

A Review of Recent Developmental Theories

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Theorists of developmental psychology have been long caught in the traditional nativist-empiricist controversy. With the aim of exploring new directions in theory construction in the field of developmental psychology, this article reviewed developmental perspectives that have emerged during the past century, including organismic vs. mechanistic views, early vs. later experiences, and gain vs. loss. In addition, three recent theories—a triarchic theory of experience, the polyarchical theory, and a systems theory—were introduced and their utilities discussed. It was concluded that theorists are moving towards the integration of various internal and external systems of and dynamic patterns of changes to models and theories. Notions such as plasticity and organismic complexity were found to be characteristic to recent developmental theories.

Key words: theory construction, triarchic theory of experience, polyarchical theory, systems theory, plasticity, complexity

INTRODUCTION

Developmental psychology is a field of scientific inquiry that focuses on changes in biological, social, cognitive, and emotional behaviors of human beings. Its inquiry processes center around two major questions about development: (1) How do human beings change over time? and (2) What determinants generate these changes? The term *develop* means “1) to grow or cause something to grow gradually; to become or make something larger, more advanced or more organized, 2) to start or cause something to start to exist and then become greater” (Oxford Advanced Learner’s Dictionary, 1995, p.318). The word *develop* itself carries a positive connotation by nature. Accordingly, developmental psychologists have conventionally viewed development as involving progressive changes in children. However, the introduction of the notion of life-span development creates an opportunity for psychologists to reconceptualize development.

While traditional developmental psychology has focused on progressive changes in children such as physical growth, the increase of cognitive ability, and the attainment of certain behaviors,

life-span development also includes aspects of decline throughout life. Baltes (1987) summarizes a family of theoretical propositions characteristic of life-span developmental psychology; this family includes life-span development, multidirectionality, development as gain/loss, plasticity, historical embeddedness, contextualism, and a multidisciplinary approach. These propositions can be contrasted with conventional views about development, such as childhood as the focal point of development and development as a progressive change.

Using such perspectives, developmental theorists have formulated changes and determinants of changes. The goal of theory varies across disciplines. Three different goals which Parke, Ornstein, Rieser, and Zahn-Waxler (1994) identify are description, prediction-control, and explanation. According to Parke et al., the ecological theory of development proposed by Bronfenbrenner is descriptive because it depicts social settings and contexts related to children’s development. Other approaches aim to increase the predictability of behaviors. For instance, Skinner’s approach is primarily on the prediction of behavioral changes. Furthermore, the aim of the grand theories of Freud and Piaget and of Bowlby’s infant social development theory is

explanation.

The purpose of this paper is to provide an overview of developmental perspectives and theories in the past century and to discuss issues related to theory development such as change and complexity. First, in order to closely examine the perspectives, two views from extreme ends of each perspective will be described and current positions on each perspective will be discussed. Second, recent developmental theories will be reviewed to examine components of these theories. Third, development will be discussed in terms of change and complexity.

OVERVIEW OF DEVELOPMENTAL THEORIES

1. *Issues in Developmental Theories*

Parke, Ornstein, Rieser, and Zahn-Waxler (1994) analyzed theory development for the last 100 years and provided dimensions for theories: the content of concerns, theoretical assumptions, specific issues to developmental psychology, methodological issues, and the explanatory process. Their article presented shifts in each aspect over time. As for contents, the five major thematic concerns at the beginning of the century were emotional development, the biological basis of behavior, cognitive development, consciousness and unconsciousness, and the role of the self in development. During the 1950s and 1960s, learning theory became a dominant power in the field of psychology and influenced each subarea. Concerns of developmental psychology were also affected by this trend. The rise of an experimental child psychology characterized this period. For example, foundational investigations of infant sensory and perceptual development were undertaken. Parke et al. specified three lines of inquiry as the basis for the current argument on developmental theories: the nativist-empiricist controversy; the analysis of neural nets; and the idea that the basis of mental life emerges during infancy. Finally, they named major concerns of the current era: emotional development, the biological bases of behavior, social relationships, and children's cognitive abilities.

