference between behavior at any two points in life could only be a quantitative one in the number of associations acquired. One could move from lower to higher levels of behavior analysis simply by adding on the similarly acquired stimulus–response associations.

By this point, then, the way in which the nurture, mechanistic model becomes translated into a theoretical view of human development should be clear. Although the mechanistic position is an abstract philosophical view of the nature of the real world, the position is not without its influence in science in general and human development in particular. One basis for this influence in human development is that behavioral phenomena traditionally associated with behaviorism (e.g., classical and operant conditioning, desensitization, and behavioral shaping) depict important features of behavioral *change*, if not behavioral development. Thus, the mechanistic position frames what are, descriptively, important means through which person–context relations (typically reduced, of course, to stimulus–response connections) may change.

Accordingly, in providing the philosophical basis of the empirical–behavioral or the functional–analysis (Baer, 1982; Bijou, 1976; Reese, 1982) approach to human development, the mechanistic position presents what has been an influential philosophical–psychological view of the nature of humanity. Naturally, the position has had significant criticisms leveled at it. In fact, one may view the organismic position as a culmination of the objections raised about the assumptions and assertions of the mechanistic position (Bertalanffy, 1933). As a means of transition to our discussion of the organismic position, let us first consider some of the important problems of the mechanistic position.

Problems of the Mechanistic Model

We have seen that the core conceptual basis of the mechanistic model is reductionism. We have also seen that the belief in reductionism is predicated on the assertion that, because all matter is made up of basic (e.g., physical–chemical) components, the only appropriate, necessary, and sufficient approach to investigating the fundamental laws of natural world is to study these basic components. Hence, the adherent of the mechanistic model asserts that to understand any and all levels of phenomena in the real world, these higher levels must be reduced to the laws of the fundamental constituent level. However, Anderson (1972) in describing the reductionistic component of the mechanistic position, also sees the viewpoint as advancing an argument containing a logical error:

> The main fallacy in this kind of thinking is that the reductionist hypothesis does not by any means imply a "constructionist" one: The ability to reduce everything to simple fundamental laws does not imply the ability to start from those laws and reconstruct the universe. In fact, the more the elementary particle physicists tell us about the nature of the fundamental laws, the less relevance they seem to have to the very real problems of the rest of science, much less to those of society. (p. 393)

But why does the ability to reduce from a higher, seemingly more complex, level of analysis to the lower level not necessarily imply the reverse? Why does such reductionistic ability not imply that one can move from the lower to the higher levels—and thereby construct the universe—by simply adding more of the same constituent elements onto what already exists at a lower level? Why, when we attempt to do this, and when we concomitantly learn more and more about the fundamental level, do we seem to be missing an understanding of the important problems and phenomena of the higher levels? Why does the reductionist fail when attempting to also be a constructionist? Again, we may turn to Anderson (1972):

> The constructionist hypothesis breaks down when confronted with the twin difficulties of scale and complexity. The behavior of large and complex aggregates of elementary particles, it turns out, is not to be understood in terms of a simple extrapolation of the properties of a few particles. Instead, *at each level of complexity entirely new properties appear,* and the understanding of the new behaviors requires research which I think is as fundamental in its nature as any other. That is, it seems to me that one may array the sciences roughly linearly in a hierarchy, according to the idea: The elementary entities of science X obey the laws of science Y.
>
> | X | Y |
> |---|---|
> | Solid-state or many-body physics | Elementary particle physics |
> | Chemistry | Many-body physics |
> | Molecular biology | Chemistry |
> | Cell biology | Molecular biology |
> | . | . |
> | . | . |
> | Psychology | Physiology |
> | Social sciences | Psychology |
>
> But this hierarchy does not imply that science X is "just applied Y." *At each stage entirely new laws, concepts, and generalizations are necessary,* requiring inspiration and creativity to just as great a degree as in the previous one. Psychology is not applied biology, nor is biology applied chemistry. (p. 393, italics added)

What Anderson is saying, therefore, is that the constructionist hypothesis fails because, simply, "more is different." In other words, as one studies levels of higher and higher complexity, one concomitantly sees that new, qualitatively different characteristics come about—or emerge—at each of these levels. The new characteristics are not present at the lower, fundamental level and are, therefore, not understandable by reduction to the lower level. One cannot move from higher to lower levels (and back again) merely by adding or subtracting more of the same, because as one combines more of the same into a higher level of complexity, this combination has a quality that is not present in the less complex constituent elements as they exist in isolation. Thus, the reductionist–mechanistic position fails because reductionism does not mean constructionism, and in turn, constructionism fails because of the presence of qualitatively new properties emerging and characterizing each higher level of analysis.

Reductionism also fails for other reasons. Reductionism is predicated on the belief that reference to the constituent elements comprising all matter can suffice in accounting for the nature of phenomena at all levels of analysis. However, we have seen that this continuity assumption is weak. If new, qualitatively different phenomena characterize each higher level of analysis, then, by definition, continuity does not exist. If something new does exist, this clearly means that just the same thing as existed before does not exist. One may not explain all natural phenomena by reference to one common set of continuously applicable fundamental laws. In other words, the shortcomings of the reductionistic–mechanistic position—whether it is a nature or a nurture version of such a view—also include the inadequacy of its continuity assumption. Thus, this philosophical position is unable to explain all natural phenomena through reduction to one set of fundamental laws. Reductionism cannot be used to explain successfully all levels of phenomena in the natural world because (Eacker, 1972):

> This conception appears to ignore the additional fact that once the behavior has been explained physiologically, the physiology still remains to be explained (cf. Skinner, 1950). Furthermore, if physiology in turn is to be explained by biochemistry and it by physics, how physics is to be explained poses an enduring problem because there are no sciences left. In short, this type of explanation leads to a finite regression with one science left unexplained, unless, of course, it is self-explanatory; no one is likely to admit that of physics. (p. 559)

We see, then, that there are many problems with the mechanistic model. It fails to suffice in accounting for the nature of the phenomena present at all levels of analysis because at each level of analysis there exist qualitatively new, and, hence, discontinuous, phenomena. One should perhaps resort to a point of view that emphasizes these phenomena. What is being alluded to is the fact that the very objections raised about the mechanistic position seem, in their explication, to suggest the necessary characteristics for a point of view that would successfully counter the po-sition. Specifically, mechanistic constructionism fails because new phenomena emerge to characte-rize higher levels of analysis; therefore, the first component of a successful alternative position would be one positing the emergence of qualitatively discontinuous changes as characterizing development. This notion of emergence would be introduced to counter the problems of reductionism, while the idea of qualitative discontinuity would be raised to address the inability of a mechanistic constructionist position to account for all phenomena present at all levels. In essence, a developing organism would be viewed as a creature passing through qualitatively different levels (e.g., phases or stages) of development, periods made different because of the presence of new (lawfully distinct) phenomena emerging to characterize that portion of the life span.

These alternative views of the nature of differences between levels of analysis, or between portions of the ontogeny of an organism, are represented in the organismic philosophy of science. Let us consider the ways in which this second position offers a view of the world in contrast to mechanism.

THE ORGANISMIC MODEL

As explained by Reese and Overton (1970), the organismic model has as its basic metaphor "the organism, the living, organized system presented to experience in multiple forms" (p. 132). Moreover, Reese and Overton (1970) go on to note that:

> The essence of substance is activity rather than the static elementary particle proposed by the mechanistic model. . . . In this representation, then, the whole is organic rather than mechanical in nature. The nature of the whole, rather than being the sum of its parts, is presupposed by the parts and the whole constitutes the condition of the meaning and existence of the parts . . . the important point here is that efficient cause is replaced by formal cause (i.e., cause by the essential nature of a form). (p. 133)

Adherents of one or another version or instance of the organismic philosophy of science (e.g., Bertalanffy, 1933; Schneirla, 1957; Tobach, 1981) reject the reductionism of mechanism and maintain that at each new level of phenomenal organization there is an emergence of new phenomena that cannot be reduced to lower levels of organization. They hold that one cannot appropriately make a quantitative reduction to a lower organizational level and hope to understand all phenomena at the higher organizational level. This inability to reduce occurs because, at each higher organizational level, something new comes about, or emerges (Novikoff, 1945a, 1945b). Thus, a change in quality and not merely in quantity characterizes the differences between one level of analysis and another. If one reduces to the lower level, one eliminates the opportunity of dealing with the new characteristic (which is actually the essential characteristic) of the higher level, the very attribute that defines the difference between the lower and higher levels.

For example, going from one animal level to another, or from one stage of human life to another, would be analogous to changing from an orange into a motorcycle. How many oranges comprise a motorcycle? Obviously this is a ludicrous question, because here we have a change in kind, type, or quality, rather than merely in amount, magnitude, or quantity.

The above argument—the irreducibility of a later form to an earlier one—is the essence of the *epigenetic viewpoint,* the view that human development is characterized by the emergence of new forms across ontogeny. One cannot reduce a qualitative change, something new, to a precursory form. Epigenesis denotes that at each higher level of complexity there emerges a new characteristic, one that simply was not present at the lower organizational level and, thus, whose presence is what establishes a new level as just that—a stage of organization qualitatively different from a preceding one. Thus, according to Gottlieb (1970, p. 111), epigenesis connotes that patterns of behavioral activity and sensitivity are not immediately evidenced in the initial stages of development. Since development is characterized by these qualitative emergences, then by definition the various new behavioral capacities that develop are not actually present until they do in fact emerge.

The doctrine of epigenesis asserts that development is characterized by qualitative "emergences." Simply, new things come about in development. Newness means just that: Something now exists that was not present before, either in smaller or even in precursory form. Epigenesis asserts that development is represented by the emergence of characteristics at each new stage of development that were not present in any precursory form before their time of appearance.

The presence of qualitatively new characteristics at each higher stage indicates that reduction to lower levels is inappropriate—if full understanding of the new stage is sought. For instance, the behavior of a three-month old may *perhaps* be understood by reference to relatively simple stimulus–response, reflexlike associations; yet, when the child reaches about two years of age there may emerge a new symbolic function—language (as an example of the ability to represent physical reality through use of nonphysical symbols). Thus, as one consequence of this representational ability, the child may now show behaviors (e.g., being able to imitate some person or event long after the time of actual viewing) that can best be understood by reference to this emergent symbolic ability; trying to reduce this two-year-old's behavior to the functioning shown at an earlier age would be inappropriate because the representational ability that enables one to account for the two-year-old's behavior was simply not present at the earlier age.

Thus, an antireductionist view is maintained because the qualitative change that depicts a higher stage of development cannot be understood, since it does not exist, at the lower level. Because the nature of what exists changes from stage to stage, and because there is qualitative change from stage to stage, there cannot be complete continuity between stages. New things—variables, processes, and/or laws—represent the differences between stages; hence, such qualitative change means that discontinuity (at least in part) characterizes differences between stages. Such differences are in *what* exists and not just in *how much* exists. Thus, to the organismic thinker, laws of the psychological level of analysis are unique in nature—they are not merely reducible to the laws of physics and chemistry. Similarly, each different phyletic or ontogene-tic level is viewed as having features qualitatively discontinuous from every other.

This aspect of the organismic position is represented in Figure 3.2, which shows qualitative discontinuity between the two levels represented. Because something new has emerged at the higher level, one cannot reduce one level to another. Level 1 is comprised of oranges and Level 2 is a motorcycle. One cannot hope to understand the functioning of a motorcycle through even an intensive study of oranges!

But, on what basis do proponents of the organismic viewpoint assert that qualitative discontinuity characterizes development? How do organismic thinkers explain their assertion that epigenesis—qualitative discontinuity—represents differences between levels?

Organismic thinkers would be in agreement with an idea borrowed from Gestalt psychology, that the whole (the organism) is more than the sum of its parts. That is, a human organism is more than a liver added to two kidneys, to one spinal cord, to one brain, to one heart, and so on. Organismic thinkers would reject the additive,

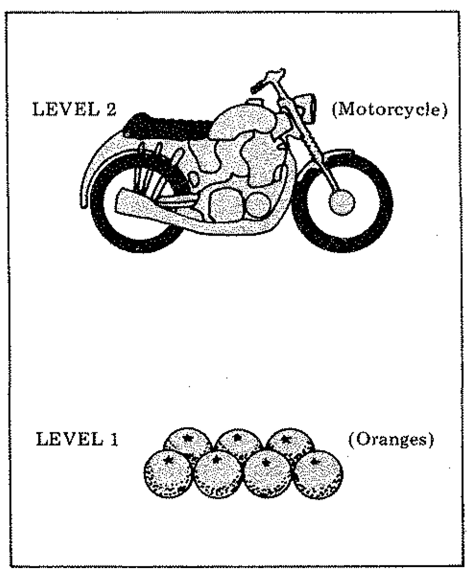


FIGURE 3.2
Organismic position: Qualitative discontinuity exists between levels.

and implicitly splitting assumption underlying the mechanistic position, and, instead, maintain that a fused, integrative, and holistic type of combination would be more accurate. They would argue that organisms, as organized and relational systems, show in the integrations among their constituent elements (their parts) properties that cannot be reduced to physical and chemical terms.

One may reach a physical and chemical understanding of a kidney, a brain, and a liver. However, properties will be seen in the organism considered as a whole that derive not from the separate organ systems per se but from their relations (integrations) with each other. When parts combine they produce a property that did not exist in the parts in isolation. The parts do not merely add up (e.g., 2 + 3 = 5), but multiplicatively interact (e.g., 2 × 3 = 6; hence, one more unit is present here than with the additive combination). This interaction brings about the emergence of a new property.

