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Cognitive Development

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Table of Contents

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Introduction

For decades the area of cognition was uniformly ignored by psychiatry, which concentrated on the energetic-dynamic model of psychoanalysis or the medically oriented "organic" approach to mental illness. This neglect, in fact, has caused one writer to call cognition the Cinderella of psychiatry. As in the fairy tale, in recent years this neglected Cinderella has indeed been discovered by a number of psychiatric princes and has become a topic of great popularity.

The reasons for this sudden surge of interest in cognition, which for many years had been the domain of somewhat isolated academicians, are many and complex. On a theoretical level the existence of mind has again become fashionable in psychology, and the strict behaviorism that attempted to deal solely with stimulus and response has lost its former prominence. It can no longer be held as valid that an organism's response is simply determined by an internal copy of a physical stimulus. Any stimulus is cognitively modified, interpreted, and perhaps partially created by the organism, which then selects a response pattern. The ever increasing number of postulated "mediational processes" confirms the need to consider active,

selective mental processes between the presented stimulus and the observed response. Similarly the stress on the greater abilities of the ego in psychoanalytic theory has shown that behavior is more than the simple transformation of unconscious drives. The id psychology of early psychoanalysis has been replaced by a theory that makes the ego and its cognitive structures central to the causes of behavior. While some "ego psychologists" such as Hartmann and Rapaport have tried to fit their innovations within the older framework of the energetic "economic" point of view, other psychoanalysts have elaborated core concepts such as identity, the self, and object-relations that are difficult to integrate with classical metapsychology and seem to imply cognitive rather than energetic structural models. Therefore, the importance of the cognitive functions of the mind has reasserted itself in terms of dealing with both external and internal stimulation.

On a more pragmatic level the coming of age of child psychiatry as an independent discipline has directed attention to the developmental process of cognitive growth. The actual observation of children rather than the former reliance on retrospective accounts of adults has underscored the need for an appreciation of cognitive development to understand the psychic world of childhood as well as the eventual psychic world of the adult. The more children were studied, the more it became apparent that their behavior could not be explained solely on the basis of accumulated S-R habits or on the basis

of libidinal stages, but that the development of intellectual faculties, independent of other factors, held an important key to the understanding of childhood.[1] Furthermore, the recent movement of psychiatry into preventive and community mental health brought to light a great number of psychiatric casualties who were lacking in cognitive abilities. The effects of early failure of appropriate cognitive development in the poor and in minority groups mobilized a massive effort at remediation and prevention of these early deprivations.

It is apparent that from the theoretical, academic, and social points of view cognition and its ontogenetic development have become an important area of study in psychiatry. This has been a salutary change since, after all, in studying human behavior we are really studying cognitive processes. The human psyche, whether viewed in terms of repressed memories, current attitudes, or expectations of the future, is made up of cognitive constructs, and, therefore, the alterations and creation of these structures are quite justifiably the province of psychiatry and should be included in a psychiatric textbook, tn the following pages some of the more pertinent issues, as well as the work of major theorists, in the area of cognitive development will be summarized.

Current Status of Cognitive Developmental Theory

The development of cognitive functions is predominantly viewed as a fluid process, with the emergence of novel capabilities at various steps of ontogenesis. Although the causes for the course of this development are unknown, current theory stresses a phase-specific interplay between innate and environmental factors, with appropriate stimulation needed to elicit or reinforce inborn patterns. There is also a great emphasis on the role of mental activity, of action, rather than simply passive reception of stimulation, as necessary for the growth of cognitive skills. Underlying this view of cognitive development as an evolving progression toward more increasing complexity is the concept of epigenesis, which states that mature abilities at each stage grow out of simpler forms of cognition and that these complex abilities are reliant on the mastery of more primitive tasks. The hallmark of current developmental theory is thus a conception of ontogenesis as a creative process, with the emergence of qualitatively new forms of behavior that require proper environmental stimulation as well as successful completion of earlier adaptations for the process to continue.

As such, most theorists see cognitive development as beginning with simple innate reaction patterns and passing through various phases to culminate in adult capabilities such as abstract ideas, relative independence from environmental events, and the establishment of self-regulatory systems. At each stage the mind is seen as *actively* structuring a world view, beginning with a primitive logic of action and building on each successive stage to

transform its relationship to the environment toward greater autonomy and complexity.

Historical Orientation: Idealism, Empiricism, and Interactionism

In the past theories of cognition usually stressed a specific philosophic position. Plato's doctrine of *Anemnesis* proposed that prior to earthly life the soul had knowledge of ideal forms whose recollection allowed man to structure his phenomenological world. Through development myriad concrete experiences re-evoked the dormant memory of the ideal forms. In modern dress Plato's myth stresses the dependence on predetermined, nonlearned cognitive modes for intellectual development. This idealist tradition thus holds that the sources of knowledge derive from innate structures that are independent of experience. Perhaps the most extreme adherent of this view was the philosopher Leibnitz who conceived of the mind as a "windowless monad" that had no contact with its environment and whose experience was the unfolding of a predetermined program.

At the other extreme empiricists have attempted to demonstrate that knowledge is totally reliant on experience and that cognitive development is the mind's gradual accumulation of sense data. As John Locke proposed, the mind at birth is a *tabula rasa,* a blank tablet, which has no inborn structure or organization, and upon which are imprinted the perceptions of sense data.

The empiricist tradition had its greatest popularity in England and France in the eighteenth and nineteenth centuries, perhaps as a result of the impact of scientific methodology and the fascination with technology. Itard, a French educator and psychologist, tried to put empiricist theory to practical use in his attempts to educate the "wild boy" of Aveyron. Itard's two monographs describing his procedures are classics, and his ingenious methods of pedagogy have enormously shaped the current educational practices with defective children. However, Itard's intent was to prove the correctness of the empiricist position, and he extensively quotes Condillac, one of its most extreme adherents. He believed that through proper stimulation he could develop the mind of a boy who had apparently lived alone in the forests of France until puberty. Ultimately Itard's experiment ended in failure: the child never attained the use of language, and Itard concluded that the wild boy had been born defective. It may well be, however, that too many years had passed and that it was too late for linguistic abilities to be formed.

Although the empiricist point of view experienced a revival of interest in this country with the work of Watson and the behaviorists, today few, if any, theorists would subscribe to either a strict idealism or empiricism in describing cognitive development. It is granted that both innate factors and specific experiences are necessary for the development of intellectual skills. It is less a question of how much is due to innate or learned abilities than how do these two sources of development interact to reinforce each other and

optimally combine to exert their maximal effect. Associated problems that arise concern the specificity of eliciting certain capabilities at set stages of development as well as the possibility of reversing the effects of prior deprivation or overstimulation.

D. O. Hebb has approached the problems of cognition from a neurophysiological standpoint and has demonstrated that much of the former controversies between psychologists regarding innate versus learned behavior may ultimately depend on the species of organism that had been studied. For example, insects appear able to perform complex functions immediately after birth, while higher organisms require long periods of nurturance and stimulation before showing even rudimentary forms of adult behavior. In primates and humans Hebb speculates that there occur two forms of learning. The first form utilizes a haphazard trial-and-error strategy and can be observed in very young children or in more mature organisms that were deprived of specific stimulation (such as children born with congenital cataracts or monkeys raised in total darkness). The second type of learning is characterized by insight, rapidity, and flexibility. Hebb comments that higher organisms that show this second form of learning also demonstrate a prolonged and less effective form of the primary type. It seems that as we go up the phylogenetic scale, there is an increase of type two learning but also that type one learning takes longer and longer. For example, a rat reared in darkness may require 15 minutes to an hour to learn a visual task after

removal from deprivation; for a chimpanzee the time required to learn an analogous task may be weeks or months. Hebb attempts to explain this difference in terms of neuroanatomy, dividing the cortex into primary sensorimotor areas, which record external stimulation, and association areas, which combine and integrate these sense data. Through phylogenesis there is a gradual increase in the amount of association areas in comparison to sensorimotor areas, a relationship that Hebb calls the A/S ratio. Species with low A/S ratios show rapid primary learning since sensorimotor sequences are easily established because there is a paucity of association fibers to be organized. However, this same lack of association areas limits the amount of flexibility of behavior after the connections have been established. In contrast, organisms with high A/S ratios require a great deal of time for stimuli to organize the massive association areas. However, once this is accomplished the complexity of the connections allows for versatility of response as well as relative independence from the immediate situational stimulus.[2] The early stage of primary learning is still of paramount importance for higher organisms since it is during this period that the association areas are structured and thus cognitive relationships may be formed that persist throughout life. This aspect of Hebb's work strongly emphasizes the importance of early experience in all later behavior. In later writings Hebb seems to view the plasticity of the very young nervous system as so great that it is difficult to differentiate innate from learned behavior.