Next, they examined aspects of developmental theory and research, claiming three major groups. The first dimension is the general theoretical

assumptions of psychological inquiry such as the nature of explanatory models and the goal of theories. The second dimension involves specific issues to developmental psychology: the discontinuous vs. continuous processes, the period of development, plasticity, the direction of influence, and the unit of analysis. The third is related to methodological issues, including longitudinal vs. cross-sectional designs, experimental vs. non-experimental approaches, and molecular vs. molar constructs.

What Park, Ornstein, Rieser, and Zahn-Waxler (1994) claimed is that these dimensions have shifted during the last century: theory is not static. Two characteristic theoretical perspectives of developmental research are the mechanistic and organismic views. An underlying assumption of these perspectives is that "the choice of explanatory model determines a variety of theoretical decisions and the nature of testable hypotheses" (Parke et al., p.14). An organismic perspective dominated beginning about a century ago until the 1950s and 1960s, when J.B. Watson emphasized the mechanistic nature of the developmental process. The recent trend is the emergence of various versions of the organismic perspective including Bowlby's attachment theory and Bronfenbrenner's ecological theory. In the shift of explanatory processes, two major processes are noted by Parke et al. One is a strong biological determinism in the form of an evolutionary progression which is symbolized by the phrase, "ontogeny recapitulates phylogeny." Another is the general process of S-R associationism that possibly explains perception, thinking, and social behaviors. The following section will overview and contrast different perspectives which emerged during the last 100 years.

2. *Developmental Perspectives*

Organismic versus Mechanistic Perspectives

An organismic perspective views development as a biologically determined process whereas mechanistically oriented theorists posit that "development [is] a mechanistic process that could be reduced to simple units of behavior that combine together through learning principles" (Parke, Ornstein, Rieser, & Zahn-Waxler, 1994, p.16). According to Parke et al., the nature of the explanatory model at the turn of the century was predominantly organismic.

It shifted to predominantly mechanistic in the middle of this century and has become more eclectic in recent years. Early theorists in the discipline, such as Baldwin, Hall, and Binet, adopted an organismic perspective (Parke et al.). Along with the strong emphasis on the biological determinism of the organismic perspective, development was considered to be a matter of maturation. For example, Gesell suggested that "all things considered, the inevitableness and surety of maturation are the most impressive characteristic of early development. It is the hereditary ballast which conserves and stabilizes the growth of each individual infant" (Gesell, in Hetherington & Parke, 1993, p.5). G. Stanley Hall was strongly influenced by Darwinism and believed that genetically determined biological factors control all development and that environment has a minimal influence in development during infancy and childhood. Piaget also endorsed an organismic perspective. According to Piaget, children gain a better understanding of their world as a result of interplay between two complementary processes. The child adapts to the environment by accommodating new information and by assimilating experiences to fit an existing knowledge structure (Hetherington et al.). From this perspective, children are viewed as active agents who construct the reality of the world, actively interpreting the information and events that they come across. How information is organized is determined by the level of the child's cognitive development. Piaget claims that children go through different stages which qualitatively differ from each other.

The founder of the mechanistic view is J.B. Watson, who explained many aspects of children's behaviors, through learning. Skinner proposed that behaviors can be modified by environmental conditions. Positive reinforcement increases the recurrence of particular behaviors whereas punishment decreases behaviors. Thus, learning theorists who take a mechanistic perspective view development as a learning process whereas organismically oriented theorists view it as a biologically determined maturation.

Thus, organismic and mechanistic views compete against each other, focusing on the argument of whether development is maturation or learning.

The interplay between maturation and learning, however, has been demonstrated in studies of the brain. Diamond (1984) found that if a young rat is placed in an environment rich with toys and playmates, its cortex begins to thicken. She also found that the same principle applies to aged rats. Her findings were consistent with similar studies. By placing young rats in an enriched environment, Diamond and her colleagues (in Diamond, 1984) found (1) change in the chemistry and structure of the outer layers of the brain, (2) an enlargement of every part of a nerve and (3) an increase in the number of support cells. What these studies imply is that development is not merely maturation and that its trajectory is also influenced by external factors or stimuli.