In essence, the organismic viewpoint asserts that the basis of the epigenetic (qualitatively discontinuous) emergences that characterize development lies in the multiplicative interactions of the constituent parts of the organism. When the parts combine, they produce a new complexity, a characteristic existing only as a product of the interaction of these parts. This new property does not exist in any of the constituent parts—or in any of the lower organizational levels—even in precursory form.

Ludwig von Bertalanffy (1933), a leading formulator of the organismic viewpoint, suggested that nothing can be learned about the organism as such from a study of its parts in isolation. He believed that this inability existed because an organism, in its natural state, viewed as a whole being (and not just as a bunch of constituent parts), shows phenomena that are so different from physical, mechanistic ones that entirely new concepts are needed to understand them.

Thus, if one accepts the epigenetic, organismic point of view; a mechanistic, reductionistic view of organisms is entirely inappropriate. The characteristics of a whole living organism have nothing in common with the characteristics or structures of a machine (or a kidney, liver, or other organ split off from the whole organism). Such distinctions occur because the characteristics—or parts—of a machine can be separated without a change in their basic properties. For instance, a car's carburetor will still be a carburetor, and will still have the same properties, regardless of whether it is

Ludwig von Bertalanffy

attached to a car. But, according to the organismic position, this is not the case with living organisms. With living organisms, at each new level of analysis an emergence takes place; with every step building up to the whole living organism, from an atom to a molecule to a cell to a tissue to an organ, new phenomena occur that cannot be derived from the lower, subordinate levels.

Thus, knowledge of the functioning of the various subsystems that make up an organism does not lead to an understanding of the whole organism. For example, water has an emergent quality (its liquidness) that cannot be understood by reducing water to its constituent (and gaseous) elements (hydrogen and oxygen). Similarly, human beings have unique characteristics (or qualities), such as being able to love, being governed by abstract principles of moral and ethnical conduct, or showing high levels of "need achievement," that emerge as ontogenetically distinct (qualitatively discontinuous) features and cannot be understood by mere reduction to underlying neural, hormonal, and muscular processes. As I have already noted, a basis for this position, which is put forward by organismic theorists, is a belief in epigenetic processes—a belief that at each new level of behavioral organization there emerge qualitatively new (discontinuous) phenomena that cannot be reduced to lower levels.

In summary, the basic characteristics of the organismic position are:

1. It is an *epigenetic* viewpoint.
2. It is an *antireductionist* viewpoint.
3. It is a *qualitative* viewpoint.
4. It is a *discontinuity* viewpoint.
5. It is an *integrative relational*, or *multiplicative* interactionist viewpoint.

Translating the Organismic Model Into a Theory of Development

When the organismic model is translated into a set of ideas pertinent to human development, an active organism model of humans results. From this perspective, the human is inherently active; that is, it is the human who provides a source of its behaviors in the world, rather than the world providing the source of the human's behaviors. Humans, by virtue of their structure, give meaning to their behavior; that is, they provide it with organization—with form—by virtue of integrating any given behavior into the whole. Thus, humans, by virtue of their activity and organization, are *constructors* of their world rather than passive responders to it. Moreover, as a consequence of the inherent activity of humans, change or development is accepted as given (Reese & Overton, 1970). In other words, change may not be reduced to efficient or material causes, although such causes may impede or facilitate change. Rather, the structure or configuration of mental or behavioral life, the integrated lattice of relationships, or simply the form of the whole, is the basis of the individual's development. In short, formal cause is basic in the organismic perspective (Reese & Overton, 1970).

From the organismic perspective, development of a given process (e.g., cognition) is an idealized and goal-directed intraorganism phenomenon. As explained by Pepper (1942):

> With organicism, no ordinary common-sense term offers a safe reference to the root metaphor of the theory. The common term "organism" is too much loaded with biological connotations, too static and cellular, and "integration" is only a little better. Yet there are no preferable terms. With a warning we shall accordingly adopt these [p. 280] . . . The categories of organicism consist, on the one hand, in noting the steps involved in the organic process, and, on the other hand, in noting the principal features in the organic structure ultimately achieved or realized. The structure achieved or realized is always the ideal aimed at by the progressive steps of the process [p. 281]. . . . The pivotal point in the system . . . is the goal and final stage of the progressive categories and it is the field for the specification of the ideal categories. (p. 283)

Qualitative change, forged by the inevitable synthesis of contradictions, as is, for example, represented by emergent structural reorganization (Piaget, 1970) or focal reorientation in the mode of dealing with the world or with gratifying one's emotions (e.g., Erikson, 1959; Freud, 1954), is seen as the key feature of development. Thus, the organismic approach is a holistic one, one wherein *formal* cause, and in its "purest" philosophical formulation also *final* cause (also termed teleological, or goal-directed cause, which we discuss again later) provides the basis of developmental explanation (Nagel, 1957; Pepper, 1942). In organicism, there is a goal for development: To achieve the form the organism is inherently destined to take. This goal serves to direct the development of the organism, literally pulling the individual toward his or her final end state. By analogy, the ideal of the full flower in bloom—for instance, the rose—pulls the seed, the bud, etc. in the direction of this future form. Such teleology, or goal-directedness, means that future idealizations of the organism—its final, fully developed form—direct change within the individual during the present, shaping the organism in manners that enable it to attain the final form (e.g., the formal operational stage or the genital stage) that is the goal of development.

However, given this formal and final explanatory orientation, especially when it is cast within a teleologically idealized view of developmental progression, material and efficient causative agents—for instance, as derived from the context enveloping the organism—are seen as irrelevant to the sequence of development, and as such to the form the organism takes at any point in this sequence. Said in another way, the inherent and goal-directed form of the organism is the basis of development, and any other potential source of influence on change across ontogeny is, at best, of only secondary importance. Thus, the context can inhibit or facilitate (i.e., speed up or slow down) developmental progression, but it cannot alter the quality of the process or its sequential universality. If a contextual variable does alter the quality or sequence of an organism's progression, then by definition that feature of functioning was not a component of development.

Ironically, then, although constituting an alternative to the nature–nurture split conceptions of mechanism, the "classic" (Reese & Overton, 1970) developmental version of organicism becomes also a split position! Although not involving as complete a split as in mechanism, wherein only one domain—nature *or* nurture—can be real, classic organicism (e.g., as in the developmental psychologies of Jean Piaget or psychoanalysis; Wolff, 1960) sees nature as of primary importance in life. This importance exists because nature provides the formal cause of developmental change. Nurture variables exist as well, however, in the view of classic organicists. The contribution of nurture variables to development is only secondary, in that their only influence is to moderate features of primarily intrinsic trends (e.g., such as pace of progression to the teleologically directed final form of development).

Gottlieb (1970) has labeled this version of organicism *predetermined epigenesis.* An early version of Victor Hamburger's (1957) organismic position epitomizes this view:

> The architecture of the nervous system and the concomitant behavior patterns result from self-generating growth and maturation processes that are determined entirely by inherited, intrinsic factors, to the exclusion of functional adjustment, exercise, or anything else akin to learning. (p. 56)

It should be noted, however, that Hamburger (1973) later repudiated this view of epigenesis and adopted a position akin to an alternative view, one labeled *probabilistic epigenesis* (Gottlieb, 1970, 1983, 1997).

The features of probabilistic epigenesis are associated with developmental systems theories (Ford & Lerner, 1992; Gottlieb, 1991, 1992, 1997; Same-roff, 1983; Thelen & Smith, 1994, 1998), such as developmental contextualism (e.g., Lerner, 1978, 1998b). This correspondence is noted again in this chapter, in the context of a discussion of how ideas associated with the mechanistic and the organismic models pertain to several key issues of development. The rationale for this presentation is that, as was the case with the mechanistic position, there are several problems we may identify with the organismic position. These problems come to the fore when comparing the mechanistic and the organismic models' positions in regard to the developmental issues we discuss. However, I argue that many of these problems can be usefully addressed by adopting a probabilistic epigenetic, rather than a predetermined epigenetic, view of organicism.

But, as I also argue, such an adoption, in actuality, constitutes a divorce from "pure" organicism. In fact, such an adoption creates a "marriage" (an integration) between organicism and another model useful in devising an approach to development: a contextual model. As I point out in various portions of the next section, organicism and contextualism are, philosophically, often intimately, related (Overton, 1984; Pepper, 1942). Thus, the "marriage" I propose is one between quite compatible models. Thus, by introducing some of the compatibilities between organicism and contextualism in the next section, and also by developing the argument for the usefulness of probabilistic epigenesis in the context of a comparative discussion of mechanism and organicism, and of the uses and problems with each, I am setting the stage for both a direct treatment of the contextual model and a discussion of its uses and limitations; therefore, I am preparing us for my proposal about an integration of the organismic and the contextual models—an integration that I labeled in chapter 1 as developmental contextualism, an instance of developmental systems theory.

MECHANISTIC AND ORGANISMIC MODELS AND ISSUES OF DEVELOPMENT

It is useful to begin this section by reiterating some of the key features of the mechanistic and organismic models. The mechanistic model stresses the continuous applicability of a common set of laws or principles. Continuity exists because even quite complex behavior may be reduced to common elements (e.g., stimulus–response connections in nurture, S–R, behavioristic theories, or genes in nature, behavioral genetics or sociobiological theories), elements whose linkage is controlled by forces external to or placed into (through inheritance) the essentially passive, reactive organism. Thus, the task of developmental psychologists, from this perspective, is to identify the efficient antecedents (e.g., the environmental stimuli or genes) controlling consequent behaviors.

The organismic model stresses the integrated structural features of the organism. If the parts making up the whole become reorganized as a consequence of the organism's active construction of its own functioning, the structure of the organism may take on new meaning; thus, qualitatively distinct principles may be involved in human functioning at different points in life.

These distinct, or new, levels of organization are typically termed *stages* in this perspective (Lerner, 1976; Reese & Overton, 1970). The task of developmental psychologists within organicism is to assess the different functions of the organism that are associated over time with its changing structure.

From these general distinctions between the two models, there arise several other issues pertinent to understanding development. Reese and Overton (1970; Overton & Reese, 1973) and Lerner (1978, 1985) have identified several of these issues. These ideas serve to highlight the distinctions that we have already drawn. In addition, their discussion leads us to a presentation of a third model, contextualism.

Elementarism Versus Holism

The mechanistic model is an elementaristic one. Human functioning is reduced to its core constituent elements (e.g., S–R connections and genes) and, in turn, the laws that govern the functioning of these elements are applicable continuously across life. Consequently, there is no true qualitative discontinuity, no newness, no emergence, and no epigenesis within this perspective. Only quantitative differences may exist.

The organismic model is a holistic one. As Reese and Overton (1970) explain, "The assumption of holism derives from the active organism model. More particularly, it derives from the representation of the organism as an *organized* totality, a system of parts in interaction with each other, such that the part derives its meaning from the whole" (p. 136). Reese and Overton also note that the idea of holism within organicism has been most clearly articulated by Werner and Kaplan (1963), who indicated that the idea

> maintains that any local organ or activity is dependent upon the context, field or whole of which it is a constitutive part: its properties and functional significance [meaning] are, in larger measure, determined by the larger whole or context. (p. 3)

As will become clear when we discuss the world hypothesis of "contextualism" (Pepper, 1942), a similar emphasis is placed on the role of the context in providing meaning for the parts of which it is constituted. Thus, as we have already implied and as Pepper (1942) and Overton (1984) have explained, there is considerable similarity between the organismic and the contextual models. However, the two models are distinct in significant ways, ways which lead us to find contextualism of use in surmounting some of the limitations that exist in the traditional (classic) organismic model. These limitations are explained as we further discuss some of the issues that divide organicism and mechanism. These discussions lead us toward an integration of organicism and contextualism as a means to formulate a concept of development that adequately remedies problems found in exclusively organismic or mechanistic (or contextualistic, for that matter) views.

Antecedent–Consequent Versus Structure–Function Relations

The mechanistic model stresses efficient (and material) causes and is thereby concerned with identifying the necessary and sufficient antecedents of a behavior. Behavior is reduced, then, to an analysis of a qualitatively unchanging, continuous, and unbroken chain of cause–effect (e.g., S–R or gene-behavior) relations. In organicism, however, the emphasis is on determining the functions associated with the actively constructed structures of the organism. Qualitative changes in structures can occur as the active organism constructs—or better, reconstructs—its organization. Thus, novelty, newness, qualitative discontinuity, or epigenesis occurs as a consequence of changing structure–function relations.

But if structure leads to function, what accounts for structure? One answer is simply function. That is, the active organism shapes its structure, which in turn influences the organism's function, and so on, in a continuous and bidirectional (reciprocal) manner (e.g., Gottlieb, 1976a, 1976b, 1983; Kuo, 1967; Tobach, 1981). This answer is only one of several possible replies and is in fact quite controversial. Kohlberg (1968), Reese and Overton (1970), Overton (1973), Gottlieb (1976a, 1976b), and Lerner (1976, 1986) have noted that there exist several formulations about the source of an organism's structure. These formulations divide on the basis of their relative emphases on nature-based processes (e.g., nativistic, preformed, and innate variables) and nurture-based processes (e.g., conditioning, the physical ecology of one's context, and the social events of one's context) in accounting for structure. As such, these formulations divide in respect to what I have suggested (in Chapter 1) is perhaps the key issue of human development—the nature–nurture issue, or the controversy surrounding the source of any facet of human behavioral development.

For instance, nurture-based, mechanistic formulations about the character of psychological structure have tended to emphasize the role of environmentally based processes (e.g., the laws of classical and operant conditioning) in building up a response repertoire (and/or mediation processes) within the organism (e.g., Bijou, 1976; Bijou & Baer, 1961). Thus, from this perspective, structure is imposed from outside the organism.