Some support for Hebb's theories has come from Sapir's and Whorf's studies in comparative linguistics showing that the structure of the language learned in childhood influences adult cognitive patterns.

Hebb's work is closely related to what has been termed "critical period" theory, which also attempts to deal with the manner of organism-environment interaction, stressing that there are "critical times" for certain behaviors to be learned or for specific stimulation to have its maximal effect. Critical period theory evolved from the field of ethology with the early experiments of Lorenz with newly hatched geese and partridges. He found that although these chicks would normally follow their mother in normal development, they would learn to follow him if he presented himself first. This strong bond continued through maturation so that Lorenz speculated that as a result of this one-time presentation, his image had been "imprinted" in the chicks. Later experiments by Hess showed that there were peak times for imprinting to occur and that after a certain amount of maturation imprinting could no longer be elicited. Scott's work with puppies showed that even in higher species there were optimal times for the formation of an emotional bond to a trainer. These studies again point to the hypothesis that early experiences or the deprivation of such experiences may have a profound effect on future development.

Harlow's work with rhesus monkeys showed that subjects raised

without adequate mothering became sexually inadequate as adults and that the females were incapable of maternal behavior. Harlow found that monkeys raised in isolation for two years were grossly abnormal in play, defensive, and sexual behavior; those raised in isolation for six months were able to develop some play behavior; while those who returned to a natural setting after 80 days of age showed an almost total reversal of the isolation effects. There appeared to be a “critical period” time after which compensatory stimulation was ineffective.

Similar conclusions have been reached in work with deprived infants. Rene Spitz found that infants who were separated from their mothers at six months of age and were not provided with an adequate substitute became listless and withdrawn, were retarded in their motor and intellectual development, and were prone to infectious disease. Spitz found that the effects of maternal deprivation were reversible only up to a period of three months, after which reunion with the mother did not completely nullify the effects of separation. Dennis and Najarian" came to similar conclusions following their studies of institutionalized children, although they interpreted the eventual developmental defects as a result of stimulus deprivation rather than the absence of mothering. Similarly Province and Lipton found that institutionalized children showed significant delay in smiling responses, handling of toys, speech development as well as interpersonal relations. In follow-up studies Goldfarb found that children who were placed in foster

homes had higher IQs than children who remained in institutions.

The pressing questions raised by critical period theory are whether the effects of early stimulus deprivation are irreversible or if later remediation can be compensatory. Scott believes that "organization inhibits reorganization," indicating that once patterns of cognitive and affective experience have been formed, it is difficult, if not impossible, to impose new patterns. Counterarguments are that most of the evidence for critical periods has been in lower species, which, as described by Hebb, have little capacity for complex neuronal interconnections in the association areas and possibly are thus less able to modify past learned behavior. Also most critical periods studied involve formation of affective rather than cognitive functions. The lack of hard evidence for the existence of critical periods in human cognitive development has caused Wolff to criticize strongly the application of this formulation to child development, especially in the form of educational gadgets or "enrichment" toys that are promoted as necessary for proper intellectual growth. Wolff believes that the greater complexity of the human brain makes feasible much more flexibility than critical period theory allows. He believes there are optimal periods for the attainment of certain abilities such as the learning of a second language, but that on the whole the human mind can make compensations that are beyond lower species. In support of his argument he quotes recent stud- ies that seem to indicate that the effects of early deprivation are not as irreversible as previously thought. Another

important point raised by Wolff is that there is little agreement about what critical periods exist in human cognitive development. Retardation may result from lack of stimulation or novelty, but it may also be a product of overstimulation and unpredictability, which prevents the child from assimilating his experience into meaningful categories. Finally the social milieu may actively discourage exploration or fantasy, negatively rewarding attempts to integrate and master experiences. Many of Wolff's arguments reflect the current controversy surrounding Head Start programs. Culturally disadvantaged children repeatedly have been shown to be deficient in language skills and abstract ability; however, the cause as well as the best methods for remediation are still hypothetical.

Cynthia Deutsch has stressed difficulties in learning auditory discrimination as basic to later language disorders. The child is surrounded by meaningless "noise" with little meaningful auditory stimulation, so he does not develop the ability to identify nuances of sound.[3] Fineman stresses the importance of mother-infant interplay in the development of an active inner fantasy life and ultimate cognitive ability. Pavenstedt emphasizes the need for emotional tranquility and regularity for any learning to take place.

Most remedial programs have found that intervention before age three is crucial, some suggesting that compensatory tutoring should begin prior to 14 months of age. These findings reinforce the concept of epigenesis that

unless early cognitive tasks are properly mastered, later development will be deficient. However, positive care during the first three years does not insure continued development; proper support and stimulation must continue throughout childhood. In fact, most of the gains made by Head Start programs have been rapidly lost once these programs were discontinued. The difficulties that beset attempts to specify the causes of deficient cognitive development in disadvantaged children may serve as illustrative to the field of cognitive development in general.

The development of cognitive functions cannot be divorced from emotional factors such as a healthy mother-infant relationship in the early years, respect for autonomy and curiosity during early childhood, parental motivation and models during middle childhood, and the effect of peer pressure in the later stages. As systems of cognitive growth will be discussed below, it is important to keep in mind that such descriptions are really artificial since the development of intellectual functions cannot be separated from the total growth of the child. Recent studies have shown that children learn predominantly through action, that sensory stimulation by itself is insufficient unless it elicits a motor response that alters the environmental situation. There is a unity between stimulation, response, and alteration of the stimuli in the growth of behavior. Numerous experiments by Held and others have shown that proper “stimulation” involves a process of motor response and resultant sensory feedback—a sequence that Held calls

"reafference." A typical study involved a series of two kittens raised in darkness, but regularly placed in a circular drum whose interior was painted with vertical lines. One kitten was strapped to a harness connected to a central axis in the middle of the drum, but it was free to exercise. The other kitten was placed in a gondola directly opposite the "active" kitten, but it was unable to exercise. Each time the active kitten moved, he caused the "passive" kitten to be passively moved by a bar connecting the kittens. In this manner both kittens were exposed to the same stimulation. After an average of 30 hours in the apparatus the active member of each pair showed normal visual behavior in terms of averting collision with objects, not going off a "visual cliff," and so forth. After the same period the passive kitten failed to show these behaviors.

Toward a General Concept of Development

The preceding section has considered the sources of development as well as the question of interaction between maturation and environmental effects for optimal cognitive development. However, what is actually meant by "development?" It is well known that a 15 year old can perform mental tasks that are beyond the capacity of an 8 year old, who, in turn, can utilize concepts unavailable to a 2 year old. However, when a definition of what lies behind these obvious changes is sought, great difficulties are encountered. It appears easier to document static levels of achievement at different ages than

to grapple with what is being altered in development. For example, most "intelligence tests" are based on purely empirical standardizations of certain given problems at various ages. These tests may give us evidence of the deviation of cognitive development from a standardized norm, but they offer little in terms of theory beyond the known fact that certain abilities increase with age.

Attempts to grasp *the essence of development,* its formal structure, rather than to document it, have come not from the fields of education or psychological measurement but rather have been spurred by the application of Darwinian evolutionary concepts to ontogenesis. One of the earliest and best known of these attempts is G. Stanley Hall's recapitulation theory. Hall speculated that human development presents in a condensed form all of the stages through which the species had traversed in evolution. The behavior of children could then be seen as atavistic remnants of former evolutionary periods. Hall's theory found its greatest influence in describing the play activities of children: the child's insistence on swinging from branches showed the influence of our simian ancestors just as the pleasure in outdoor group activities was seen as a vestige of primitive man's tribal existence. A very similar theory was espoused by Thorndike, who saw the behavior of the child as expressing those actions that had allowed the species to survive. Although avoiding Hall's Lamarckian interpretation of evolution, this theory as well neglects the effects of acculturation and seems to equate ontogeny

with phylogeny. Today these two processes are seen as similar but far from identical so that the one cannot be used to explain the other, although both may follow analogous laws.