Early versus Later Experience

What period of development is most important? What is the focal period of development? Along with these questions, researchers argued about the relative importance of different periods of development. This argument can be linked to the psychodynamic perspective of development through which Freud, in particular, emphasized the critical role of the preschool years in the development of personality. Freud proposed three aspects of personality, the id, the ego, and the superego, which form the structure of the developing personality. Each of these three personality facets changes its role as the infant who is usually under instinctual drives becomes more rationally bound. Freud viewed development as a discontinuous process in which a child goes through a series of discrete stages: oral, anal, phallic, latent, and genital. According to Freud, the way each stage is managed by the child will have a significant impact on the person's personality in his or her later life. For instance, infants whose needs were not satisfied by oral stimulation are more likely to grow up to be smokers. In Freud's view of the nature of development, the central assumption was that events in early years in life have a formative impact on later development.

However, much research refutes this idea. Findings demonstrating evidence about plasticity have shown that humans are malleable and later experience can often moderate what happened before. Such findings have been accumulated in

the context of brain studies. For example Shatz claims that neural development is a process of address selection (1992). Shatz cites Stretarvan's study that revealed a sequence of developmental changes in the branching pattern in the visual system. As development continues, the axons' sprouts elaborate terminal branches and lose their side branches. Soon, individual axons from each eye have highly branched terminals that are restricted to the appropriate layer. This sequence shows that the adult pattern of connections emerges as axons remodel by the selective withdrawal and growth of different branches. Axons grow to many different addresses within their target structures and eliminate addressing error. These findings imply that organisms have some potential to change what happened previously. That is, early experience can be modified by later experience.

Regarding focal periods and aspects of development, Gollin (1981) described development as multimodal and polyphasic. In other words, a number of different aspects of development are in progress at any given point. Also, Gollin suggests that development is highly plastic and results from a complex interplay between individual and environmental factors. According to Gollin, development is nonlinear, but involves growth spurts, with different structures and subsystems experiencing different rates of change at different times in ontogenic development. Thus, the configuration of the system is different at successive periods throughout the life span. Recent findings negate an assumption about linearity in development, namely, that early experiences determine development. Developmental processes are more complex, being multimodal and polyphasic.

Gain versus Loss

As the word "develop" connotes, development in general implies progressive changes in a child. Therefore, childhood has been viewed as a focal point of development whereas later periods of life have not been considered to be developmental. Many myths about the aging process have led people to conceive of late adulthood as the time of loss. However, the advancement of research in adult intelligence has altered this perspective and provided evidence of life-long development. For example, Schaie's Primary Mental Ability (PMA)

research demonstrated that adult intelligence does not necessarily decline. Using a combination of cross-sectional and longitudinal analysis, Schaie (1979) examined the relative impact of age, cohort membership, and time of measurement on different aspects of intelligence in adulthood. The cross-sectional study revealed that different types of abilities, involving number, verbal meaning, space, and reasoning, showed various age-related peaks. A longitudinal study indicated that age-related changes in intelligence remained minimal before subjects entered their sixties. More importantly, sequential analyses revealed that cohort differences better explained the sectional or longitudinal age effects for many abilities than chronological age. This result was confirmed by a follow-up study which additionally indicated that the degree to which age decrements were found depended upon both (1) the type of ability studied and (2) cohort membership. The most important implication of Schaie's 21-year study of adult intelligence is that the notion of irreversible, biologically based decline in abilities with age is clearly unfounded.

Thus, recent findings negate extreme perspectives of developmental psychology, implying the need for including such notions as complexity and plasticity into developmental theories. Parke, Ornstein, Rieser, and Zahn-Waxler (1994) listed five major explanatory processes in the 1990s, characterizing them as more eclectic than previous processes. These processes involve processes operating within an individual's situation, genetic influence, biological constraints on behavioral development, concepts of temperament, and social interaction processes. In order to portray these characteristics of newly established developmental theories, I would like to overview three developmental theories: a triarchic theory of experience, the polyarchial theory, and a systems theory.