In turn, there exist several formulations associated with the organismic model. Several nature-based views stress the role of nativistic variables and indicate that such variables exert a predetermined influence on an organism's structure—an influence independent of any role of nurture variables. Examples are from Chomsky (1965, 1966) and McNeill (1966), who maintain that psychological (linguistic) structures are completely present at birth, and Hamburger (1957), who was cited earlier as maintaining that the inherent structure of the nervous system directly determines various behavioral functions. Given that the character and course of changes in such structures are believed to be so thoroughly shaped by nativistic variables, it may be apparent why Gottlieb (1970) has labeled such views predetermined–epigenetic.

Some formulations associated with the organismic view emphasize that an *interaction* between nature and nurture variables provides the basis of structure. However, as is discussed again later, the concept of interaction is itself a complex, controversial one. Indeed, one's concept of interaction—the components one sees as interrelating within the organismic whole—determines whether one remains committed to an exclusively organismic model or to a position that integrates organicism and contextualism (Lerner, 1985; Lerner & Kauffman, 1985).

For instance, Piaget (1968, 1970) maintained that while there existed an innate (congenital) structure, or organization, structures consequently develop through an interaction between the innate organization and the ongoing activity of the person (Reese & Overton, 1970). Note, however, that this concept of interaction sees the focal point, the locus, of interaction *within* the organism. The interaction is between the existing internal organization and the active organism's constructionist functions on or with that organization. While this organismic, internal version of interaction stands as the converse of the nurture, mechanistic, more extrinsic notion of interaction (as a relation between past reinforcement history and present stimulus conditions), the Piagetian (1968, 1970) notion of interaction is distinct from those we discuss as being associated with the contextual model. That is, to preview that discussion, a *strong* concept of organism–environment interaction (Lerner & Spanier, 1978, 1980; Overton, 1973), transaction (Sameroff, 1975), or dynamic interaction (Lerner, 1978, 1979, 1985) is associated with a contextual perspective. This concept rejects a split between nature and nurture, or even between organism and environment, and stresses that a fused relationship exists among all components of the developmental system (Schneirla, 1956, 1957). As such, organism and context are always embedded each in the other (Lerner, Hultsch, & Dixon, 1983). The context is composed of multiple levels changing interdependently across time (i.e., historically) and, because organisms influence the context that influences them, they are efficacious in playing an active role in their own development (Lerner & Busch-Rossnagel, 1981).

But, as is also emphasized in organicism (Werner & Kaplan, 1963), because of the mutual embeddedness of organism and context, a given organismic attribute will have different implications for developmental outcomes in the milieu of different contextual conditions; this relativism exists because the organismic attribute is only given its functional meaning by virtue of its relation to a specific context. If the context changes, as it may over time, the same organismic attribute will have a different import for development. In turn, the same contextual condition will lead to alternative developments, in that different organisms interact with it. Thus, to draw quite a subtle distinction in somewhat strong terms, in the type of interactions stressed in contextualism a given organismic attribute only has meaning for psychological development by virtue of its timing of interaction—its relation to a particular set of time-bound contextual conditions. The import of any set of contextual conditions for psychosocial behavior and development can only be understood by specifying relations of the context to the specific, developmental features of the organisms within it. This central role of the timing of organism–context interactions in the determination of the nature and outcomes of development provides, as we shall see, a time- (or timing-) dependent, probabilistic component of epigenesis (Gottlieb, 1970; Scarr, 1982; Scarr & McCartney, 1983). As such, a distinctive feature of an approach to development that draws on contextual philosophical ideas is the treatment of the concepts of time and timing.

Although this probabilistic epigenetic perspective gains its potential for providing an approach to developmental theory distinct from organicism (by drawing from issues associated with the contextual treatment of the concepts of time and timing), it can only do so by building on organicism. This relation is highlighted in the next developmental issue we discuss.

Behavioral Versus Structural Change

What is it that develops, that changes, with development? Does this development have any necessary direction? As Reese and Overton (1970) explain, the answers to these questions provide human development with perhaps the most important distinctions between the mechanistic and the organismic (and, we may also note the contextual) positions.

Within the mechanistic model, qualitatively identical elements may be added to or subtracted from the machine. For instance, in the nurture, behavioristic translation of the model, lawfully identical S–R connections may be added to or subtracted from the response repertoire. Development is thus a matter of quantitative constancy or change, with elements being added to or subtracted from the organism's repertoire in accordance with, for instance, the laws of conditioning (Bijou & Baer, 1961).

With decreases or increases possible in the number of S–R connections in the repertoire, development may be said to be multidirectional within this perspective. In short, in this exemplar of the mechanistic model in human development, what changes in development is the number of S–R connections in the organism's repertoire, and there is no a priori direction to such change.

Quite a different set of ideas exists within the organismic model. Reese and Overton (1970) noted that this model emphasizes changes in structures and functions, and they stressed that these changes are specified a priori to move toward a final goal or end state. That is, as I noted earlier in this chapter, development is *teleological* within this view; it is goal-directed. Indeed, Reese and Overton (1970) indicated that within the organismic model, the definition of development is "changes in the form, structure, or organization of a system, such changes being directed towards end states or goals" (p. 139).

Reese and Overton (1970) explained that development within this view is an a priori concept; that is, the general function of development—the end state or goal (e.g., "maturity," "ego integrity," "genital sexuality," or "formal operations"—is postulated in advance and acts as a principle for ordering change. In short, in the organismic perspective, structure–function relations develop and these changes are, in a final sense, unidirectional—they move toward a final end state.

But, although development is thus seen to be an a priori, idealized ordering of structure–function relations, and development is therefore continuous in the sense of always being directed by the final end state, there may be—and typically are—qualitative changes in structure–function relations over the course of development. The possibility of structure–function changes of a qualitative character raises two other key developmental issues on which the models provide divergent perspectives.

Continuity Versus Discontinuity

Continuity means constancy or a lack of change in some feature of development. For example, a given personality trait (e.g., dependency) may be continuously present within a person across his or her life, or a child's growth rate (e.g., two inches a year) may remain constant across the childhood years. Discontinuity means change. Dependency may be altered or transformed into independence, and with puberty and the adolescent growth spurt, an individual's growth rate may increase dramatically.

Both the mechanistic and the organismic models speak of continuity and discontinuity. In the nurture, mechanistic model, the number of S–R connections (elements) in the response repertoire may be continuous; and in organicism, a given structure–function relation may be continuous for a specific period of the person's life. Thus, ideas of continuity may be derived from both models.

However, the models divide clearly when the issue of discontinuity is raised. Quantitative discontinuity is only possible within the translations of mechanism present in human development. However, within organicism, the active organism may construct—or better, revise—its structure, and in so doing a new structure–function relation will exist. Thus, qualitative discontinuity is possible within organicism. Such a change constitutes not just more of a previously or already existing structure; rather, it constitutes something new, something that cannot be reduced to a prior state or status of the organism. Such changes are said to be emergent ones, and such qualitative discontinuity is termed epigenesis.

The possibility that life is characterized by qualitatively distinct phases of structure–function relations raises another key developmental issue. This is the issue of stages.

Stages of Development

Like many of the other concepts we have been discussing, the concept of stage is a complex and controversial one (e.g., Brainerd, 1978; Flavell, 1980; Kessen, 1962; Lerner, 1980; McHale & Lerner, 1985; Overton & Reese, 1973; Reese & Overton, 1970; Wohlwill, 1973). Here, we need to note only that the models clearly divide on the basis of the way the term *stage* is used as a theoretical construct. In nurture, mechanistic, and behavioristic positions (e.g., Bijou, 1976), a stage summarizes the presence of some set, or some quantity, of S–R connections. However, there is nothing qualitatively different about organisms at one or another stage of life.

In organismically derived theories, however, a stage denotes a qualitatively distinct level of organization (e.g., Reese & Overton, 1970; Schneirla, 1957); that is, a stage is an organizational structure qualitatively discontinuous with those of prior or later periods. As Reese and Overton (1970) explain:

> Within the active organism model, change is in structure–function relationships or in organization. As organization changes to the extent that new system properties emerge (new structures and functions) and become operational, we speak of a new level of organization which exhibits a basic discontinuity with the previous level. (p. 143)

Sources of Development

The mechanistic position, when translated into a developmental theory, will typically take the form of either a nature or nurture position. Resting on an additive and a mechanistic assumption, the mechanistic position tries to explain behavioral development in terms of a single set of source determinants. Because they are committed to a continuity position, mechanistic thinkers would, by definition, be committed to the view that the same set of laws can always account for behavior. If continuity is asserted, it is then most difficult to draw one's explanations of behavioral development from different sources of development. (Of course, it may be possible to argue that nature and nurture laws may be reduced to the same laws and are thus not different sources after all; but this type of appeal really begs the question because, once again, we are back to one common set of laws.)

As we have seen, mechanistic–behavioristic theorists view the environment (nurture) as the source of the determinants of behavior. Human beings are seen as machines; they are energized to respond by stimulation that derives solely from the environment. Hence, humans are seen as essentially passive. They must await energizing stimulation that evokes behavior. Human behavior is seen as amorphous, as having no (initial) shape or form. It is held that all human behavior is derived from a stimulus environment that is independent of human beings, who have no original form; their form is shaped completely by the environment, and, hence, processes or variables not involved with such environmental stimulation really do not contribute at all to the shaping of behavior. Thus, heredity (nature) is never systematically incorporated into these theorists' ideas, and the environment is considered the material and efficient source of the shaping of human behavior.

In mechanistic, nature theories (e.g., Freedman, 1979; Plomin, 1986; Rowe, 1994) behavioral development is seen as deriving from a single source; but in this case, the source would be nature. Behavioral development would thus be the continuous unfolding of preformed genetic givens. Prior to the behavior genetic theories of Plomin (1986) and Rowe (1994) or the sociobiological theories of Dawkins (1976), Freedman (1979), and Rushton (1987, 1999), William Sheldon's (1940, 1942) constitutional psychology position was a view consistent with a mechanistic nature formulation, as was the work of some of the European animal behaviorists (ethologists such as Lorenz, 1965; see Chapter 12). Sheldon viewed body type as the essential determinant of personality or temperament. He maintained that body type—whether essentially fat, muscular, or thin—is primarily genetically determined; hence, he views personality as essentially derived from a single source—genetic inheritance. Lorenz (1965) may also be seen as a mechanistic-nature theorist. As is discussed in greater detail in Chapter 12, Lorenz believed that in some animals there existed behavior patterns called instincts, entities whose structures were inherited. Such instincts, therefore, were totally unavailable to any environmental influence. The validity of ideas such as those of Sheldon and specifically of Lorenz is evaluated in subsequent chapters.

The present point is that mechanistic theorists typically emphasize either a nature or nurture viewpoint. Although some (if not most) nurture, mechanist theorists do explicitly admit, for example, that nature may provide an important contributory source of human functioning (e.g., see Bijou & Baer, 1961), this admission never seems to lead to any systematic consideration of the role of this other source in the development of behavior. Because changes in behavior are held to be continuous and additive instead of multiplicative, only one source of behavior (nature or nurture) is systematically taken into account. The combination of influences from nature and nurture occurs, however, as one of the predominant points of view within the organismic philosophy of science.

Although all organismic–epigenetic positions have the basic characteristics listed earlier, I have noted that the precise basis of the determinants of epigenesis is itself a controversial issue among organismic thinkers. What determines when and how the constituent parts comprising the whole organism interact to produce qualitative discontinuity? The basic issue involved in this question is the nature–nurture problem, and relates to the concept of interaction discussed earlier. The question becomes simply, "Does the source of epigenesis lie in nature, nurture, or a combination of the two?" On the one hand, there are those thinkers who maintain that epigenesis is predetermined through genetic inheritance (e.g., Erikson, 1959). Maturation, for instance, is held to play the key role in the order and timing of the qualitative emergences that define epigenesis (Erikson, 1959). In other words, development is seen as going through qualitative changes, and some epigenetic thinkers argue that these changes are completely determined by genes; the environment in which these genes exist is seen to play no role in producing the qualitative changes that characterize development (in this regard, such epigenetic thinkers are indistinguishable from the nature, mechanistic theorists such as Lorenz, 1965). Thus, these epigenetic changes are predetermined by invariant maturational factors, such as growth and tissue differentiation, which are held simply to unfold in a fixed sequence—a sequence that arises independent of any experiential context. As noted before, this predetermined–epigenetic viewpoint is well illustrated by the early views of Hamburger (1957). According to Gottlieb (1983) this version of epigenesis, as it is expressed in the early views of Hamburger (1957) and others, means that:

> The development of behavior in larvae, embryos, fetuses, and neonates can be explained entirely in terms of neuromotor and neurosensory maturation (i.e., in terms of proliferation, migration, differentiation, and growth of neurons and their axonal and dendritic processes). In this view, factors such as the use or exercise of muscles, sensory stimulation, mechanical agitation, environmental heat, gravity, and so on, play only a passive role in the development of the nervous system. Thus, according to predetermined epigenesis, the nervous system matures in an encapsulated fashion so that a sufficiently comprehensive account of the maturation of the nervous system will suffice for an explanation of embryonic and neonatal behavior, the key idea being that structural maturation determines function, and not vice versa. (p. 11)

As is demonstrated in Chapter 4, this nature–epigenetic viewpoint has rather severe conceptual limitations (akin to those involved in the type of view represented by Lorenz). In my view, the alternative conception of the source of epigenesis—*probabilistic epigenesis*—appropriately deals with the conceptual issues inherent in a consideration of human development. Moreover, this view represents, in opposition to both the mechanistic and the predetermined–epigenetic views, the notion that developmental changes are determined by a multiplicative interaction—or, better, a fusion, a complete, systemic integration—of two sources of development, nature and nurture. Since the probabilistic–epigenetic position views development as qualitatively discontinuous, and further views this discontinuity as arising from such a strong interaction, it is understandable that two different sources of development (hereditary and environmental sources) can be seen to provide the basis of the multiplicative interaction or fusion that defines and brings about the qualitative discontinuity.