It was toward a discovery and elaboration of these laws of general development that the comparative psychologist Heinz Werner applied himself in a series of articles and his major book, *The Comparative Psychology of Mental Development.* Werner believed that developmental psychology has two basic aims: (1) to grasp the characteristic pattern of each genetic level and the structure particular to it, and (2) to establish the genetic relationship between these levels in respect to the direction of development in order to discover any general tendency in development. Through his work Werner eventually proposed an "orthogenetic principle"' by which he hoped to be able to explain any open system in the process of evolutionary change. Toward the end of his career Werner had even discarded the dimension of time in his consideration of development, basing his studies on increasing complexity of certain factors in discovering the direction of movement for any open system. He thus antedated "general systems theory" and was a pioneer in the field of theoretical model-building for biological systems. Through this type of analysis Werner tried to encompass the evolution of cultures, the growth of language, the changes observed in psychopathology, as well as the normal development of the individual. In his book, in fact, Werner discusses many important aspects of ethology, anthropology, and psychopathology;

however, for our purposes the discussion will exclude these other contributions and concentrate on his theory of human cognitive development. [4]

Werner criticized most psychological theories of development, with the exception of Gestalt psychology, as too mechanistic, considering development as the mere addition of new abilities. For Werner development is creative and organismic, bringing about totally new abilities and radically changing the developing entity. Each new stage represents a totally new organizational synthesis that must be understood through different criteria than previous or later stages. “Any level, however primitive it may be, represents a relatively closed, self-subsisting totality. Conversely, each higher level is fundamentally an innovation, and cannot be gained by merely adding certain characteristics to those determining the preceding level” (p. 22). Werner attempted to find standards by which to compare and measure these differing stages of development. The two major changes that occur in development and that thus could be used to assess it were: (1) that development proceeds from a state of relative globality to a differentiation of parts, and (2) that there is an increasing integration of these parts into a hierarchical arrangement. Here again it must be stressed that Werner was interested in formulating the formal overall plan of development rather than a detailed descriptive analysis.[5]

In order to measure these two major dimensions, Werner formulated five sets of parameters that he applied to cognitive development. The first, that of *syncretic* versus *discrete* functioning, refers to the interpenetration of functions in the child that become increasingly discrete in the adult. For example, the child often fuses together sensory, motor, and emotional components of experience. Young children exhibit synesthesia or the fusing of two sensory modalities, such as a three-year-old boy, reported by Werner, who stated that "a leaf smells green." This syncretic tendency of a child's thinking was experimentally demonstrated by Wapner at Clark University. Children of increasing age were asked to adjust the speed of a series of pictures moving past an aperture in a board so that these pictures moved at the same speed as another series of pictures moving past another aperture in the same board. In comparing the adjustments made for a static picture (grazing horse) and a dynamic picture (running horse), it was found that younger children increasingly adjusted the dynamic picture series to a slower speed than the static picture series. The dynamic aspects of the presented form were syncretically fused with its actual speed for the younger children so that the running horse series seemed to be moving faster than the grazing horse series.

A further example of syncretic functioning is given by Werner and Kaplan"' from their studies of linguistics, although their conclusions are equally applicable to child development. In studying the language of the

Trobriand Islanders, they found that, in contrast to our own language, a specific word contained many exact yet unconnected meanings. The word "yam," for example, in addition to being an edible type of potato, denotes a specific degree of ripeness, bigness, and roundness. If one of these characteristics is missing, the object is 110 longer a yam—it is something else. Similarly the child infuses an object with a myriad of unessential qualities that to the adult seem separate from the object itself.

An important instance of the child's syncretic fusing of cognitive and emotional modes is expressed in Werner's concept of "physiognomic perception." Werner means that the child ascribes human qualities to all sorts of objects so that they appear animate and express some sort of inner life. A rock may be happy or a hat may be sad. Even adults retain this form of description in such phrases as an angry sea or melancholy sunset. However, while for the adult the imagery is metaphorical, the child actually ascribes feelings to inanimate objects, again fusing qualities that to the adult seem quite discrete. Werner also noted that in pathological states such as brain damage and schizophrenic psychosis there is a regression of formal thought operations to the syncretic mode.

A second parameter is that of *diffusion* versus *articulation,* indicating the transition from the global perception of wholes to the appreciation of parts in relation to the whole. Werner showed this tendency of young children to omit

details and grasp only vague global characteristics by asking them to reproduce geometric figures. A square, as well as the letter "C," was reproduced as a circle, demonstrating a trend toward symmetry and an avoidance of nonglobal characteristics such as corners or breaks in contour. More complex figures were similarly simplified. A more crucial aspect of the diffusion-articulation continuum is the young child's tendency to equate a detail of the whole with the whole itself. Werner reports a boy who was afraid of spiders becoming upset when a hair stuck to his fingers. When the hair was removed the child asked, "Didn't the hair bite you?" showing that he equated qualities (biting) of the whole (spider) with the part (hair). In an analogous manner two situations may be equated if they share an element, however trivial, in common. Another child reported by Werner, who was picked up by an uncle wearing a rose in his lapel, expected to be nursed by the uncle because his wet nurse often wore violets. Here the sight or smell of flowers made the situation of being picked up by uncle identical to being fed by nurse. Again the use of part-symbols to represent wholes is often used by adults in allegorical works, but to the child the identity of the associated situations or objects is real rather than poetic or metaphorical. Werner termed this type of cognition *pars pro toto* (or part for whole) reasoning. This type of logical association has been subsequently found to occur in adult psychopathological states; in addition, it is similar to processes described by Freud in his interpretation of normal dreams. As will be described below, Arieti has

discussed the same process as fundamental to "paleologic thought" and Piaget has coined the term "transduction" to describe association of wholes by their similar parts.

The remaining three parameters can be dealt with more briefly. The *indefinite-definite* continuum refers to the organization of goal-directed behavior and the ability to withstand desires to give way to momentary gratifications. The *rigid-flexible* continuum describes the transition from fixed, stereotyped responses to the ability to vary or modify behavior to meet the needs of a situation. Finally the *labile-stable* continuum refers to the distractibility of the child by external stimuli in contrast to adult behavior, which is characterized by persistence to a task despite environmental interruptions.

It is apparent from this very brief resume of Werner's system that he was more concerned with formulating laws of development than in describing various developmental stages and in stating broad principles than in noting the abilities of children at various ages. His experiments and illustrations serve primarily to confirm his general hypothesis: that development is a fluid, evolving process that can be assessed by specific parameters. Wapner, who worked with Werner on numerous studies, has recently tried to postulate a series of stages of development as derived from the "organismic" point of view. Wapner describes four major stages in the

cognitive development of the child. The first is the *biological-organismic* level, in which there is minimal separation of the self from the environment, physiological intraorganism mechanisms predominate, and behavior consists largely of innate reflexes. The next state is the *sensorimotor* level, characterized by a separation of the self from the environment and the willful manipulation of objects. The third stage is the *perceptual operations* level, in which thought and behavior are dominated by the most striking perceptual elements in the environment. The last stage is the *conceptual operations* level, in which behavior is a result of symbolic representations of objects and events rather than pure mirroring of reality. Wapner stresses, as did Werner, that as newer levels are reached, the older cognitive styles are not eliminated but relegated to a lower hierarchical status and that primitive forms of behavior may still emerge in the presence of stress or disease.

Despite these attempts at delineating steps in cognitive development, it must be reemphasized that Werner's major contribution seems to have been in trying to grasp the essence of the developmental process rather than in defining discrete stages. The more painstaking and perhaps thorough task of studying the child's cognitive behavior as it relates to developmental stages as well as the total process has been more closely actualized by Piaget and his collaborators, whose work will be considered next.

The Genetic Epistemology of Jean Piaget

Theoretical Introduction

Piaget has carefully termed his work "studies in genetic epistemology," emphasizing his concern with the way the individual constructs and organizes his knowledge of the world during his historical development. At each stage of development problems in world construction are handled according to age-appropriate conceptions, with the earlier attempts forming the foundations for later capabilities, culminating in the logical thought of the adult.