3. Recent Developmental Theories

A Triarchic Theory of Experience

Scarr (1992) suggests that it is possible to consolidate both nomothetic (typical development) and idiographic (individual) patterns of human development into a single framework. Her claim has arisen from her question: How do the combination of organisms and environments produce

human development and many variations on it? Traditionally, the nature-nurture debate is about which contributes more to development, genes or environments. Scarr presents three observations leading to her own hypotheses regarding the relationship between the environment and individual development. First, common observations show that characteristics of parents, the environment they provide, and children's outcomes correlate with each other. Secondly, previous studies have indicated that children affect caregivers' behaviors. Thirdly, Scarr cites action theory (source unknown), which hypothesizes that people have the power to influence their developmental courses by making choices across time and illustrates how individuals shape their own developmental outcomes. These rationales led Scarr to offer two major propositions: (1) each child constructs a reality from the opportunities afforded by the rearing environment; and (2) the constructed reality produces variations among children and their later experiences.

Based on these assumptions, Scarr (1992) proposes a triarchic theory of experience which conceives that environments and genes interact with each other. Scarr first demonstrates findings from empirical studies indicating that individuals construct their own influences. Several lines of research indicate: (1) people construct their own experiences and personal histories; (2) individuals have different styles in emotional responses to situations; (3) personal characteristics determine how others respond to the stimulus person; (4) each individual constructs a personal myth giving coherence to his or her life; and (5) a sociocultural environment exists within the meaning that human participants give it. Based on these propositions, Scarr concludes that "people act upon their environments in different ways that create different experiences for each person (p.5). Scarr's triarchic theory of experience is threefold: 1) genotype affects environment; 2) people evoke responses from others; and 3) people actively select an environment. As opposed to the traditional notion of the unilateral impact of external factors on the development of children, Scarr's theory does not consider that children are passive entities. For instance, while many have thought

that different styles of parenting would create variations in child development, Scarr believes that "good enough parents" do not differ from "super-parents" in terms of the influence on the children's development. In other words, good enough parenting indicates that the impact of parents on children's development is limited. Furthermore, Scarr emphasizes that an "average expectable condition" is necessary for the occurrence of normal development. Finally, nearly all children can achieve "functionally equivalent development" with an adequate environment. Although Scarr does not explicitly state it, she assumes that family is the most fundamental unit in which normal development occurs.

The uniqueness of Scarr's triarchic theory is the interaction between the environment and individual organisms. It twists the traditional notion, in which the environment and the organism were always separate entities. Also, it questions the common idea that parenting influences the developmental course of children. Methodologically, the present inferential statistics that many psychological studies relied on do not support a cause-effect relationship. Scarr's argument would make psychologists' recognition more sensitive to this issue. However, as Baumrind (1993) points out, Scarr's theory is weak in defining normal development. As discussed in the above section, a theory has three functions: description, explanation, and prediction. Scarr's argument that good enough parenting would lead children to being "functionally equivalent" is based on the predictive aspect of her theory. Therefore, the validity of her theory cannot be tested unless being functionally equivalent or good enough are well defined.

The Polyarchical Theory

The polyarchical theory proposed by Scott (1995) assumes that development is governed by many rules. Two different functions in development, control systems and operating systems, are hypothesized. Control systems function to initiate development, whereas operating systems are processes and mechanisms that support or maintain the organisms. The whole system operates with a set of rules, and each subsystem has its own rules. These subsystems are nested so that the rules of the whole system can prevail over the

subsystem rules. The polyarchical theory also includes cycles which influence one another as systems do. According to Scott, the polyarchical model for predicting developmental status involves the following assumptions: 1) developmental status is probabilistic rather than certain; 2) development is hierarchical and cumulative; 3) both genes and environment play a part in development; and 4) there are unknown factors in the occurrence of development. One of the unique characteristics of the polyarchical theory is its description of control systems within individuals and the environment. Pointing out that the environment is not well conceptualized by psychologists, Scott (1995) emphasizes the need for description and classification of the environment. While control systems in individuals are classified as survival and competence, control systems in the environment are categorized as force, organization, and cycles. Additionally, it should be noted that the model is characterized by its clear statement that the goals of development are competence and adaptation.