T. C. Schneirla (1957), the eminent comparative psychologist, argued that no behavior is predetermined or preformed. The role of the environment must always be taken into account in trying to understand the qualitative changes that characterize epigenesis. Specifically, one must consider the experience of various stimulative events acting on the organism throughout the course of its life span. These stimulative events may occur in the environment outside the organism (exogenous stimulation) or in the environment within the organism's own body (endogenous stimulation). No matter where they occur, however, the influence of patterns of environmental stimulation upon the contribution that genes make toward behavior must always be considered.

Genes must exist in an environment. They do not just float in nothingness. Changes in the environment may help or hinder the unfolding (better, the contribution) of the genes. In other words, the experiences that take place in the environment will play a role in what contribution genes can make. If X-rays invade the environment of the genes, if oxygen is lacking, or if poisonous chemicals enter this environment, the role of the genes in contributing to behavior will certainly be different from their role if such environmental stimulative events did not occur. In addition to toxic or noxious influences, the internal and external environments provide essential signals for gene expression during the course of normal development (Gottlieb, 1991, 1992, 1997).

To illustrate the interaction of genes and external environment (i.e., the environment outside the organism), it is useful to consider the results of experiments testing how exposure to enriched, as opposed to impoverished, environments alters the most basic chemical constituent of genes: DNA. Uphouse and Bonner (1975) assessed the transcription of RNA from DNA in the brains or livers of rats exposed to:

1. High environmental enrichment (i.e., living in a cage with eleven other rats and having "toys" and mazes available for exploration).
2. Low environmental enrichment (i.e., living in a cage with one other rat but no exploration materials).
3. Isolation (i.e., living in a cage alone and with no exploration materials).

The RNA from the brains of the environmentally enriched rats showed a level of transcription of DNA significantly greater than that of the other groups. No significant differences were found with liver RNA.

Grouse et al. (1978) also found significant differences between the brain RNA of rats reared in environmentally rich versus environmentally impoverished contexts. In addition, Grouse, Schrier, and Nelson (1979) found that the total complexity of brain RNA was greater for normally sighted kittens than for kittens who had both eyelids sutured at birth. However, the RNAs from the nonvisual cortices and from subcortical structures were not different for the two groups. Grouse, Schrier, and Nelson (1979) concluded that the normal development of the visual cortex, which is dependent on visual experience, involves a greater amount of genetic expression than occurs in the absence of visual experience. Given such findings about the contextual modifiability of genetic material, it is possible to assert that genes are appropriate targets of environmental influence.

Moreover, one cannot say with total certainty what type of environmental stimulative influences will always occur or whether the environment will interact with genes to help or hinder development. Rather, one may say only that certain types of environmental influences will *probably* occur (as they do with the average organism of a certain species) and/or that a given emergence will *probably* take place if the gene–experience interaction proceeds as it usually does.

Thus, in order for development to proceed normally (i.e., in the appropriate sequence typical for the species), environmental stimulative events must operate on (interact with) the maturing organism at specific times in the organism's development. Since epigenesis is determined by both hereditary (genetic) and experiential sources, experience must interact with hereditary-linked processes (e.g., maturation) at certain times in the organism's development in order for specific emergences to occur. If the emergence of a particular behavioral development is determined by a maturation–experience interaction, and if for a particular species this interaction usually occurs at a certain time in the life span (e.g., at about six months of age), then if the particular experience involved in this interaction occurs either earlier or later for a given member of the species, there will be a change in the emergent behavioral capacity. Thus, the species-typical timing of maturational–experiential interactions is essential in order for the emergences that characterize development to occur normatively.

However, the timing of these interactions is not invariant. One can never expect with complete certainty that these interactions will occur at their typical times for all members of a species. Some individuals in a given species may undergo these interactions earlier than others, while others may undergo them at a later-than-average time. For instance, in humans, adolescents differ in the timing of their pubertal maturation, with some youth attaining a particular point in their maturation (e.g., menarche) earlier than their age-mates, and other youth reaching this point later than average (Brooks-Gunn & Petersen, 1983). These differences may or may not lead to significantly different, or substantially altered, characteristics in the resulting behavioral capacity. For instance, early maturing boys enjoy greater peer popularity than do late maturing boys, whereas the reverse set of associations occurs during early- and mid-adolescence for early- and late-maturing girls (Brooks-Gunn & Petersen, 1983; Petersen, 1987, 1988).

The point is that although emergent behavioral developments find their source in the interaction between maturation and experience, one cannot expect the timing or functional significance of these interactions always to be the same for all individuals in a species. As illustrated by early- and late-maturing adolescents, alterations in the timing of these interactions, if extreme enough, could lead to changes in the behavioral characteristics that develop as a consequence of the interactions. Thus, one can say that certain emergences will probably occur, given fairly typical timing of maturation–experience interactions. Hence, the probabilis-tic–epigenetic position recognizes that:

1. Both experience and maturation are invariably involved in determining the qualitative changes that characterize development.
2. The timing of the interactions between maturation and experience is a factor of critical importance in the determination of behavioral development.
3. Since these interactions cannot be expected to occur at exactly the same time for every organism within a given species, one can only say with a given level of confidence that certain emergences will probably occur.

The probabilistic formulation of epigenesis should appear more complicated than its predeterministic counterpart because it is! Development is an exceedingly complex phenomenon and any accurate conceptualization of it would have to take this complexity into account. Thus, Schneirla (1957), recognizing both the complexity of behavioral development and the failure of predetermined–developmental notions to acknowledge that complexity, illustrates the probabilistic–epigenetic viewpoint by stating:

> The critical problem of behavioral development should be stated as follows: (1) to study the organization of behavior in terms of its properties at each stage from the time of egg formation and fertilization through individual life history; (2) to work out the changing relationships of the organic mechanisms underlying behavior; (3) always in terms of the contributions of earlier stages in the developmental sequence; and (4) in consideration of the properties of the prevailing developmental context at each stage. (p. 80)

As I have indicated, I believe that this probabilistic–epigenetic viewpoint offers the most appropriate conceptualization of development. Indeed, as is discussed in later chapters, this perspective provides the basis of developmental systems notions of human development (e.g., Ford & Lerner, 1992; Gottlieb, 1991, 1992, 1997; Gottlieb, Wahlsten, & Lickliter, 1998).

Conclusions

The mechanistic model stresses a passive organism in an active world; it emphasizes reductionism, continuity of laws governing development, only quantitative behavioral change across life, potential multidirectionality of change, elementarism, and antecedent–consequent relations; and it eschews the idea of stages as qualitatively distinct periods of life. The organismic model stresses an active organism in a relatively passive world, and it emphasizes emergence; qualitative change in structure–function relations across life; unidirectional, teleological, goal-directed change; holism; and the appropriateness of the idea of stages as qualitatively distinct levels of organization.

Each of these two models has led to a set of theories—sets that we have noted that Reese and Overton (1970) termed a "family of theories." These families are of use in the study of all or part of the life span. For instance, the behavioristically oriented, functional–analysis approach of Bijou and Baer (1961; Bijou, 1976) exemplifies the translation of a nurture, mechanistic model into a theory of development. However, other family members include the social-learning theories of Miller and Dollard (1941), Davis (1944), and McCandless (1970). The theories of Werner (1948), Piaget (1950, 1968, 1970), Freud (1954), and Erikson (1959, 1963, 1968) exemplify the translation of the organismic model into developmental theories.

Both mechanistically and organismically derived orientations encounter problems when attempting to formulate a useful concept of development. Mechanistically derived conceptions cannot, as we have noted, deal directly with novelty or with qualitatively distinct levels of being. In the former case, novelty must be interpreted as reducible to common constituent elements; in the latter case,

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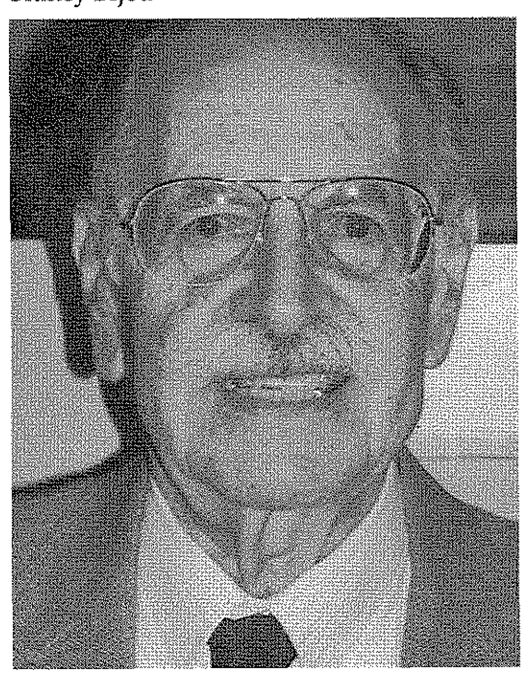
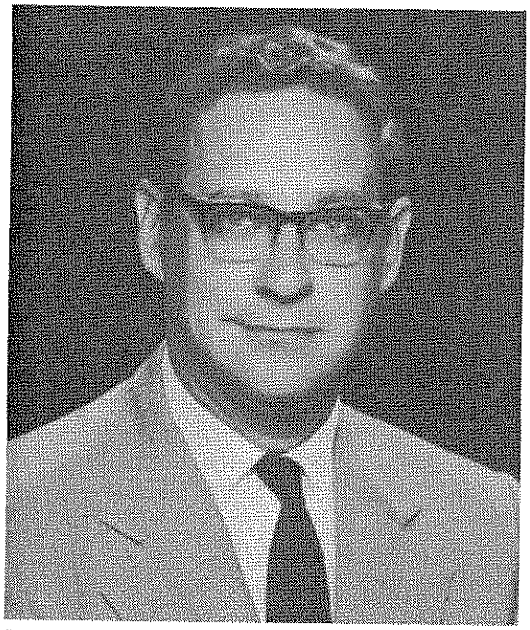




Donald Baer

the influence of cultural, sociological, and physical ecological variables, for instance, must also be reduced to common (e.g., behavioristic) principles in order for their influence to have a place (i.e., an efficient causal influence) in the continuity perspective of mechanism. Often, such reduction is quite forced and/or artificial and, as such, variables from distinct levels of analysis may end up being ignored. Moreover, despite the possibility of multidirectionality in development, we have seen that, in practice, mechanistically derived conceptions often adopt a position involving the continuous applicability of early experience to later life (e.g., Thorndike, 1905; Watson, 1928). In fact, in nature, mechanistic theories that stress the role of genes as the material and efficient causes of behavioral development (e.g. Plomin, 1986; Rowe, 1994; Rushton, 1987, 1999) *the very first experience—conception*—is the key experience in human life. It is at conception that the genotype is received, and it is held that this inheritance is the major source of structure and function across the life span. Moreover, we have noted that Zukav (1979) argued that the view of antecedent–consequent relations held by mechanists logically requires such a proscription against discontinuity or change in later life. Finally, there is mechanism's insistence on a passive model of the organism. Such a conception, especially when translated into a theory of human development, is unable to account for the evidence that organisms have characteristics that as much shape their world as their world shapes them (Bell, 1968; Bell & Harper, 1977; Lerner, 1982; Lerner & Busch-Rossnagel, 1981; Lewis & Rosenblum, 1974) *and* that these organismic characteristics cannot be adequately interpreted as merely derivative of the organism's conditioning history or experience-independent genetic inheritance (Gottlieb, 1992, 1997; Gottlieb et al., 1998; Schneirla, 1957; Tobach, 1981; Tobach & Schneirla, 1968).

For these reasons, I am oriented more to formulating an organismically derived concept of development than a mechanistically derived one. There are, however, major conceptual problems with organicism that diminish its usefulness for derivation of a concept of development. Among these are:

1. The need in organicism to "deal mainly with historic processes even while it consistently explains time away" (Pepper, 1942, p. 280).

2. The fact that "organicism takes time lightly or disparagingly" (Pepper, 1942, p. 281; and, as an instance, see Kaplan, 1983).

3. The teleological features of organicism, wherein for the "fragments" of an organic whole there is "inevitability of connections among fragments . . . [an] implication of wholeness contained in them" (Pepper, 1942, p. 292), "an internal drive toward the integrations which complete them" (Pepper, 1942, p. 291), and where, although the particular path to a goal is not predetermined it is, nevertheless, the case that "the goal was predetermined in the structure of the facts" (Pepper, 1942, p. 295).

These key features of "pure" organicism fail to deal with the point that the timing of interaction of causal developmental variables is probabilistic (Gollin, 1981; Gottlieb, 1970; 1976a, 1976b, 1991, 1992, 1997; Scarr, 1982; Scarr & McCartney, 1983; Schneirla, 1956, 1957; Tobach, 1981; Tobach & Schneirla, 1968). As a consequence, there is a lack of concern with the implication that such differences in time may mean that, while the process of development may remain invariant across history (e.g., while an orthogenetic progression in structure–function relations may exist), the ongoing features of developmental trajectories may show considerable interindividual variability, *and* there may be no universally inevitable end state for a developmental progression. In other words, there may be a probabilistic, rather than a predetermined, pattern to epigenetic change.