Piaget states, "psychologists eventually began to wonder whether the logic was innate or resulted from a gradual development. To solve problems of this kind they turned to the study of the child and in so doing promoted child psychology to the rank of genetic psychology. Genetic psychology becomes an essential tool of explicative analysis to solve the problems of general psychology."

In attempting to derive the adult modes of thought from childhood experience, Piaget shows his basic roots in biology and his great debt to Darwinian thought. In his later works he acknowledges that our knowledge of reality is not a copy but an organization of the real world. But at the same time this knowledge cannot go beyond our actual experience as human beings enmeshed in nature. He discards any transcendental aspect of truth that goes beyond our biological makeup. Knowledge is seen as a biologically useful

ability that regulates the individual's exchanges with the environment, and cognitive functions are conceived of as specialized organ systems that help higher organisms relate to their world.

Piaget specifies three types of intelligence: (1) innate abilities such as instincts; (2) learning that relates to the concrete physical world; and (3) logical mathematical structures that are utilized in nonrepresentational abstractions. Whereas most species are suitably adapted through instinct, in the higher animals there is a breakdown of instinct or hereditary programming in favor of new cognitive self-regulations. These take the forms of "reflective interiorization," meaning the ability to re-create internally segments of experience, and "experimental exteriorization," meaning the ability to vary the course of a behavioral response for maximum benefit. For Piaget, cultural or social interaction takes the place of previously fixed instinctual responses in protecting an organism in its exchange with nature. This Darwinian view of the origins of cognition bears a strong resemblance to the equally evolutionary theory of thought in recent psychoanalytic literature. Hartmann, for example, states that as an organism ascends the phylogenetic scale, the id becomes increasingly estranged from its reality, giving rise to the need for greater ego functions. For psychoanalysis this estrangement of instinct from nature leads to inescapable problems in biological expression and fulfillment; for Piaget, however, this development of mind does not bring about any psychological disharmony.

The other major difference between Piaget and the classical epistemologists is his emphasis on the role of action in cognition. For Piaget an object is known to the extent that it is acted upon or forms part of an action process. Cognitive functions not only subserve action but also are forms of action themselves. Thinking is not only for action but also is action. What Piaget calls operational thinking is in essence internalized action sequences; thus the early motor action sequences constitute the source of all later cognitive operations. This stress on mind as action and as specifically concerned with solving problems that will insure adequate functioning helps explain Piaget's notion of the nature of intelligence and of some of the driving forces in cognitive growth. This view of thought as internalized action shows Piaget's roots in pragmatism and ultimately his seeming disinterest of the richness of inner life.

Growth as Sequential Equilibration

Piaget broadly equates intelligence with biological adaptation, which he sees as more complex than simply survival or the establishment equilibrium between organism and environment. Adaptation is a process involving the reciprocal sequences of assimilation and accommodation. By assimilation is meant the process whereby "reality data are treated or modified in such a way as to become incorporated into the structure of the subject." The environment is grasped or reacted to only if it can be fitted or transformed

into the existing mental capabilities of the subject. For Piaget "intelligence is assimilation to the extent that it incorporates all the given data of experience within its framework." The corollary process, accommodation, occurs when alterations in the environment cause the organism to broaden its mental framework so as to integrate the new data. Rather than altering or misperceiving the stimulus to fit pre-existing cognitive modes, the organism must modify itself to deal with this new experience. Each process is never pure since each assimilation introduces some new element that causes accommodation; and each accommodation, by creating new mental schemes, sets the stage for more sophisticated assimilation. It is this interplay between assimilation and accommodation that describes the progressive enlargement and development of mental structures or schemes. At each stage of mental development there is a constant sequential balance between the two processes. It is important to note Piaget's stress on the reciprocity of stimulus and response. The cyclic process can be found in all stages of development, from the neonate's spontaneous movements and reflexes to the adult's abstract formulations.

Although the equilibration of assimilation and accommodation are used to describe development, these are not the forces that cause cognitive growth; rather Piaget delineates four general factors that are important causes for mental development. The first factor is organic growth or maturation of the nervous and endocrine systems. A second factor is the role of exercise and

acquired experience from action performed upon physical objects. This area of development relates directly to firsthand experience with the routine physical world. The third factor is social interaction and transmission. The fourth factor is an inherent striving toward equilibrium or self-regulation. This last factor is as far as Piaget seems willing to go in favor of any pre-established or teleological view of development. He quite specifically states, "in the development of the child there is no pre-established plan but a gradual evolution in which each innovation is dependent on the previous one."

The Stages of Cognitive Development

Through the interlocking processes of assimilation and accommodation there is a progressive evolution in the mental structures that are utilized to adapt successfully to the environment. Piaget's experimental effort has been to investigate and describe the schemes or modes of mental organization at various stages of development. This goal helps explain his most frequently used experimental method called the "clinical method," in which children of various ages are asked to perform the same or similar tasks. Following the presentation of a task the child is asked about his understanding of his performance. Piaget is not so interested in the result of the child's behavior as in the types of mental procedure that underlie the child's performance at various stages of ontogenesis. Through these investigations Piaget has been able to document a series of stages that describe the major cognitive modes of

childhood. What changes during development are the mental schemes, the mode of organizing and constructing experience.

The earlier or more primitive schemes are concerned with action per se without ideational representation; they are characteristic of the sensorimotor period that extends from birth to roughly 24 months of age. Although behavior during this period is essentially devoid of any conceptual representation of the external environment, the behavior is generally adaptive and therefore "intelligent." At first the sensorimotor level is characterized by reflexes, which, however, should not be conceived of as pure automatism, but as requiring exercise for their continued usage and development. Thus after a few days the newborn "nurses with more and more assurance and finds the nipple more easily when it has slipped out of his mouth than at the time of his first attempts." This stage of reflexes gives rise to the stage of acquired habits. The infant begins coordinating vision and prehension; that is, the child begins to manipulate freely objects in his visual field. This ability to act upon environmental objects initiates what J. M. Baldwin had called a "circular reaction," which implies the eliciting of a stimulus from the environment as a result of the infant's behavior, which, in turn, tends to affect further behavior. In this manner the response pattern tends to prolong itself and to stabilize its own existence. Through a positive feedback mechanism a primary circular reaction is the exercise and practice of innate reflexes such as thumb-sucking. The secondary circular reaction,

however, is more akin to what has been called operant conditioning. The infant's behavior accidentally produces an environmental change that causes a repetition of the act that had fortuitously produced the change. This type of behavior appears around four months of age and ushers in the beginning of intentional adaptations, that is, the beginning of an act in the service of a desire, and with it a gradual differentiation of means and ends. Piaget describes how the child learns to pull a cord in order to cause the shaking of a rattle at this stage. At the same time the child begins to separate internal actions from external results. He begins to form the concept of an external world of permanent objects existing in continuous space. After the age of four months the child begins to react toward a partially hidden object, such as the nipple or a bottle, as he formerly did toward the whole bottle. In the next stage of the sensorimotor level extending from 8 to 12 months, the child is able to utilize his action schemes in new situations to produce novel results and achieve new goals. The schemes have become an instrumental act that can be applied to varied situations.

There are correspondent advances in the child's concept of an object. At about one year of age the child can search for an object if it is placed behind a barrier. Thus the child has the concept of the permanence of that object that continues to exist even when it is not directly observed. However, if the object is removed from behind one barrier and in full view of the child placed behind a second barrier, the child will continue to search for it behind the first. The

child has the idea of object permanence but not of the multiple displacements of the object. It has to exist where it belongs. It is not until a later stage extending from 12 to 18 months of age that the child appears to understand the multiple displacement of objects and to search for the object wherever it was last put. Yet at this stage the child still cannot cope with "invisible" movements. Thus if an object such as a ball is held in a clenched fist, the fist put behind a pillow and out of view of the child, and the ball released behind the pillow, the child will persistently search the hand for the ball, never considering that the ball may have been left behind the pillow. It is only with the last stage of the sensorimotor level of intelligence, extending from 18 to 24 months of age, that the child can conceive of actions that he does not witness directly and thus searches for the ball behind the pillow even though he did not see *it put there*.