Thus, the polyarchical theory is descriptive as well as explanatory. As Scott notes (1995), it is confined to a description of general development rather than specific aspects of development. Another disadvantage of the theory, according to Scott, is that it is not testable within the context of current psychological knowledge. The polyarchical theory is unique because of the classification and the inclusion of comprehensive elements in the environment. However, types of such elements vary from physical elements to culture. Therefore, it is very difficult for psychologists to identify appropriate units of analysis from such a variety of elements. This may be a major obstacle to testing the theory.

Systems Theory

Thelen (1992) introduces systems views of development, focusing on the self-organization of individual organisms. According to Thelen, dynamic principles answer several fundamental questions: where new behavioral forms come from, what to make of variability, and how to measure the levels of causality. Variabilities include two types: variability within a certain individual in different contexts, and variability between individuals. Systems theory, first theorized by Ludwig von Bertalanffy and

supported by biologists, emphasizes the nonreductionist properties of living organisms, that is, their self-organization, complexity, multiple levels of causation, and nonlinearity. The systems approach to development views development as a time-dependent process rather than a static and structural construct. The general principles controlling the assembly and coordination of behavior also govern developmental changes. Thelen (1992) states that development should not be viewed as a prescribed series of structural changes to progressive stages but as a preferred behavioral state changing at different degrees of stability and instability: "as organisms develop, behavior soft-assembles to use Kugler and Turvey's term, from multiple and coequal elements and components, each of which has its characteristic dynamic, and this assembly represents a preferred state of the organism in the context of a particular environment and task" (Thelen, 1992, p.190). In addition, Thelen views newly established behavior as the product of the convergence of different components within a specific problem context. Factors constraining the new behavior involve the phylogenetic and ontogenic history of individuals, the normal environment, and the tasks encountered by individuals. These factors direct individual solutions toward common outcomes as constraints.

Furthermore, Thelen (1995) presents a new synthesis of studies of motor development in conjunction with a systems approach in which the multicausal, fluid, contextual, and self-organizing nature of development are emphasized. As an example of multicausal development, she offers the newborn stepping reflex, an alternating step-like movement which newborn infants perform when placed with their feet on a support surface. This stepping appears when infants are still motorically immature and disappears in a few months. Thelen contrasts her own explanation of the newborn stepping reflex from a systems approach to the traditional single-cause explanation. The single-cause explanation is that "[m]aturation of the voluntary cortical centers first inhibited subcortical or reflexive movements and then facilitated them under a different and higher level of control" (Thelen, 1995, p.81). In other words, the disappearing reflex is programmed by the brain. On the other

hand, Thelen and her associates speculate that a change in posture would change the relationship between the body mass and the gravitational field. When infants gain weight rapidly during the first two or three months from birth, their limbs also become heavier but not strong enough. As a result, the convergence of heavy legs and a biomechanically made posture results in the disappearance of stepping.

Beyond the field of psychology, Thelen refers to the matter of movement coordination in physics and in physical biology, citing the work of Kugler, Kelso, and Turvey (1980, in Thelen, 1995). Here, nonequilibrium dissipative systems in the natural world are introduced. Nonequilibrium dissipative systems are complex/heterogeneous and gain/lose energy. Among examples are clouds, fluid flow systems galaxies, and such biological systems as slime molds and complex ecosystems. Such systems are characterized by the formation of patterns, complexity in time and space, and self-organization. Thelen points out that psychologists have looked at performance variables at only one time, not ongoing measures of coordination such as trajectories and phase relations. However, recent interest in the application of dynamics has driven researchers to formulate coordinations with physical mathematical principles.

Thelen concludes that a dynamic view would enable a prediction of "an initial high variability in configurations representing an exploration stage, narrowing of possible states to a few patterns, and a progressive stability as patterns become practiced and reliable" (Thelen, 1995, p.84).