Moreover, as with mechanistically derived conceptions, the use of "pure" organismic conceptions of development is diminished in light of several sets of findings for which extant organismic views cannot devise adequate interpretations. That is, as opposed to mechanistic conceptions, which encountered difficulty as a consequence of failures to treat adequately organismic features of the person, organismic conceptions have encountered difficulty as a consequence of not being able to test effects on the person ultimately associated with variables derived from the context enveloping the person (e.g., Baltes et al., 1998, 1999; Elder, 1998; Shweder et al., 1998).

Attempts to use a biological model of growth, one based on an organismic conception of development (e.g., Cumming & Henry, 1961), to account for data sets pertinent to the adult and aged years have not been completely successful (Baltes, Reese, & Lipsitt, 1980; Baltes & Schaie, 1973). Viewed from the perspective of this organismic conception, the adult and aged years were necessarily seen as periods of decline (Cumming & Henry, 1961). However, all data sets pertinent to age changes (e.g., in regard to intellectual performance) during these periods were not consistent with such a unidirectional format of change. For example, as is noted in Chapter 1, increasingly greater between-people differences in within-person change were evident in such data sets (Baltes, 1983; Baltes & Schaie, 1974, 1976; Schaie, Labouvie, & Buech, 1973). Simply put, as people developed into the adult and aged years, differences between them increased.

On the basis of such data, Brim and Kagan (1980b, p. 13) concluded that "growth is more individualistic than was thought, and it is difficult to find general patterns." Factors associated with the historical time within which people were born (i.e., with membership in particular birth cohorts) and/or with events occurring at particular historical times appeared to account for more of these changes, particularly with respect to adult intellectual development, than did age-associated influences (Baltes et al., 1980). Data sets pertinent to the child (Baltes, Baltes, & Reinert, 1970) and the adolescent (Elder, 1974, 1980, 1998; Nesselroade & Baltes, 1974) that considered these birth-cohort and time-of-measurement effects also supported their saliency in developmental change. These findings led scientists to induce conceptualizations useful for understanding the role of these nonage-related variables in development (e.g., Baltes, Cornelius, & Nesselroade, 1977; Baltes et al., 1998, 1999; Brim & Ryff, 1980). These conceptualizations have been interpreted as being consistent with a developmental contextual view of development (Baltes, 1979b; Lerner, 1982, 1998b; Lerner, Hultsch, & Dixon, 1983).

Brim and Kagan (1980b) have summarized the character of this developmental–contextual view by noting that this

> conception of human development . . . differs from most Western contemporary thought on the subject. The view that emerges . . . is that humans have a capacity for change across the entire life span. It questions the traditional idea that the experiences of the early years, which have a demonstrated contemporaneous effect, necessarily constrain the characteristics of adolescence and adulthood . . . there are important growth changes across the life span from birth to death, many individuals retain a great capacity for change, and the consequences of the events of early childhood are continually transformed by later experiences, making the course of human development more open than many have believed. (p. 1)

Given the interest and importance attached to ideas linked to contextualism in the scholarship summarized by Brim and Kagan (1980), it is appropriate to evaluate the usefulness of this model for the derivation of an adequate concept of development. While contextualism does have many attractive conceptual features, similar to mechanism and organicism, it also has significant problems, Indeed, these problems are of sufficient scope to obviate the use of "pure" contextualism in deriving an adequate concept of development. However, contextual views may be combined with organismic ones. I shall argue that such a synthesis provides a quite useful basis for deriving a concept of development, one that eliminates many of the problems found in the two models taken separately.

THE CONTEXTUAL MODEL

According to Pepper (1942), the main metaphor of contextualism is neither the machine nor the whole organism. It is the historic event. "The real historic event, the event in its actuality, is when it is going on *now*, the dynamic dramatic active event" (Pepper, 1942, p. 232). In contextualism, every behavior and incident in the world is a historic event, and, thus, change and novelty are accepted as fundamental. A contextual model assumes (a) *constant change* of all levels of analysis;

and (b) *embeddedness* of each level with all others—changes in one level promote changes in all levels. The assumption of constant change denotes that there is no complete uniformity or constancy. Rather than change being a phenomenon to be explained, a perturbation in a stable system, change is a given (Overton, 1978). Thus, the task of the scientist is to describe, explain, and optimize the parameters and trajectories of *processes* (i.e., variables that reflect the *relations* among the levels of the system and that show time-related changes in their quantity and/or quality).

The second assumption of contextualism stresses the interrelation of all levels of analysis. Because phenomena are not seen as static but rather as change processes, and because any change process occurs within a similarly (i.e., constantly) changing world (of processes), any target change must be conceptualized in the context of the other changes within which it is embedded. Thus, change will constantly continue as a consequence of this embeddedness.

There is an organism in the contextual perspective, but it is conceived of as an "organism in relation" (Looft, 1973) or an "organism in transaction" (Dewey & Bentley, 1948; Lerner, 1991, 1996; Pervin, 1968; Sameroff, 1975, 1983) with its context. These relations are the focus of developmental analysis. They constitute the *basic process* of human development. As such, the timing of the interaction between organism and context is critical in contextualism. Indeed, as implied earlier, the fact that the timing of interaction plays a central role in contextualism serves to provide a key distinction between contextualism and organicism. As Pepper (1942) explains:

> Organicism takes time lightly or disparagingly; contextualism takes it seriously. . . . The root metaphor of organicism always does appear as a process, but it is the integration appearing in the process that the organicist works from and not the duration of the process. When the root metaphor reaches its ultimate refinement the organicist believes the temporal factor disappears. (p. 281)

Although emphasizing that the transaction or "dynamic interaction" (Lerner, 1978, 1979, 1980) between organism and context is what develops in development, it is important to note that, because of its admittance of multiple causative "agents" (formal, efficient, material, but not final), into developmental explanation, contextually derived perspectives do not exclude features associated with organismic–developmental theories. A major example is the use made by contextually oriented theorists (e.g., Lerner, & Busch-Rossnagel, 1981) of the orthogenetic principle (Werner, 1957) to describe the nature of change in the relations between individuals and their contexts; in fact, this principle has been used in even broader contextually related analyses—those pertinent to the relations among large-scale systems in the universe (Prigogine, 1978, 1980).

In short, a contextual perspective, when used to devise a concept of development (and, thus, when synthesized with features of organismic thinking), need not, should not, and typically *does* not (Lerner, 1984, 1985) avoid the use of universalistic, and, thus, constantly applicable, principles of development. Instead, the emphasis in such approaches is on the *relation* between the structural and functional characteristics of the organism and the features (e.g., the demands or presses) of the organism's context. Indeed, particular attention is paid to the mutual constraints and opportunities provided by both elements in the relation—organism and context (Lerner, 1984, 1991). Rather than seeing ideas such as "orthogenesis," which have traditionally been used primarily to depict intraorganism development (e.g., see Siegel, Bisanz, & Bisanz, 1983), in reference to the individual psychological level of analysis alone, the use of such ideas is made in reference to a "unit of analysis"—the "organism in transaction"—linking individual and context.

However, it is at this point that major problems arise with the use of "pure" contextualism as a paradigm from which to derive a concept of development. Contextualism is at its core (Overton, 1984) a dispersive paradigm. That is, there is no necessary connection or relation among the parts of the whole, either within or across time. Relations at one point in time (e.g., among thoughts, feelings, personality, and behavior) may or may not exist at another point in time. In pure contextualism, there is simply no prediction possible from one point in life (or history) to the next. In other words, a purely contextual approach sees the components of life as completely dispersive (Pepper, 1942)—as lacking any necessary across-time organization, systemic connection, or successive patterning. Pepper (1942) believed that it was the dispersive character of contextualism that was the key idea making it a world view distinct from the organismic one, a world view in turn marked, according to Pepper (1942), by integration. As I argued in Chapter 1, if the term development is to have meaning beyond that of mere change, it must imply, at the very least, systematic and successive changes in the organization of an organism or, more generally, a system. Thus, a world view that stressed only the dispersive, chaotic, and disorganized character of life would not readily lend itself to the derivation of a theory of development.

But, although contextualism may not suffice in and of itself as a model from which an adequate concept of development may be derived, there is a way to combine features of this model with organicism—with which we have seen that contextualism is closely aligned (Pepper, 1942)—to forge such a concept. As I suggested earlier, this "marriage" is possible by reference to the ideas associated with the probabilistic–epigenetic view of organicism.

Contextualism and Probabilistic Epigenesis

A major point of contrast between organicism and contextualism arises because the contextual perspective excludes any notion of final cause (e.g., see Nagel, 1957; Pepper, 1942), and, thus, leads to a belief in the potential plasticity of the organism across life. However, this view of plasticity is one derived from the contextual concept of dispersiveness, and, thus, is a notion that involves, in effect, limitless, unconstrained, and unpredictable plasticity. Such a notion is clearly counterfactual (Lerner, 1984).

Accordingly, whereas the "pure" contextual view of plasticity is not empirically or logically useful, when teleology is rejected and/or a state of tension (or a "contradiction"; Tobach, 1981) is postulated between influences that promote multidirectional changes and influences that promote integration, a developmental contextual conception is reached. This view emphasizes not the intrinsically preformed or inevitable timetables and outcomes of development, but rather that the influence of the changing context on development is to make the trajectory of development less certain with respect to the applicability of norms to the individual (Gottlieb, 1970). Thus, developmental contextual conceptions emphasize the probabilistic character of development and in so doing admit of more plasticity in development than do predetermined–epigenetic conceptions.

In other words, the developmental contextual view of human development reflects the ideas in the position labeled "probabilistic epigenetic organismic" by Gottlieb (1970), and developed by Gottlieb (1976a, 1976b), and earlier by Schneirla (1956, 1957) and Tobach and Schneirla (1968). Overton (1984) termed this conception *organismic–contextual* and, in turn, Gottlieb (1991, 1992, 1997; Gottlieb et al., 1998) described this position as a developmental psychobiological systems view. However it is labeled, "probabilistic epigenesis" designates (Gottlieb, 1970):

> The view that the behavioral development of individuals within a species does not follow an invariant or inevitable course, and, more specifically, that the sequence or outcome of individual behavioral development is probable (with respect to norms) rather than certain. (p. 123)

Moreover, Gottlieb (1970) explains that this probable, and not certain, character of individual development arises because:

> Probabilistic epigenesis necessitates a bidirectional structure–function hypothesis. The conventional version of the structure–function hypothesis is unidirectional in the sense that structure is supposed to determine function in an essentially nonreciprocal relationship. The unidirectionality of the structure– function relationship is one of the main assumptions of predetermined epigenesis. The bidirectional version of the structure–function relationship is a logical consequence of the view that the course and outcome of behavioral epigenesis is probabilistic: it entails the assumption of reciprocal effects in the relationship between structure and function whereby function (exposure to stimulation and/or movement of musculoskeletal activity) can significantly modify the development of the peripheral and central structures that are involved in these events. (p. 123)

In essence, as compared to predetermined epigenesis, where the key assumption (Gottlieb, 1983)

> holds that there is a unidirectional relationship between structure and function whereby structural maturation determines function (structural maturation → function) but not the reverse, probabilistic epigenesis assumes a bidirectional or reciprocal relationship between structural maturation and function whereby structural maturation determines function and function alters structural maturation (structural maturation ←→ function). (p. 12)

Most important for the formulation of a useful concept of development, the changes depicted in this probabilistic–epigenetic formulation of development are not completely dispersive. As does Overton (1984), I believe that when features of organicism—for instance, its regulative ideas about integrative change across ontogeny (e.g., as illustrated through the concept of orthogenesis; Siegel, Bisanz, & Bisanz, 1983; Wapner & Demick, 1998; Werner, 1957)—are synthesized with the probabilistic nature of contextual change, a useful *development contextual* conception is created, one that reflects the ideas described in Chapter 1 as linked to developmental systems theory.

Developmental Contextualism and the Issue of Dispersion

As noted, Pepper (1942) emphasizes that the dispersive nature of contextualism is the feature that is the key to its being a world view distinct from organicism. He argues that:

> The historic event which is the root metaphor of contextualism is a nearer approximation to the refined root metaphor of organicism than any common-sense term. This is so true that it is tempting to regard these two theories as species of the same theory, one being dispersive and the other integrative. It has occasionally been said that pragmatism is simply idealism with the absolute left out, which in our terms would be to say that contextualism is simply dispersive organicism. But, the insistence on integration which is characteristic of organicism makes so great a difference that it is wiser to consider them as two theories. (p. 280)

In being completely dispersive, a "pure" contextualism would not be suitable for use as a philosophical model from which to derive a concept of development. However, as I have explained, a "pure" organicism would also be limited as a paradigm from which to derive a useful concept of development (e.g., because of teleology and, thus, the insistence on an inevitable unidirectional end course to development).

Mechanism cannot be used as an alternative to either of these two paradigms because there is really no concept of developmental change, qualitative discontinuity, or even of newness or novelty that can be derived from this paradigm. Thus, either some new paradigm must be adopted or, as Overton (1984) suggested, it may be possible and *empirically useful*—despite Pepper's (1942) and others' (e.g., Kendler, 1986) protestations—to merge ideas from contextualism and organicism. Overton (1984) termed this merger *contextual organicism*. My own preference is for the term suggestedby Gottlieb (1970): probabilistic epigenesis. The term developmental contextualism may be used *if* sight is not lost of the fact that one is still referring to an organismic, epigenetic process. That is, it is not just that the context produces alterations in development. Instead, since the context is influenced as well as constrained by the organism's characteristics, we must keep in mind the need to define development in terms of organism—context reciprocal, or dynamic–interactional (Lerner, 1978, 1979, 1982, 1984) relations (Brandtstädter, 1998, 1999; Brandtstädter & Lerner, 1999; Ford & Lerner, 1992; Lerner & Walls, 1999). Indevelopmental contextualism or, more broadly, in developmental systems theories, the concept of development is really one of probabilistic epigenesis, of a synthesis between organismic processes and changes and contextual ones (e.g., Gottlieb et al., 1998; Sameroff, 1983; Thelen & Smith, 1998). Let us consider more fully the nature and implications of this concept of development.