The later stages of sensorimotor development are also characterized by tertiary circular reactions whose central attribute is the invention of new behaviors to achieve desired ends. In the secondary circular reactions the child was able to use established patterns in novel situations. Here the response pattern itself is original. This behavior is similar to trial-and-error learning in which alternate solutions are attempted until the correct one is accidentally stumbled upon. It is important to note that these schemes are not created *de novo* but evolve from acquired habits that, in turn, grew out of innate reactions.

The final stage of the sensorimotor level is marked by the beginning of internal representation, which is the transition to later forms of intelligence. The child is able to find new means, not only by "external or physical groping but also by internalized combinations that culminate in sudden comprehension or insight." There is no longer a need to see objects in order to realize their permanence. The ability to picture objects mentally allows the child to search for them after multiple displacements. This understanding underlies the child's concept of spatial relations. The idea of an object being able to cross a path from multiple fixed positions is basic to seeing space as a continuous medium. At the same time the internal representation of space is necessary for the child to see himself in a space and to be able to follow a continuous map from one position to another. A possible limitation of Piaget's pragmatic view of thought as internalized action sequences is his relative neglect of the importance of internalized images during early childhood. The works of Melanie Klein and later Arieti have shown the crucial role that internalization of emotionally important personages and events during this stage plays in later life. Similarly, although Piaget has devoted an entire book to the subject of symbolism, he seems to view the symbolic functions of the mind in terms of their use for strategies and not important in their own right, as emphasized by Cassirer and Langer.

In summary, the sensorimotor level traces the development from birth to the beginnings of internalized thought. It shows the evolution of habits

from reflexes and trial-and-error behavior, culminating in internalized action schemes that make possible the mental manipulations of objects that are not immediately present. With the advent of true representative cognitive structures, the child is no longer at the stage of sensorimotor behavior, yet, on the other hand, neither is he able to form "operative" schemes, which imply a separation of thought from the immediate aspects of reality. The stage of operational thinking consists of representational actions that are reversible in thought but not necessarily so in reality. Prior to this stage the schemes are "preoperational." They are composed of internalized actions but are still tied to perceptual rather than cognitive criteria.

Another characteristic of the preoperational level is "egocentric" thinking, which should be taken only in its epistemological sense: the child cannot put himself in the place of another person. For example, when asked to describe the view of a model of mountains from positions other than his own, the child at the preoperational level is unable to describe or to select out a proper perspective of the model other than what he sees from his own position. There is also a similar ascendancy of assimilation over accommodation. The child tends to fit his experience into his own categories rather than to expand these categories to give a more realistic grasp of his environment. This is evidenced by the preoperational child's great use of fantasy in play. The play is unhampered by external rules, which are altered as the situation demands, or by a strict adherence to the realistic nature of

objects. These characteristics help explain another aspect of the preoperational level, that of ascribing a willful causality to most physical events. For example, children feel that night comes so that we can go to sleep or that if you put on a raincoat it will rain.

This level of intelligence can further be subdivided into two stages, that of preconceptual thought, which lasts from roughly age two to age four, and that of intuitive thought, which lasts from roughly age four to age seven. The former stage begins with the internalization of action, that is, the conceptual intelligence. The child shows deferred imitation, which gives evidence of the beginnings of this internalized representation. The transition from representation in action to representation in thought is reinforced through symbolic play and through the use of drawing and painting materials. Finally the development of language gives the child the usage of symbols by which to handle internal images and memories. Through language the child can represent a long chain of action sequences very rapidly (while at the sensorimotor level the child had to follow events without altering their speed). The reasoning of the young child, however, is still concrete and at the same time distorts reality. Piaget describes how the young child forms primitive classes based on particulars of objects that have no essential relevance. As stated above, this process, which Piaget calls transduction, is similar Werner's *pars pro toto* reasoning. The particular of an object is equated with the whole in relating objects. The child has not as yet derived a

system of concepts that separates details of objects from their essential nature. This centering on an unessential, although perhaps the most conspicuous, aspect of an object continues into the intuitive phase.

The second phase of preoperational intelligence is characterized by a growing capability of separating thought from action. The child is better able to group objects into classes, but only on a perceptual rather than a cognitive basis. The child has not achieved the primacy of thought over appearance. For example, Piaget presented children with a box containing 20 wooden beads, 18 of which were brown and 2 of which were white. The children were then asked whether a necklace made from the brown beads would be longer, shorter, or equal in length to a necklace made from wooden beads. Children at the intuitive level mostly replied that the brown beads would make the longer necklace. From this and similar experiments Piaget concluded that the child at this stage is incapable of thinking of two subordinate classes, that is, white and brown beads, at the same time as he is thinking of the whole class, that is, the total number of wooden beads. The child's attention is centered on the preponderance of brown beads in relation to white beads, the most conspicuous property, and he cannot simultaneously switch from the relation of "brown beads to white beads" to the relation of "brown beads to the total number of beads." The child's thought is guided by the perceptual aspect of reality. Children continue to conclude that a brown bead necklace would be longer even after they acknowledge that there are more wooden beads than

brown beads. The point is that these two aspects of the same situation cannot be integrated at this level. At the level of concrete operations, stretching from roughly age seven to age eleven, however, the child immediately answers that the wooden bead necklace would be longer because "there are more wooden beads than brown beads." Here the child can simultaneously take into consideration the relation of brown beads to white beads (part to part) and brown beads to wooden beads (part to whole). Piaget asserts that at this later stage the child's thought is "decentered," that is, no longer exclusively focused on the perceptual, and is "reversible," that is, can move back and forth through a logical relational thought sequence.

These principles are also exemplified by Piaget's experiments on conservation. One of these experiments involved an equal amount of liquid in two identical beakers, A-1 and A–2, which the child acknowledged as the same. The liquid from beaker A-2 was then poured into two smaller beakers, B-1 and B–2, directly in front of the child. The child is then asked if the liquid in the beakers B-1 and B-2 was equal to the amount in the original beaker A-1. Children at the intuitive level of intelligence felt that the quantity of liquid had been altered when poured into the two smaller beakers. Similar alterations in quantity were ascribed to when the liquid was poured into different shape beakers, although here again the liquid was poured directly in view of the child. Piaget concludes that these interpretations are due to the child's lack of the schemes of reversibility and conservation; the child centers

on what he sees and cannot disengage his thought from his perceptions so that he can mentally reverse the process and conclude that the amounts of water were originally the same. Because of this perception bound set the child cannot consider two aspects of one situation simultaneously, but can only examine one aspect at the expense of all the others. For example, when the child at this stage is shown a ball of clay that is rolled into a sausage shape, he will say that there is either more clay because the sausage is longer than the ball or less clay because the sausage is thinner than the ball. The child cannot conceive of the ball simultaneously becoming both longer, thus having more clay, and thinner, thus having less clay. It is this ability to attend to two aspects of the environment and to relate them in a coherent fashion that leads to the scheme of conservation and marks the beginning of the operational stage. Similarly with the bead experiment described above, the child in the preoperational stage cannot conceive that white beads and brown beads equal wooden beads. He is centered on the color and cannot conceptualize the two aspects of color and total number simultaneously.

It is with the onset of the operational period that perceptual appearances no longer predominate over thought processes. In this period thought becomes truly "operational," that is, independent of what is phenomenologically possible. The child can go through action steps in his mind that would be impossible in reality. With this enlargement of perspective or "decentering," the child at seven or eight becomes less

egocentric. He can shift rapidly between his own views and the views of others, facilitating communication because there is also less idiosyncratic meaning given to words. There is an overall autonomy of the central cognitive processes from the immediacy of the situation. Thought begins to follow a logical, rather than a haphazard, perceptual structure. The child forms the schemes of reversibility and conservation despite perceptual evidence to the contrary. The schemes are seen to go from a quasi-logical order of groupings to a higher hierarchical level of classes.