CHANGE AND COMPLEXITY

Change

Since the major focus of developmental psychology is placed on change, it is necessary to understand concepts of change in the context of development. Development is considered to be progressive ontogenic change. The questions are whether change is predetermined and how changes in different parts of the organism are related to those of the whole. Oyama (1985) raises the question whether the developmental course is predetermined, by quoting Gould's comparison

between preformationists' and epigeneticists' perspectives. Gould (1977, cited in Oyama) agrees with the preformationists' idea about preexistence as the only refuge from mysticism, but disagrees with their emphasis on preformed structure. Regarding epigeneticists, Gould agrees with their idea that the visible outlook of development is not mere illusion. Also, admitting the preformationists' idea that preexistence is the only refuge from mysticism. Oyama argues that this is true only when the certain change is "a one-time-only simultaneous creation of all things" (Oyama, p.20). Oyama explains the viewpoints of preformationists, epigeneticists, and modern thinkers about the relationship between pre-existing and final form: preformationists thought that both were material; epigeneticists considered that form was first disembodied, and then embodied; the modern thinker's claim was that form is material but cryptic at the beginning, and appears in the phenotype.

Oyama's argument (1985) is that the relationship between initial and final structure is misunderstood. "Preformationists and epigeneticists agreed that a formless egg required form from without. Preformationists placed accomplished form inside the egg, while epigeneticists rejected this solution and instead posited an additional force" (Oyama, p.20). In other words, for Oyama, both preformationists and epigeneticists assumed pre-existing components are required for the initial structure. While preformationists argued that something was programmed inside the egg, epigeneticists insisted on something additional. Furthermore, Oyama views maturation as a cause rather than a described state. Maturation is not a final outcome of change but a driving force for change.

Finally, Oyama (1993) claims that a developmental system should be conceptualized as a complex of interacting influences, some inside the organism's skin, some external to it, and including its ecological niche in all its spatial and temporal aspects, many of which are typically passed on in reproduction either because they are in some way tied to the organism's (or its conspecifics') activities or characteristics or because they are stable features of the general environment (p.27). In short, change occurs as a function of possible factors such as genes and external factors. In this

sense, Oyama's view of change is similar to that of the systems approach.

Plasticity

Plasticity means malleability, formability, and changeability. While general change refers to initial and final outcomes of change, plasticity may be viewed as change in a more dynamic pattern. In his multimodal and polyphasic model of development, Gollin (1981) argues that individual differences are related to plasticity, consisting in variations in the time of onset of particular developmental phases. For Gollin, what varies between individuals is pace, not the structure or sequence of development. Additionally, organisms and environments are inseparable from each other. Therefore, Gollin conceives that individual differences depend on pace caused by both organisms and environments.

A multimodal and polyphasic model emphasizes that development involves changes of different structures and subsystems at different rates and at different ontogenic times. At a certain time, the organism or the living system is "a configuration of many structures and functions" (Gollin, 1981, p.239). Thus, the configuration of the system is different at successive periods in the life span. This model shifts the focus of development from the stimulus to the organism, with the organism in different states of readiness for growth, depending on the point it is at in its growth. The significance of a response is not determined by its correctness, but rather by what it tells about the state of change of the organism. The addition of pace to the developmental model is unique. Previous studies using a cross-sectional method have relied on the assumption that organisms change at the same pace. As Gollin claims, we should be aware of the methodological limitation of tracking change in the organism because of its complexity and multifactorial aspects, and even if we could trace and predict individual change, there is no guarantee of generalization to every individual.

Complexity in the Natural World and Development

Departing from an oversimplified nature-nurture argument, developmental psychologists have become aware that driving forces of developmental change involve complex and possibly interactive factors. As presented in the previous section of

this paper, recent theorists tend to view different factors relating to developmental changes as systems rather than as separate entities. For example, Scarr (1992) hypothesizes that the environment and genes interact with each other. Gollin (1981) conceives that environments and organisms cannot be separated. Scott (1995) claims control systems and operating systems as functions of developmental systems. Furthermore, systems theorists view organisms' nonreductionist properties. This complexity can be explained and described by relating human development to research in complexity in the natural world. In "Chaos, Self-Organization, and Psychology," Scott Barton (1994) links models of psychological systems to a new paradigm of chaos, nonlinear dynamics, and self-organization. This paradigm without any specific title has been employed to explain complexity in the natural world.