THE CONCEPT OF DEVELOPMENT IN DEVELOPMENTAL CONTEXTUALISM

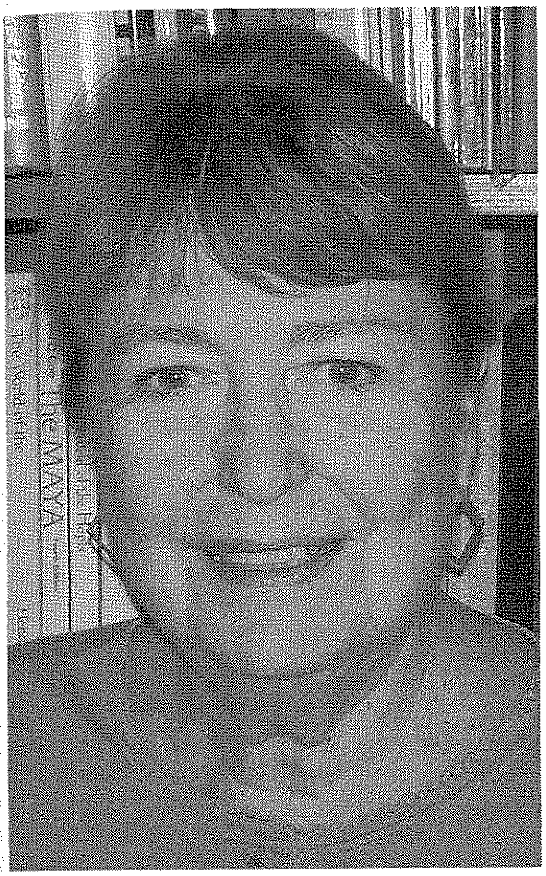
Gollin (1981) explained that probabilistic developmental change is not dispersive because the living system—the organism—has organization and internal coherence, and these features constrain the potentials of the *developmental context* to affect the system. Gollin (1981) says:

> The determination of the successive qualities of living systems, given the web of relationships involved, is probabilistic. This is so because the number of factors operating conjointly in living systems is very great. Additionally, each factor and subsystem is capable of a greater or lesser degree of variability. Hence, the influence subsystems have upon each other, and upon the system as a whole, varies as a function of the varying states of the several concurrently operating subsystems. Thus, the very nature of living systems, both individual and collective, and of environments, assure the presumptive character of organic change. Living systems are organized systems with internal coherence. The properties of the parts are essentially dependent on relations between the parts and the whole (Waddington, 1957). The quality of the organization provides opportunities for change as well as constraints upon the extent and direction of change. Thus, while the determination of change is probabilistic, it is not chaotic. (p. 232)

Gollin's position illustrates that one needs to understand that development occurs in a multilevel context, and that the nature of the changes in this context leads to the probabilistic character of development. However, one also needs to appreciate that the organism shapes the context as much as the context shapes the organism (Lerner & Busch-Rossnagel, 1981; Lerner & Walls, 1999).

Tobach (1981), Scarr (1982), and Scarr and McCartney (1983) made similar points. For example, Tobach (1981) indicated that:

> Three processes (contradictions) intercept in time to bring about qualitative changes in the individual (development, which includes growth and maturation): (a) the inner contradiction of the organism; (b) the inner contradiction of the environment; and (c)



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the outer contradiction between the organism and the environment. Some of the inner contradictions would be the metabolic cycle, and neurohormonal cycles; these have characteristics of negative and positive feedback that bring about continuous change with more or less stability in the organism. The environment expresses its own contradictions in diurnal and seasonal variations, faunal and floral interrelations, and so on. Given different lighting conditions (environmental contradictions), the effects on the hormonal function (intraorganismic contradictions) bring about changes in the organism's activity that bring it into changing relationships with the abiota or biota, and particularly with conspecifics (contradiction between organism and environment). The intersect of these three processes (contradictions) brings about developmental change in the organism. The organism may act on the environment (the social aspect), resulting in copulation, bringing about a new developmental stage. (pp. 60–61)

In turn, Scarr (1982) noted:

> Two big questions have occupied developmental theorists from antiquity to the present day . . . First, is the course of human development directed primarily by structures in the environment that are external to the person or is development guided principally by the genetic program within? Second, is development primarily continuous or discontinuous? (p. 852)

Answering the first question bears on the idea of probabilistic epigenesis; answering the second relates to the concept of plasticity. In regard to the first issue, Scarr (1982) explained:

> Answers to the first question have shifted in recent years from the . . . empiricist position to the . . . nativist view. Neonativist arguments, however, do not assume the extreme preformism of the early century. Development does not merely emerge from the precoded information in the genes. Rather, development is the probabilistic result of indeterminate combinations of genes and environments. Development is genetically guided, but variable and probabilistic because influential events in the life of every person can be neither predicted nor explained by general laws. Development, in this view, is guided primarily by the genetic program through its multilevel transactions with environments that range from cellular to social. The genetic program for the human species has both its overwhelming commonalties and its individual variability because each of us is both human and uniquely human. (pp. 852–853)

In regard to the second question, Scarr (1982) suggested that as a consequence of an organism's biological contributions and the probabilistic transactions this biology has with its multilevel context, neither complete consistency nor complete change characterizes the human condition. Instead:

> Human beings are made neither of glass that breaks in the slightest ill wind nor of steel that stands defiantly in the face of devastating hurricanes. Rather, in this view, humans are made of the newer plastic—they bend with environmental pressures, resume their shapes when the pressures are relieved, and are unlikely to be permanently misshapen by transient experiences. When bad environments are improved, people's adaptations improve. Human beings are resilient and responsive to the advantages their environments provide. Even adults are capable of improved adaptations through learning, although any individual's improvement depends on that person's responsiveness to learning opportunities. (p. 53)

In other words (Scarr & McCartney, 1983), there exists:

> A probabilistic connection between a person and the environment. It is more likely that people with certain genotypes will receive certain kinds of

> parenting, evoke certain responses from others, and select certain aspects from the available environments; but nothing is rigidly determined. The idea of genetic differences, on the other hand, has seemed to imply to many that the person's developmental fate was preordained without regard to experience. This is absurd. By involving the idea of genotype → environment effects, we hope to emphasize a probabilistic connection between genotypes and their environments. (p. 428)

Similarly, Gollin (1981) noted that:

> The relationships between organisms and environments are not interactionist, as interaction implies that organism and environment are separate entities that come together at an interface. Organism and environment constitute a single life process. . . . For analytic convenience, we may treat various aspects of a living system and various external environmental and biological features as independently definable properties. Analytical excursions are an essential aspect of scientific inquiry, but they are hazardous if they are primarily reductive. An account of the *collective behavior* of the parts as an organized entity is a necessary complement to a reductive analytic program, and serves to restore the information content lost in the course of the reductive excursion. . . . In any event, the relationships that contain the sources of change are those between organized systems and environments, not between heredity and environment. (pp. 231–232)

In a related vein, Tobach (1981) noted:

> Gene function is expressed in enzymes and proteins that are fundamental and ubiquitous to all aspects of molecular function and derivatively in physiological integration. However, the preeminence of societal factors in human development in determining the significance of these biochemical processes is also never lost. If the child is discovered to have an enzyme deficiency that is corrected through dietary supplementation, the outcome will depend on whether the child is in a society in which such knowledge is not available, or if the knowledge is available, whether the treatment is available to the individual child. Extremes in chromosomal structures and function such as trisomy-21, despite their demonstrated molecular base, are also variably vulnerable to societal processes. (p. 50)

A final point about the developmental contextual/probabilistic–epigenetic view needs to be highlighted. Although both contextual and mechanistic–behavioral perspectives make use of the context enveloping an organism in attempts to explain development, it is clear that they do so in *distinctly* different ways. Contextually oriented theorists do not adopt a reflexively reductionistic approach to conceptualizing the impact of the context. Instead, because of a focus on organism–context transactions, and thus a commitment to using an interlevel, or relational, unit of analysis (Lerner, Skinner, & Sorell, 1980), the context may be conceptualized as being composed of multiple, qualitatively different levels (e.g., the inner–biological, the individual–psychological, the outer–physical, and the sociocultural) (Riegel, 1975, 1976a, 1976b).

Moreover, although both the mechanistic and the developmental contextual perspectives hold that changes in the context become part of the organism's intraindividually changing constitution, the concept of "organism" found in the two perspectives is also quite distinct. In developmental contextualism, the organism is not merely the host of the elements of a simplistic environment. Instead the organism is itself a qualitatively distinct level within the multiple dynamically interacting levels forming the context of life. As such, the organism has a distinct influence on that multilevel context that is influencing the organism. As a consequence, the organism is, in short, not a host of S–R connections but an active contributor to its own development (Lerner, 1982; Lerner & Busch-Rossnagel, 1981).

How may such organism–context interactions occur? In other words, how may an organism make an active contribution to its own development? One answer to this question is found in the "goodness of fit" model of person–context relations (e.g., Lerner & Lerner, 1983, 1989; Lerner et al., 1995). Just as a person bring their characteristics of physical, emotional, and behavioral individuality to a particular social setting, there are demands placed on the person by virtue of the social and physical components of the setting. These demands may take the form of:

1. Attitudes, values, or stereotypes held by others regarding the person's attributes.
2. The attributes (usually behavioral) of others with whom the person must coordinate, or fit, for adaptive interactions to exist.
3. The physical characteristics of a setting (e.g., the presence or absence of access ramps for the handicapped) that require the person to possess certain attributes (again, usually behavioral) for the occurrence of efficient interaction.

The person's characteristics of individuality, in differentially meeting these demands, provide a basis for the feedback he or she gets from the socializing environment. For example, considering the second type of contextual demands that exist—those that arise as a consequence of the behavioral characteristics of others in the setting—problems of fit might occur when a child who is highly irregular in his biological functions (e.g., eating, sleep–wake cycles, and toileting behaviors) interacts in a family setting composed of highly regular and behaviorally scheduled parents and siblings.

Lerner and Lerner (1983, 1989) and Thomas and Chess (1977; Chess & Thomas, 1984, 1999) believed that adaptive psychological and social functioning do not derive directly from either the nature of a person's characteristics of individuality per se or the nature of the demands of the contexts within which the person functions. Rather, if a person's characteristics of individuality match (or "fit") the demands of a particular setting, adaptive outcome in that setting will accrue. Those people whose characteristics match most of the settings within which they exist should receive supportive or positive feedback from the contexts and should show evidence of the most adaptive behavioral development. In turn, of course, mismatched people, whose characteristics are incongruent with one or most settings, should show alternative developmental outcomes.

In sum, the present point is that to probabilistic–epigenetic theorists, behavioral development becomes, at least in part, a matter of self-activated generation. These theorists view development as arising essentially from the multiplicative interaction or, better, the fusion of two qualitatively different sources—heredity and environment. Hence, it is a logical next step to focus on the meeting place of those factors lying primarily within the organism (hereditary) and those lying primarily outside (environmental). This meeting place is, of course, the organism itself. By focusing on the contributions that the organism's own characteristics (e.g., its type of behavioral style and its physical appearance) make toward its own further development, developmental–contextual theorists are essentially studying the continual accumulations of the interacting contributions of nature and nurture. This focus brings about a concern with what roles various aspects of the organism play in shaping the individual's own behavior. A fuller explication of this aspect of the probabilistic–epigenetic, or developmental–contextual, viewpoint is made in Chapter 8.

Developmental Contextualism as a "Compromise" Conception

We have discussed the notion that developmental contextualism constitutes an integration, or "compromise" position derived from several different philosophical models or world views. For instance, we have noted that Overton (1984) suggested that organicism may be integrated with either contextualism or mechanism in order to formulate a synthetic position which capitalizes on the useful features of the mechanistic and the organismic positions. While I have argued that mechanism in and of itself is not useful for forging a true developmental theory, following Overton (1984), I suggest that within developmental contextualism there exists at least two ways of synthesizing some of the potentially useful features of mechanism and, of course, organicism.

The levels-of-organization hypothesis. The first of these means of synthesis has been implied in much of what we have previously discussed. It is termed the *levels-of-organization hypothesis* and is illustrated by the work of Schneirla (1957). The compromise notes that there are different levels of organic and/or phenomenal organization and that the laws of the lower levels (e.g., physics and chemistry) are implied in the laws of the higher (e.g., the psychological) level. Yet, the laws of the higher level cannot be reduced to or predicted from the laws of the lower level. This is true because such reduction will not lead to an understanding of the emergent quality of the higher level. Clearly, this assertion has been presented as a basic part of the organismic–epigenetic viewpoint. The water example provided earlier in this chapter is an illustration of this compromise. Another illustration is that although certain neural, hormonal, and muscular processes certainly underlie (are implied in) a person's being in love, reduction of love to these lower levels—or to the still-lower levels of chemistry and physics—is unlikely to result in an understanding of this phenomenon.

An example of the application of the levels-of-organization compromise may be seen by reference to some classic findings in the literature on children's problem-solving behavior. Kendler and Kendler (1962) devised a way to study problem-solving behavior in various species of organisms (e.g., rats and humans), as well as in humans of various ages (e.g., nursery-school children and college students). In the procedure they devised, children are presented first with two large squares and two small squares. One of each type of square is painted black and one of each type is painted white. Thus, there are a large black and a large white square, and a small white and a small black square. The children's task is to learn to respond either to the color dimension (thus, ignoring the size) or to the size dimension (thus, ignoring the color). For example, a child may be presented with a large black and a small white square on one trial and then perhaps a large white square and a small black square on another. Now, if size is the aspect of the stimuli that should be responded to and, further, if a response toward the bigger of the two squares will always lead to a reward, the child should choose the large stimulus in each trial, no matter what the color. In other words, the child first learns that size is the relevant aspect of the stimuli; therefore, the subject learns to respond to the difference in size and to ignore (not respond to) differences in color of the squares.