Yet during the first part of the operational period children can only reason in this manner when they are actually manipulating concrete objects. Their abilities are not revealed on a verbal or nonrepresentational task. A child who can easily arrange a series of dolls according to height and match the dolls to different size sticks either in a progressive or reverse order cannot as yet answer questions such as "Jane is lighter than Nancy. Jane is darker than Lois. Who is the darkest of the three?" The child can reason independently of perceptual influences, but only when the elements of his cognitive behavior are concretely present. Thus the first part of the operational period is called that of concrete operations. To quote Piaget,'" "The concrete operations relate directly to objects and to groups of objects (classes), to the relations between objects and the counting of objects. Thus the logical organization of judgments and arguments is inseparable from their content." The child can only reason with what is palpably before him. He

cannot utilize nonrepresentational abstractions in his cognitive operations. There can be no hypotheses unless the elements of the propositions are directly present in reality. The eventual freeing of thought from content makes the advance to the stage of formal operations possible. In this final stage there is a disconnection of thought from concrete objects so that the mind is capable of dealing with relationships between things rather than with only the things themselves. The preadolescent becomes capable of forming classes according to abstract principles and similarities that defy concrete representation. This "combinatorial system" allows the mind to consider all possible alternatives of any given situation. Some ramifications of this advance are that the adolescent can conceive of the future and plan for it, can think not only about concrete things but also about his own thought.

Furthermore, this ability to consider all alternatives leads to an "experimental spirit." The adolescent, when presented with a problem, takes a preliminary inventory of all the factors and then varies each factor alone, keeping the others constant. At the level of concrete operations the child proceeds directly to action with little attempt at systematization. One of Piaget's and Inhelder's experiments demonstrates the difference between concrete and formal operations quite clearly. They arranged a series of jars of colorless liquids and then showed the child that by adding a few drops from the last jar to an unknown mixture of the liquids a yellow color could be produced. The significant aspect of this problem was that there was no way

for the child to figure out ahead of time which mixture of liquids would produce the yellow color once the indicator was added. Inhelder and Piaget then observed the manner by which children tried to combine liquids to arrive at the yellow color. The younger child attacked the problem by adding a few drops from the last jar to each of the others and then felt essentially defeated. From here on he proceeded in no particular order and usually did not think of mixing various liquids and then adding the drop from the last jar. The child at the stage of formal operations, however, solved the problem by systematically going through all combinations of liquids, often keeping notes to be sure that he could keep track of his experimentations. Eventually he not only solved the problem but also identified the different liquids as to their relationships. For example, one jar contained a substance that prevented the color from appearing. Therefore, in the stage of formal operations the person can generate theories about relationships and derive laws that will explain occurrences in the environment. These laws are not limited to their immediate content and can be applied to analogous events. To quote Piaget, "indeed the essential difference between formal thought and concrete operations is that the latter are centered on reality whereas the former grasps transformations and assimilates reality only in terms of imagined or deduced events.[6]

Summary and Overview of Piaget's System

It will be obvious at this point that Piaget and his associates have derived an enormously rich and complex concept of development, any small segment of which could generate an enormous amount of research and study. However, it is important in reading Piaget to constantly keep in mind his overall system and his epistemological interest. Briefly Piaget believes that cognitive growth is best described as the progressive evolution of the schemes that underlie outward intelligent behavior. At the sensorimotor level schemes are pure action, but gradually this action is internalized into mental representation so that the schemes become truly cognitive. These cognitive schemes progress from representations of the environment to more sophisticated attempts to construct an understanding of the world. During the preoperational phase this construction of reality is haphazard and follows a loose, disconnected pattern. Objects and events form groupings rather than logical classes and are associated by idiosyncratic or egocentric linkages. The child centers on the most obvious perceptual elements of his environment. This dependence on what can be observed is gradually subsumed under what can be reasoned, exhibiting the supremacy of thought over perception. This decentering allows the mind to follow reason rather than appearance. Piaget thus differs from the Gestalt psychologist's attempt to describe perception and cognition by similar laws. For Piaget these functions are entirely different, with perception being an inferior and more rigid form of behavior. The mind conceives of schemes, such as reversibility, that are impossible in

the real world. At first these operations are possible only when directly involved with concrete objects, but eventually operations involving abstract, non- representational forms are evolved. Piaget thus views cognitive development as progressively freeing thought from its concrete surroundings, culminating in abstract schemes that are totally independent of concrete experience. At the same time, however, Piaget remains firmly rooted in biology, stressing that each advance in schemes serves the more pertinent purpose of organismic adaptation. Piaget seems most interested in the mind as a creator of strategies and as the solver of problems. In later years he has devised mathematical-logical models to describe the mind's processes at various stages. As such, he has been less interested in the irrational, poetic, and creative aspects of mind, and his effort has been one of a rigorous logician.

In recent years there has been a renewed interest in Piaget that might be best described as an explosive revival. Piaget has been discovered, not just by developmental psychologists, but by educators, philosophers, social theorists, and psychoanalysts. Some applications of Piaget's work have been extremely important and interesting. Inhelder has applied some of Piaget's concepts to the diagnosis of mental retardation, which might ultimately culminate in a new system of intelligence testing. Others have used Piaget's experiments to assess the effects of cultural differences. Golden and Sims, for example, found that children of varying social classes did equally well on

experiments like Piaget's until two years of age, when lower socioeconomic groups of children began performing much more poorly than higher socioeconomic groups. Wolff has attempted to integrate psychoanalytic findings of object relations with Piaget's work on object constancy in infancy. Odier has utilized much of Piaget's work to show the childhood origins of adult symptoms when extreme anxiety causes a reemergence of prelogical forms of cognition. For example, Odier sees a resemblance between the child's reification of his own feelings and perceptions in believing in their objective reality and the adult's use of projection in pathological states. Similarly Freeman and McGhie have attempted a description of schizophrenic thought according to Piaget's levels of cognitive development, and Anthony has tried to apply some of Piaget's concepts to child psychiatry. Although these applications have been salutary, Piaget has warned against the overly pragmatic use of theory and what he calls "the American question," meaning the ways by which to speed up intellectual development. Piaget makes a strong point that development has to proceed at its own pace. Too much stimulation or instruction is simply not assimilated and eventually might be harmful.

Finally Piaget seems more interested in theory than in these pragmatic applications. In his summary works he quotes experiments that test other theoretical hypotheses rather than practical aspects of his own work. While much applied, and misapplied, to all sorts of educational and psychological

endeavors, Piaget seems to wish to remain in the realm of philosophy and epistemology rather than applied science.

The Psychoanalytic Approach to Cognitive Development

Until recent years the field of cognitive development played a very limited role in psychoanalytic thought. Although certain cognitive concepts have always been a part of psychoanalysis, these have been used mainly in reference to symbolization in symptoms and distortions in dreams." The study of cognitive life as recognized by academic psychologists was considered to be too superficial or too removed from basic motivating forces to exert any real effect on development. In addition, the early years of psychoanalysis were primarily devoted to the demonstration of the existence of unconscious life, infantile sexuality, and psychic determinism—against massive opposition—so that such topics as cognitive development had to await easier times.

Nevertheless, any system of psychology as far-reaching and comprehensive as psychoanalysis could not entirely ignore cognitive factors, and Freud did attempt to formulate a theory of thinking. According to this model, mental excitation flowed from sensory structures to the motor process that discharged the excitation. Along this basically S-R path memory traces were activated by the excitation, aiding in the choice of discharging action.

When, however, the ability to discharge the energy through action was blocked, it reversed its flow back toward the sensory end, resulting in an internal psychic experience rather than action. This model sought to account for dreams, hallucinations, and psychiatric symptoms. The point of this model is that thought or conscious experience occurs when motor discharge of energy is blocked. In a later paper Freud used the same model to account for the mental life of infants and the development of thought. The beginnings of thought or images appear when instinctual satisfaction, and thus the discharge of energy, is not possible because of the lack of a satisfying object. The instinctual energy then activates a memory trace of previous satisfaction as an attempt to partially discharge the energy, and this previous state of satisfaction is hallucinated by the child. Therefore, thought begins as an attempt at wish fulfillment and follows what Freud called the "pleasure principle." Ultimately, however, the hallucinated satisfaction does not really gratify the instinctual need, and the infant must come to grips with external reality as well as his internal wishes. There is, therefore, a transformation to the "reality principle." However, the mind is always ready, as in dreams or in psychosis, to revert to an hallucinatory world of pleasurable wish fulfillments. Freud's view of mind, his metapsychology, has been repeatedly criticized as being limited by the prevalent scientific modes of thought of his time. This early description of the "psychic apparatus" leans heavily on energetics and resembles the hydrodynamic models of physics popular at the turn of the

century.