Ruthen (1993) introduces a group of researchers at the Santa Fe Institute who tried to predict behaviors of complex systems such as all living systems, economy, and ecology, and provides the movement from order to chaos during the past 100 years. Invented during this period, chaos theory formulates that "if a system consisted of a few parts that interacted strongly, it could exhibit unpredictable behavior" (Ruthen, p.132). In the 1970s, physicists became aware that what chaos theory could not account for was dynamics. They started to search for complexity beyond chaos. Ruthen refers to a theory of complexity which had been searched for before chaos theory gained its popularity. A theory of complexity explains interactions among parts within a certain system. When the Santa Fe Institute began its projects in the mid-1980s, one of the questions among researchers was whether the theory of complexity was applicable to an adapting system. According to one explanation, an adaptive system is a system in which different independent parts are highly interacting. Further, "the system's behavior obviously depends on the sophistication of the strategies and the mechanism of change" (Ruthen, p.132). Much overlap can be speculated between inquiry processes of complexity in the natural world and those of human development: a system consists of different parts that interact with each other, and

involves certain dynamics.

An interest in explaining such complexity has motivated researchers to establish a unified theory. A unified theory is introduced in the article "From Complexity to Perplexity" by Horgan (1995). The claim underlying the construction of a unified theory is that all different systems can be explained by a single theory, and that these systems share significant characteristics called complex adaptive systems (CAS). General principles are presumed to govern all CAS and to solve problems within each CAS.

Although a unified theory has not been validated yet, it would be applicable to the developmental process of human beings. In human development, each individual represents one complex system, consisting of biological, psychological, and social properties. The change in psychological properties such as emotion, cognition, and behaviors cannot be separated from physiological properties such as neural systems. There may be principles governing change in the whole system, that is, in an individual. However, we do not know the significance of constructing such a theory yet.

CONCLUSIONS

Recent theories are moving towards the inclusion of various systems within organisms and environments and dynamic patterns of change. This trend is considered to affect research methodology and the profile of developmental psychology itself. Oyama's argument (1985) regarding the relationships between initial structure and final structure, and Gollin's (1981) multimodal and polyphasic model of development and the concept of plasticity provide an implication that unstable states as well as stable states have to be accounted for by developmental theories and models. Systems approach theorists also claim the importance of including dynamic patterns in the prediction of changes. Thelen (1995) states that "[t]heory predicts that times of instability are essential to give the system flexibility to select adaptive activities" (Thelen, p.85). Conventionally, states which fail to reach expected states have been considered as errors or measurement errors. Recent theorists believe that developmental studies must include

such unstable states. In other words, units of analysis in empirical studies should include dynamic changes rather than variables in static status.

As researchers at the Santa Fe Institute seek to establish a unified theory, developmental theory will be more comprehensive than it used to be. The inclusion of multiple systems within organisms requires the involvement of different disciplines such as biology and ethology in the field of developmental psychology. Developmental psychologists need to collaborate with researchers from various fields. To date, every field has been subdivided into very narrow subareas. A possible problem in working with scholars in different areas is language, since the academic field has become so specialized that it is difficult to share scientific discourse with scholars from other backgrounds. Furthermore, one may question how higher education will respond to the integration of different areas. It is impossible for individual students to cover all areas. As Parke et al. demonstrated (1994), theoretical emphases shift over time: concerns, exploratory processes, and goals. Each theorist has selected the components of his/her theory based on what is known. In this sense, theory development is epistemological. When developing or interpreting theories, it is important to understand the limitations of each theory. Therefore, we might suspect whether new theories will be significant because we cannot validate such theories with current research methodology. However, Thomas (1985) claims that "a theory is better if it stimulates the creation of new research techniques and the discovery of new knowledge" (p.22). In this sense, a unified theory and new theories in developmental psychology would form better theories.

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