Rats, nursery-school children, and college students can all learn this first problem-solving task. The interesting thing about this type of problem solving is what happens when the rules about the relevant aspect of the stimuli are changed. In the first problem-solving task, size was the relevant dimension (the big squares were rewarded and the small squares were not). Without directly cueing the children that this rule has changed, it is still possible to keep the size of the stimuli as the relevant dimension (and the color as the nonrelevant dimension), but to make choice of the *small* squares the response that will be rewarded. Thus, the same dimension of the stimuli (size) is still relevant, but there has been a reversal as to which *aspect* of size (from large to small) will lead to a reward. Kendler and Kendler called this type of alteration a *reversal shift;* the same stimulus dimension is still related to reward, but which of the two stimuli within this same dimension is positive and which is negative is reversed.

A second type of shift may occur, however, in the second problem-solving task. Instead of size being the reward-relevant dimension, color can be. Now, response to the black squares (regardless of their size) will lead to a reward, and response to the white squares (regardless of their size) will not. This type of change involves a shift to the other dimension of the stimuli and is not within the same dimension. Hence, the Kendlers termed this second type of possible change a *nonreversal shift.* Figure 3.3 illustrates the reversal and the nonreversal shifts. In all cases, the stimuli toward which a response will lead to a reward are marked "+," while the stimuli toward which a response will not be rewarded are marked "−."

Kendler and Kendler (1962) reviewed the studies of reversal and nonreversal problem solving done with rats, nursery-school children, and college stu-

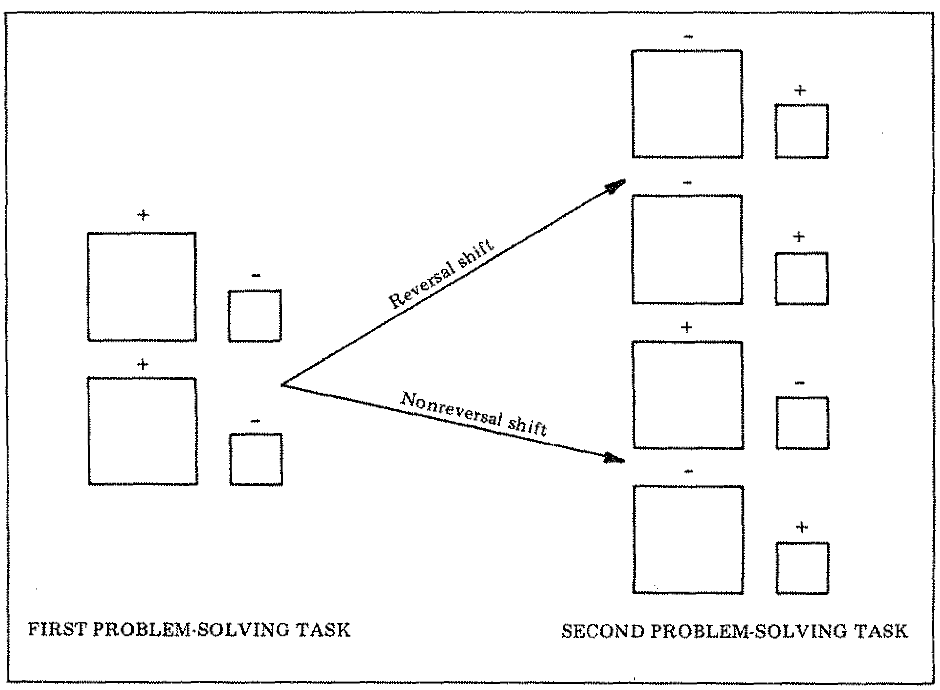

FIGURE. 3.3
Examples of a reversal and a nonreversal shift.
Source: H. H. Kendler and T. S. Kendler (1962). Vertical and horizontal processes in problem solving. *Psychological Review,* 69. Copyright © 1962 by the American Psychological Association. Reprinted by permission.

dents. After learning the first problem (e.g., after making 10 correct responses to the large-size stimuli), would it then be easier to learn a reversal shift or a nonreversal shift (again using the learning criterion of 10 consecutive correct responses)? The Kendlers' review indicated that rats learn a nonreversal shift more easily than a reversal shift. Moreover, so do most nursery-school children. As do rats, these human children reach the criterion for making a nonreversal shift faster than they reach the criterion for making a reversal shift. However, somewhat older children, as well as college students, find a reversal shift easier.

The Kendlers interpreted these age changes by suggesting that in development there emerges a new mental process in children such that they move from rat-like responses to (college) student-like responses; this new mental process, not present at earlier ages (e.g., efficient language processes), alters children's problem-solving behavior so that a reversal shift becomes easier than a nonreversal shift. Whereas children's problem-solving behavior at the nursery-school level can be accounted for by reference to processes apparently also identifiable in rats, their later behavior may be explained by the emergence of a new mental process.

Certainly, the processes present in the nursery-school children provided a developmental basis for the processes seen among the older children.

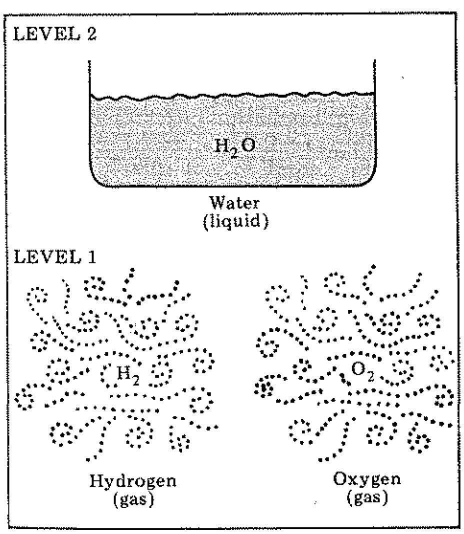

FIGURE 3.4
Levels-of-organization compromise between the mechanistic and the organismic positions.

That is, it would be unlikely to find older children who now functioned like college students but never functioned like younger children (or rats, too, in this case). Yet, these former processes are not sufficient to account for the behavior of the older children. The type of problem-solving behavior changes, and this alteration appears related to the emergence of a new mental function. Any attempt to reduce the laws of the later level to those of the earlier level will avoid dealing with the important emergent processes that apparently characterize the older age level. Thus, although other interpretations of these findings have been offered (see Esposito, 1975), the present point is that the work reported by the Kendlers (1962) illustrates the level-of-organization compromise. The laws of the lower level may be involved in those of the higher one, but because those of the higher involve emergent qualities, the former laws will not suffice to account for the phenomena of the higher level if any attempt at reduction is made.

The levels-of-organization compromise is presented diagrammatically in Figure 3.4. Here, we see that at Level 1 two gases, hydrogen and oxygen, are present; at Level 2, however, the two gases combine to produce a substance (water) that has a property (liquidness) that did not exist in either of the Level-1 elements in isolation. Although the presence of the lower level's phenomena is certainly implied in the phenomena of the higher level, the latter level still has phenomena (e.g., liquidness) that cannot be understood through reduction to those of the lower level.

The general-and-specific-laws compromise. The second compromise between the mechanistic and the organismic positions maintains that there are general and specific laws that govern development: Certain general laws apply to any and all levels of psychological functioning. Yet, each specific level of psychological development is also governed by specific laws. Such a compromise is often found in the work of organismic theorists (e.g., Heinz Werner and Jean Piaget) (see Chapters 5 and 15, respectively). Like other organismic developmental theorists who stress the concepts of stage in their ideas, Piaget viewed development as involving two processes: First, a general, continuous process (the "equilibration" process) that is present at all levels, and, in fact, is used to account for the continual development of children through the various stages of cognitive development; and second, specific qualitatively distinct phenomena (e.g., preoperational thinking), which actually serve as the definitional basis of the various stages of development at which they occur.

Sigmund Freud, also an organismic theorist, similarly made use of a compromise between general and specific laws of development. Freud viewed sexual functioning as passing through various "psychosexual stages of development" (1949). However, he saw this development as being energized by a finite amount of mental energy ("libido") present in every individual at birth. This mental energy passed through the body of a person in a prescribed sequence and became concentrated at particular locations of the body (e.g., the mouth during the "oral stage") at specific periods of the person's life. Although this same mental energy was seen as always being involved in emotional ("psychosexual") functioning at all times in a person's life—and as such represents a general law of development—the manner in which emotional functioning was expressed was dependent on exactly where the mental energy was centered. Thus, to Freud, psychosexual functioning involved the combined contribution of a continuously applicable mental energy and a specific area (or zone) of the body where this mental energy happened to be located at a certain time in development. This specific characteristic of psychosexual functioning determined the mode of expression of one's emotions. Hence, Freud's view of psychosexual development, which is discussed again in Chapter 15, is an example of how organismic developmentalists may utilize the general-and-specific-laws compromise in their theories.

The general-and-specific-laws compromise is represented in Figure 3.5. At both Level 1 and Level 2, we see that a general law, G, exists. However, at Level 1, there is also present a specific law, S_1, but at Level 2, there is present a different specific law, S_2.

If at each new developmental level of organization there is an emergence of new phenomena that cannot be reduced to lower organizational levels, how may the laws governing—or the variables involved in—these new phenomena be understood? Typical of other organismically oriented theorists, Schneirla (1957) maintained that to understand this emergence one must look at the specific contribution of that developmental level's genetic inheritance (nature) and its environment or experience (nurture). The sources of behavior must lie within these two domains, and one must look at how each level's nature and nurture dynamically interact to produce the qualitatively new phenomena that characterize it. This type of interactive view of the process of development has many uses, several of which will be focused on in succeeding chapters. Here, however, I should note that, as with organicism, mechanism, and contextualism, the developmental–contextual integration I propose also has problems and limitations. Let us consider some of the key ones.

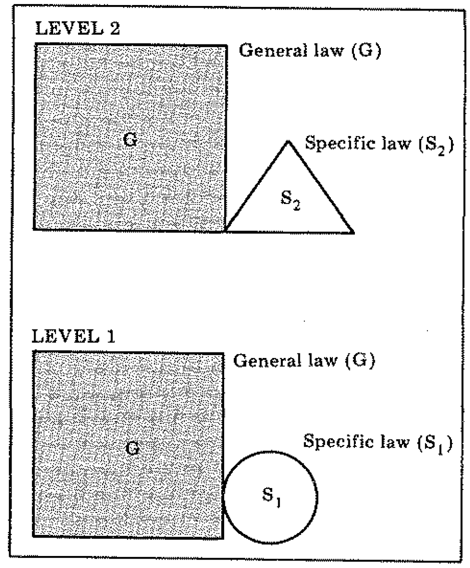

FIGURE 3.5
General-and-specific-laws compromise between the mechanistic and the organismic positions.

LIMITS AND PROBLEMS OF A DEVELOPMENTAL–CONTEXTUAL PERSPECTIVE

The concepts of organism, of context, and of the relations between the two found in a probabilistic-epigenetic, developmental–contextual perspective are, as a set, quite distinct from those associated with organismic and mechanistic conceptions. Such a developmental–contextual perspective leads to a multilevel concept of development, one in which the focus of inquiry is the dynamic organism–environment relation or transaction. Further, such a developmental contextual orientation places an emphasis on the potential for intraindividual change in structure and function—for plasticity across the life span. Yet, several conceptual and derivative methodological problems must be confronted in order:

1. To move such a developmental contextual orientation from merely being a "perspective" to being useful for the derivation of theory (Baltes, 1979b).

2. To usefully employ developmental contextualism as a framework within which to study dynamic individual–context relations.

First, substantively, we must recognize that despite the great amount of evidence that exists for human plasticity (Baltes et al., 1998, 1999; Gollin, 1981; Gottlieb, 1997; Lerner, 1984), we still cannot answer several fundamental questions about the contextual, dynamically interactive parameters of plasticity. Are different levels of analysis and/or different targets within levels differentially plastic? For example, it may be the case that selected features of our genotype (e.g., the number of chromosomes that we possess) cannot be altered (without, at least, severely damaging our organismic integrity) no matter what the nature of our organism–context relations may be. On the other hand, more molar, behavioral features of functioning may not be subject to such restrictions.

For instance, are there limits to the number of random digits a person can learn to recall or to the number of locations a person may recall? Current evidence indicates that such limits are quite variable, and that even among very old people—for example, those in their eighth or ninth decade of life—there are training techniques that can capitalize on their still-available (albeit diminished, relative to earlier age periods) "reserve" of plasticity in order to enhance performance on such tasks (e.g., see Baltes, 1987, 1997; Baltes et al., 1998, 1999).

In addition to not fully knowing the limits of plasticity that currently characterize levels of analysis, we do not know what further substantive and technological advances may imply for the future character of these limits. If we take the idea of probabilistic epigenesis seriously, and if we recognize that science and technology represent natural parts of the human ecology, then we cannot anticipate where future scientific advances may lead.