Eventually, through the evolution of psychoanalytic theory, thought became more than simply an internal agency of wish fulfillment. As a result of revisions brought about by the "structural theory" and ego psychology, the ability to internalize action sequences into thought took on protective aspects and evolutionary significance. The ability to think was seen not just as a way of postponing actual satisfaction and temporarily discharging energy, but as a means of trial action that helped the individual adapt to his environment. Hartmann- especially stressed this pragmatic survival function of thought in psychoanalytic theory emphasizing its adaptive and "conflict- free" functions. Nevertheless, Hartmann attempted to reconcile his "new" view of the ego with the original economic theory of the "psychic apparatus" as an instrument to reduce tension or energy of the instincts.

Later psychoanalytic thought stated that the ego does not arise out of the id through conflict resolution, but that the ego and its functions develop independently if the environment is adequate. This significant innovation stresses that the ego (and thus cognitive functions) has an autonomous development that unfolds throughout ontogenesis and that development is not contingent on resolution of conflict. Anna Freud has extensively documented various "developmental lines" that trace the path of ego functions through childhood, stressing mastery of such areas as eating,

eliminatory functions, body management, as well as relationships to others.

Concomitant with these views on the purpose of thought in ontogeny and phylogeny, Freud postulated two great classes or modes of thought that he called the primary and secondary processes. The primary process was solely concerned with the discharge of energy through any means. Its goal was release of tension or pleasure, and it was not characterized by any strict logical structure. This primacy of instinctual discharge was described in terms of "loosely bound cathexes," which meant mobility and instability. Cognitively this meant that instinctual energy could be displaced onto neutral figures, or that an image could become a composite of many objects (condensation), if this facilitated tension reduction. The primary process was essentially the mode of the unconscious; it manifested itself in dreams, psychosis, parapraxis, and other symptoms that revealed the true instinctual desires of the individual. On the other hand, the secondary process is characterized by Aristotelian logic and typifies most of our everyday conscious behavior. This secondary process mode of thought is concerned with the individual's relationship to his environment rather than with the release of tension. In terms of development the infant's cognition follows the primary process and his main concern is the attainment of pleasure. Through repeated frustrations, however, the infant learns to cope with the environment, and through the attainment of the reality principle he develops secondary process modes of cognition. This gradual transition from primary to secondary

process and the development of ego controls over the biological drives that cannot be expressed because of environmental restrictions have formed the bulk of psychoanalytic studies on the development of cognitive structures in the child. David Rapaport, who was perhaps the psychoanalytic theorist most interested in cognitive theory, stated quite clearly that the major concern of psychoanalytic formulations in the development of cognition was to trace the evolution of ego mastery in the perpetual conflict between satisfaction of internal drives and societal demands. Numerous psychoanalytic studies of child development repeat the theme of ego mastery and view cognitive growth only in the service of this primary aim.

Only in recent years have psychoanalysts turned their attention to cognitive processes as significant in their own right and not simply as better methods of defense against unconscious drives. One problem that is currently attracting a great deal of attention is the process of internalization of environmental figures and events into intrapsychic structures. Sandler, in a number of articles, has stressed the importance of the "representational world" inside the mind as directing behavior. Schafer, in an important monograph, has tried to refine the vagueness ascribed to terms such as introjection, identification, and incorporation that are commonly used in psychoanalytic parlance. Although these attempts are crucial in directing study to the child's cognitive experience and lessening the emphasis on the pure unfolding of instinctual processes, this area of research is still in its

beginning stages and has not as yet arrived at definitive formulations. Other authors who have dealt with topics such as identity formation or the relation of the self to environmental figures without trying to integrate their theories into an energetic model have, on the other hand, refused to classify their concepts as basically cognitive as if this meant a betrayal of psychoanalytic principles.

Another avenue of psychoanalytic study has been the work of Arieti, who has dealt with the development of inner reality and motivational forces from a truly cognitive frame of reference. While praising the psychoanalytic emphasis on inner life, Arieti'' disagrees with its stress on instinctual and biological forces. He believes that the individual is ultimately motivated by higher order concepts such as expectancies of others, demands from the self, and internalizations of significant others rather than discharge of energy or primitive biological needs. In a recent book Arieti has attempted to describe the development of these inner concepts through ontogenesis. His concern has not been with the child's ability to manipulate the physical environment as much as with the transformation that occurs in intrapsychic life.

He describes the first months of life as dominated by "simple feelings," or "protoemotions," such as tension, appetite, fear, rage, and satisfaction. In general, these protoemotions are global, nonlocalized bodily experiences that are elicited by a stimulus directly present in the environment. These

sensations require a minimum of cognitive ability and appear to be the felt components of autonomic reaction patterns.

Toward the end of the first year of life, according to Arieti, the infant begins to retain enduring mental representations of external objects, events, and relationships. The child can create an image—a memory trace that has psychical representation. The image becomes a substitute for the external object and can from then on direct behavior. With the formation of the image inner life truly begins. Cognition can no longer be considered a hierarchy of mechanisms but a psychological content that retains the power to affect its possessor, now and in the future. In contrast to Piaget and some of the stricter learning theorists, Arieti is concerned with the content as well as the processes of the child's psyche. This ability to create lasting internal images initiates the child into what Arieti calls the *phantasmic stage of inner reality.* This stage is characterized by a higher level of emotional life since the child responds to internal mental constructs as well as to the stimuli of the environment. Arieti calls these feelings "second order emotions" because they are not elicited by immediate, external threats to homeostasis but by the anticipation of such a change; that is, by a mental event that predicts an external event. In this manner purely inner cognitive events begin to alter the life of the child. As early as 1947 Arieti attempted to separate fear and anxiety on a cognitive basis: fear is a primitive reaction to an environmental object, while anxiety results from an anticipated image, that is, from a cognitive

construct.

At this stage of development the child also constructs what Arieti has termed the "paleosymbol." By this he means a specific mental concept that represents something that truly exists in reality but whose meaning and value are highly private and personal; the meaning of the paleosymbol is not commonly shared by others. These highly idiosyncratic values given to paleosymbols may account for the young child's seemingly irrational likes or fears of common objects. According to parental handling, neutral objects such as a feeding table or baby stroller can become internally associated with various emotions so that as rudimentary symbols for these objects are internalized, specific meanings are given to their internal representations. For Arieti not only is the creation of symbols in the service of external adaptation, but also it is essential for the construction of inner life; they become the building blocks for psychic reality. Again there is an important emphasis on inner content and its emotional impact as well as on adaptation to external demands. In addition, however, at this phantasmic stage of development the child has difficulty in clearly distinguishing between internal and external reality. Much of what has only internal meaning is projected or acted out on the environment. The child readily mixes fantasy and fact. This flexibility may account for the richness of clinical material that may be obtained through symbolic play techniques with children. At this stage they literally act out their inner fantasies through the use of dolls and the like, losing themselves in

the context of play so that it is no longer "play" in the adult sense of the word, ft is only gradually that the child separates the two domains of internal and external reality. This final separation begins to be accomplished when the child is able to form true concepts and has completely mastered verbal means of expression.

Between the phantasmic level of inner experience and the eventual mature form of psychic reality, Arieti postulated the emergence of a mental construct that he calls the "endocept." By this concept Arieti means a primitive organization of memories and images that, however, are nonrepresentational. The endocept is a feeling state that cannot be expressed with the precision of language: it is "at times experienced as an 'atmosphere,' an intention, a holistic experience which cannot be divided into parts or words . . ." (p. 97), comparable to what Freud has described as the "oceanic feeling." This experiential level can be relieved in adult life in aesthetic experiences or in certain empathic feelings toward others.

However, in regard to purely cognitive growth the phantasmic world of paleosymbols is replaced by a primitive attempt at logical thinking. Arieti calls this stage of experience "the paleological world," stressing both its primitive and its logical characteristics. During the first stage there is an attempt to structure experiences and to associate events into broader categories, but the associative linkages are highly arbitrary and idiosyncratic.