For example, the geneticist Brown (1981) noted that in the 1970s scientists could not *imagine* how a gene could ever be isolated. Yet, Nobel laureate Paul Berg (1981) indicated that by the 1980s such identification was quite routine, and that in just a few years the growth in the application of recombinant DNA methods had been truly explosive. For instance, he indicated that:

> Molecular cloning provides the means to solve the organization and detailed molecular structure of extended regions of chromosomes and eventually the entire genome, including man. Already, investigators have isolated a number of mammalian and human genes, and in some instances determined their chromosomal arrangement and even their detailed nucleotide sequence. (p. 302)

As Toulmin (1981) put the issue:

> And as for the possibilities open to future, more complex cultures, there too we must be prepared to speculate open-mindedly. There, perhaps, people generally will take pride in having overcome the "illusions" of material conservation and Euclidean space alike, and may come to talk about everyday material objects with the same conceptual sophistication we ourselves display toward such un-everyday things as electrons. (p. 261)

For instance, can microcomputers implanted in the brain enhance cognitive (e.g., memory) capacities? Might other microcomputers, implanted in the nervous and muscular systems return aged people to former levels of physical agility or, for paralyzed individuals, enable them to again use their limbs? At this writing, these technological advances exist in developmental form. Before this book is 10 years old, such technology will certainly be more common. Thus, current limits of plasticity are not necessarily future ones. These limits are themselves plastic and are likely to change in a direction that, for some of us, lies beyond our imagination.

But recognition that the limits of plasticity can change over time raises a developmental issue. The actualization of plasticity, of course, involves change, and change can only be identified over time. Numerous questions exist about the rates of change of plastic processes at the several levels of analysis that are integrated to provide the bases of behavior. First, it is clear that there is a "nonequivalent temporal metric" across the various levels of analysis (Lerner, Skinner, & Sorell, 1980) involved in person–context transactions. That is, all levels of the context change over time, but time may not have an identical meaning at all the levels.

One way to understand this is to note that the smallest meaningful division of time to detect change differs among levels. If time is one's X axis, with the Y axis reflecting levels of one's target process, then sensible X-axis divisions to detect infant neuromuscular changes may be as small as weeks. However, the smallest sensible division to detect changes in society brought about by new public policies regarding the availability of food for the poor may be a year. As such, the effects of such a policy change on infant growth might need to be assessed not by studying changes *within* a group if infants but, instead, by comparing differences *across* different infant birth cohorts.

For example, one could understand through such a comparison if, say, 36-week-old infants have greater neuromuscular maturity, as a group, one or two years after the policy than was the case for groups studied one or two years before the policy. In other words, because it may take a year or more to detect changes due to macro-level alterations, within-person changes (which may occur over weeks or months) may "fall between the cracks," that is, between the year-by-year (or larger) divisions of the X axis. Indeed, if an attempt is made to verify the existence of such macro (e.g., policy) influences, it may be that a long-term, perhaps intergenerational, perspective needs to be taken; or in a within-cohort analysis, it may be that only interindividual differences in intraindividual change, and not intraindividual change itself, can be assessed.

In addition, even within a given level, time may not have an equivalent meaning at different points in development. For example, on the level of the individual, a one-year separation between birthdays may seem a vast length of time to a five-year-old; to someone experiencing his or her thirty-ninth birthday, the one-year period until the fourtieth birthday may seem quite short; and to an 85-year-old, a one-year wait for some important event may, again, seem quite long.

Complicating this issue is that even though the effects of a biological intervention on society may take a long time to detect, there is not necessarily symmetry of influence. That is, "upper level" societal alteration and social change may quite visibly, and relatively rapidly affect "lower level" individual and biological processes. For example, changes in federal government funding programs for school lunch programs for poor children; welfare support to working, single mothers; or Medicare and Medicaid for the elderly can rapidly affect an individual's health, and cognitive and familial functioning variables (Lerner, Sparks, & McCubbin, 1999, 2000).

The issues of the nonequivalent temporal metric, and of the asymmetry of interlevel influences, can be seen to lead to other ones. First, given the rates of change of different levels, one needs to know how processes at different levels connect to one another: How do interlevel influences occur? One answer to this question may be to explore the use of a "goodness of fit" model of person–context relations (e.g., Eccles, 1991; Eccles & Midgley, 1989; Lerner & Lerner, 1983, 1999). Here, individual behavioral characteristics that are congruent with pertinent behavioral presses are studied for their import for adaptive person–immediate–social context (e.g., peer group) exchanges.

Of course, the goodness-of-fit model is not the only conception of person–context relations that may be derived from a developmental–contextual orientation. Indeed, an infinity of interlevel relations may perhaps occur, and there exists a potentially similarly large array of ways to model them. Scholars need to devote more thought and empirical energies to their investigation.

Methodology and Issues for Intervention

Interventions represent attempts to:

1. Ameliorate or prevent undesired or problematic features of individual and/or group behavior.
2. Enhance or optimize an individual's or a group's behavior or social situation in the direction of some desired or valued end (e.g., better health or improved self-concept).

A developmental–contextual view of person–context relations, and of plasticity, raises several issues pertinent to intervention. First, the issue of asymmetry of interlevel influences raises largely unaddressed concerns about efficiency and about cost–benefit ratios. For instance, with an intervention targeted at the cognitive–behavioral level (e.g., the modification of academic achievement) is it more efficient to institute a "bottom-up strategy" (e.g., intervening at the biological level), a "parallel-level strategy" (e.g., intervening by cognitive–behavioral means), or a "top-down" strategy (intervening by instituting or changing social programs)? Which strategy leads to the most benefits, relative to economic, social, and personal costs? We simply do not know the answers to these questions for many of the potential targets of intervention.

A decision about the level of analysis on which to focus one's intervention efforts is complicated by the fact that all levels of analysis are developing or changing over time. While this feature of the human condition permits both *concurrent* (same time or immediate) and *historical* (long-term or delayed) interventions, it again raises questions of efficiency and cost–benefit ratios. For example, when during the life span is it best to intervene to optimize a particular target process (and, of course, on what level is it best to focus one's efforts)? Are periods of developmental transition (e.g., puberty or retirement) or periods of *relatively* more stability (e.g., midlife; Lachman & James, 1997), better times to focus one's efforts? Moreover, do some intervention goals, for example the elimination of fetal alcohol syndrome, or FAS (Streissguth et al., 1980), require an intergenerational–developmental rather than an ontogenetic–developmental approach? In the case of FAS, for instance, might it be of more benefit to intervene with women who are at risk for excessive alcohol use during pregnancy—*before* they become pregnant? Again, for most potential targets, intervention issues such as these have remained relatively unaddressed.

A final relatively unaddressed issue relates to direct and indirect intervention effects and to planned and unplanned effects. If an individual's plasticity both derives from and contributes to the other levels of analysis within which he or she transacts, one must anticipate that actualizing the potential for plasticity at any one level of analysis will influence changes among other variables, both at that level and at others. From this perspective, one should always expect that any direct and/or intended effect of intervention will have indirect and often unintended consequences (Willems, 1973).

This recognition leads to two points. First, interventions should not be initiated without some conceptual or theoretical analysis of potential indirect and unintended consequences. One needs to consider the developmental system when planning an intervention. For instance, changing a spouse's assertiveness may be the direct intended effect of a cognitive–behavior therapist's efforts. However, the changed assertiveness might lead to a diminution of marital quality and, in addition, to a divorce. Such indirect effects might have been unintended by the therapist and undesired by either therapist or client. Thus, my view is that one must think quite seriously about the broader, contextual effects of one's intervention efforts. Clearly, a developmental–contextual perspective would be of use in this regard. It would sensitize one to the general possibility, and perhaps some specific instances, of the indirect effects of one's intervention efforts. Such reflection is useful in several ways, a major instance of which is that some undesirable indirect effects may be anticipated. If so, the issue of cost–benefit ratios can be addressed before intervention begins.

Of course, the fact that undesired effects may arise from intervention efforts raises the point that plasticity is a double-edged sword: A system open to enhancement is also open to deterioration. That is, plasticity permits interventions to be planned in order to improve the human condition, but indirect effects may also cause a deterioration in a target person's life condition and/or the condition of the context. This problem is also complicated by recognizing that as a consequence of people being transactionally related to their multilevel contexts, a failure to intervene (to alter the context of life) is *itself* an intervention; that is, it keeps the context on a trajectory from which it might have been shifted if one had acted. Thus, one must assess the cost–benefit ratio not only of one's actions but also of one's failure to act.

Conclusions

I have pointed to some of the key conceptual and methodological issues that remain to be resolved if a developmental–contextual perspective is to be successfully used not only to study individual–context relations but also to intervene to enhance such relations. Pessimism because of the presence of these problems is unwarranted. Every approach to human development has limitations, as I hope I have made clear in this chapter. Thus, the fact that there are problems to be resolved about developmental contextualism, or about developmental systems theories in general, does not single these views out from other developmental paradigms. Indeed, given that it was only in the 1970s that this view of contextualism came to the fore, the clarity with which the problems have been articulated, the methodological advances that have already been made (e.g., see Nesselroade, 1988; Nesselroade & Baltes, 1979; Nesselroade & Ghisletta, 2000; Nesselroade & von Eye, 1985; von Eye, 1990a, 1990b), and the several data sets that speak to the empirical use of this contextual perspective (e.g., Baltes et al., 1980, 1998, 1999; Brim & Kagan, 1980) are reasons for great optimism for the future.

Developmental contextualism has influenced and will continue to influence scientific activity. Indeed, all the models we have considered in this chapter have such an influence. Let us conclude this chapter, then, with a brief discussion of the implications of the models for scientific activity.

IMPLICATIONS OF PHILOSOPHICAL MODELS OF DEVELOPMENT FOR SCIENTIFIC ACTIVITY

Philosophical models are not capable of being evaluated in terms of whether they are correct (Overton, 1998; Reese & Overton, 1970). Nevertheless, they shape the theories that scientists use to interpret the facts they derive from their studies of the "real" world. Moreover, in shaping theories, world views shape the very questions scientists ask in their study of the real world. The questions that follow from different theories are likely to be quite different, and in turn, the data generated to answer these contrasting questions are unlikely to provide comparable answers.

For instance, a nurture, mechanistic theorist who derives a theory of human development may try to reduce behavior to learning principles common to people of all ages. Thus, he or she might seek to discover those environmental–behavioral reactions that remain identical from infancy through adolescence and adulthood. Alternatively, an organismically oriented theorist would attempt to find those phenomena that are unique to and representative of particular age periods. In turn, a developmental–contextualist theorist might look at the relation of an event to others at earlier times in the life cycle, as well as to current cultural, environmental, and long-term historical influences. The reciprocal nature of these interactions would also be considered.

The point is that scientific activity derived from alternative world views asks different questions about development. Consequently, scientists committed to alternative world views may collect data on different topics. One scientist is not necessarily functioning correctly and another incorrectly. The issue is not one of deciding which theory is best, or which leads to truth and which does not. Theories from different world views asks different questions because the very nature of reality is conceived of differently. Thus, what is a true depiction of reality for one world view may be irrelevant for another (e.g., see Kuhn, 1962).

One major implication of the nature of this philosophy–science relationship is that a criterion other than truth must be used to evaluate interpretations of development. Earlier in this chapter and in Chapter 1 as well, I forwarded "usefulness" as one such criterion (e.g., in regard to accounting for more variance in developmental data sets, leading to more novel discoveries, or integrating a broader range of phenomena pertinent to development than is the case with other positions), and explained that such dimensions of utility could be summarized by the concepts of precision, scope, and deployability. When theories have precision, scope, and deployability, they are useful for the description of developmental phenomena, for the explanation of development, and for devising ways to optimize human behavior and development.

Of course, such deployability is not the sole province of science. Using theory and research to enhance human life requires collaboration between scholars and the societal institutions and individuals their work is aimed at serving (Lerner et al., 1994; Lerner & Simon, 1998a, 1998b). Scholars cannot ethically deploy their theories and research to enhance human life without the agreement and collaboration of the community, broadly writ (Chibucos & Lerner, 1999; Fisher & Tyron, 1988, 1990; Lerner & Simon, 1998b). In addition, such application requires not only scholar–community collaboration but also the financial support of public and private funders (e.g., the federal government, and businesses or foundations, respectively). Deployability is a political issue as much as it is a scientific one and, as such, issues of policy and policy engagement become a central concern to scholars interested in the application of developmental science (Fisher & Lerner, 1994a, 1994b; Lerner, Fisher, & Weinberg, 2000a, 2000b).

In sum, since any theory might be used to pursue understanding of human development or to influence public policy, I have suggested that theories should be evaluated on the basis of their usefulness and indicated that a developmental–contextual perspective may be particularly useful in regard to description, explanation, and optimization. Of course, these uses depend on the meaning attached to the concepts of description, explanation, and optimization.

Theories differ in regard to the features of behavioral or mental life they deem important to describe. Nevertheless, there is consensus that description per se pertains to the depiction or representation of the phenomena of interest in a given theory. However, as is noted in Chapter 1, considerably less consensus exists in regard to the explanation of development. For instance, as noted earlier in this chapter, mechanistically oriented organismically oriented, and contextually oriented theorists differ in respect to whether cause–effect, formal, or configural information is regarded as essential for explanation. When theories differ in regard to how development is explained, they also vary in their ideas for what variables need to be engaged in interventions aimed at optimizing development.

In Chapter 5, we focus on the issues of description, explanation, and optimization as they pertain to the topic of continuity–discontinuity in development. Throughout the succeeding chapters, we return to the various ideas about description, explanation, and optimizations associated with different theories of human development. For instance, in Chapter 8, we discuss the features of developmental contextualism and its ideas about description, explanation, and optimization. As can be readily inferred from my presentation in this chapter, this discussion pertains to a great extent on a consideration of the nature–nurture controversy and on an indication of the specific stances taken by developmental contextualism in regard to this key issue of human development. As such, it is important to turn, in Chapter 4, to a discussion of this issue.