Arieti describes this clustering of mental events as a "primary aggregate," appearing like a strange agglomeration of disparate things put together, as they are in a collage. At other times it may be recognized as an embryonic structure from which conceptual structures eventually emerge. Or in some cases it may even embrace a field that at higher levels of development corresponds to a highly abstract concept. The primary aggregate form of cognition is replaced by "paleologic thinking." While not as yet conforming to the adult standard of Aristotelian logic, this form of mentation is not haphazard; it does follow specific laws or organization in which elements of thought are arranged into classes. However, the characteristics by which this organization of elements takes place appear insignificant or unessential to the adult. Objects or events are seen as identical if they have one quality in common. This stage is comparable to Piaget's preoperational level, where objects were associated by their most prominent perceptual quality, as well as to Werner's *pars pro toto* functioning. It is also similar to what Freud had described as primary process thinking as universally manifested in dreams. For example, an individual may dream that he is in the presence of a king, and on analysis of the dream he will reveal that the king was representative of the dreamer's father. Here a similar element (exalted authority) had been used to create a paleologic identification. In view of the similarity of paleologic thinking to the primary process, Arieti terms its form of cognitive organization the "primary class." In contrast, what Arieti calls the "secondary

class" (similar to Freud's secondary process) is a collection of objects or events that have elements in common, but these elements are seen as similarly modifying the event or object. Each of these similarities is seen as separate from the object that may be abstracted or conceived of in pure form. This type of organization that underlies adult thought does not deduce identity from similarity. However, in pathological states such as schizophrenia, there may occur a reversal to primary class formation, explaining the peculiarities of thought found in this disorder. This "teleological regression" to primitive forms of cognition is utilized to satisfy inner needs that cannot be gratified in reality.

While the phantasmic world was predominantly visual and static, the paleologic world is mainly auditory and utilizes language. Together with linguistic forms there is also an appreciation of sequence and causality. The paleologic world is not inhabited by copied images of reality, but by rudimentary abstractions. The child can begin to reason and to build on his experience: he can separate similar data from the manifold of objects and begin to organize these objects into classes. However, because this process of abstraction is far from complete, the part is often confused with the whole, or two dissimilar events can be conceived of as identical. In other words, reality can be severely misunderstood and as a result internally misrepresented. As a result children are prone to make generalizations that follow a primary class organization and are unfortunately retained into adult life. These early

misrepresentations are all too often seen in the irrational behavior of adults.

Concomitant with this increased ability to organize life events, the child begins to consider problems of causality. Prior to this stage, according to Arieti, the child's world is acausal, events simply occur. As the child begins to give causes to events, however, he utilizes extremely teleological explanations in which most things occur because someone has so willed them. Arieti speculates that this explanatory model is chosen by the child because so much of his life is actually determined by the will of powerful adults. The pertinent aspect of this new dimension of thought for the emotional and cognitive development of the child is that events are caused by people and thus one is responsible for these events. This new insight is necessary for what Arieti calls "third order" emotions. These emotional states presuppose a knowledge that a person can have an emotional affect on another, that one can cause a feeling state in someone else. Typical of this highest class of emotions are depression, hate, love, and joy. Here again Arieti is stressing that affective states grow in correspondence to cognitive development.

When the child reaches the level of conceptual thought—that is, his internal world consists predominantly of consensually validated concepts, rather purely personal symbols or images—secondary process mechanisms truly prevail and concepts are organized into secondary classes. This type of cognition becomes perfected through childhood and reaches true prominence

in adolescence. Arieti's use of the term "concept," however, encompasses more than is generally acknowledged by developmental psychologists. He is more interested in internal concepts such as one's self-image or one's view of the mothering figure. These concepts are in a state of change throughout development just as concepts of geometry or logic differ at various stages of childhood. Furthermore, according to Arieti, these concepts should be viewed as cognitive structures in their own right. Arieti believes that ultimately we are motivated and gratified through mental concepts rather than through instinctual energies. As the child develops, higher order concepts form his aspirations and fears. These mental structures should be seen as cognitive and not reduced to physiological drives. Here there is a blending and reinforcing of the affective and cognitive aspects of development. Even neurotic defenses should be viewed as cognitive configurations rather than solely emphasizing their affective or energetic basis. To quote one of Arieti's recent articles:

> In a large part of psychiatric, psychoanalytic and psychological literature, concepts are considered static, purely intellectual entities separate from human emotions and unimportant in psychodynamic studies. I cannot adhere to this point of view. Concepts and organized clusters of concepts become depositories of emotions and originators of new emotions. . . . Not only does every concept have an emotional counterpart, but concepts are necessary for high emotions. In the course of reaching adulthood, emotional and conceptual processes become more and more intimately interconnected. It is impossible to separate the two. They form a circular process. The emotional accompaniment of a cognitive process becomes the propelling drive not only toward action but also toward further cognitive

processes, [p. 23]

At each stage of development the evolution of cognitive structures that allow for a greater behavioral repertoire with the environment also creates a more sophisticated internal world with the emergence of higher level emotions and more abstract methods of mentation. Thus the motivation of the individual varies according to levels of development. Greater cognitive abilities give rise to higher order emotions, which, in turn, push toward growth of awareness, interpersonal relationships, and abstract processes.

In summary, Arieti has attempted to explore the growth of "inner reality" and the interlocking relationship of affective and cognitive structures in development. Furthermore, he has suggested that some psychic structures that are pertinent in everyday behavior, such as the self-concept, be viewed as cognitive entities that grow through ontogenesis. Arieti has stressed that the emotional aspect of development should not be neglected, and the reconstruction and understanding of the inner world of childhood has an important place in the study of cognitive development.

Conclusion

From the foregoing presentation of current theorists, it becomes apparent that the developmental process is directed at self-regulatory behavior and the relative independence of behavior from immediate

stimulation. Following a period of primarily reflexive, innate behavior, most theorists describe a stage of internalization of the environment so that events in the world can be mentally represented. Once this internal world is created, the child begins to structure stimuli and select adaptive responses rather than reacting automatically. However, as has been shown, this early representation of the environment is impressionistic and prone to error. The child is still bound to an egocentric yet concrete view of his environment, in which events and objects are associated by primitive logical linkages, into "nestings" or "primary aggregates" rather than hierarchical and logical classes. When the child begins rationally to order experience, it appears to be on a perceptual rather than logical basis. He responds to what is most striking in his environment rather than through understanding.

The last step in cognitive development, that of reason over appearance, is what Piaget has termed operational thinking. This divorce of thought from appearance is perhaps the true hallmark of the human psyche and the very foundation of human functioning. The reliance on logic and the attempt to formulate cognitive laws to order the chaotic world of the senses are the ultimate goals of cognitive development. It is equally important, however, to realize that cognitive development does not occur in a vacuum, but is interwoven with the development of internal emotional life as well as increased sensory and motor capabilities.

For many years the study of the ontogenesis of thought was predominantly an academic, ivory tower preoccupation. Today, however, the complexity of our modern industrial society, greater than at any time in the history of civilization, requires of each individual cognitive abilities that in the past were the province of a very small privileged minority. Despite this requirement for more sophisticated levels of mentation for both economic and social survival, an inordinately large percentage of individuals do not achieve this ultimate aim and cannot share in the rewards or responsibilities of modern society. The study of how the mind develops, the forces that affect this development, and the ways to correct deficiencies due to both internal and external forces has thus become a desperately important scientific discipline, not simply for the satisfaction of intellectual curiosity, but for the greater benefit of all.

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Notes

[1] An actual incident may demonstrate the role of cognition in the behavior of children. A three-year-old girl whose father often traveled by airplane developed an enthusiasm for flying. When the family planned to take a vacation and to travel by air the girl was ecstatic. However, when they were ready to board the plane the young girl panicked and refused to go on the plane. After calming her down, her parents inquired about the reasons for her "plane phobia"; the girl quite simply and honestly replied that she didn't want to get on the plane because she didn't want to shrink. The girl had been watching planes taking off and diminish in size as they became airborne, and her immature concept of size constancy did not allow for such rapid and extreme changes. The point is that her fear was a result of her immature cognitive ability and not of underlying dynamic events or prior learned habits.

[2] Hebb developed neurophysiological correlates of these types of learning. Very briefly, early simple percepts create "cell assemblies" or self-stimulating reverberating neuronal circuits in the brain. More complex impressions are stored in the form of "phase sequences" made up of a series of cell assemblies in a specific series. Although this aspect of this theory is important in neurophysiologv, its detailed explanation in terms of anatomy is beyond the scope of this chapter.

[3] In neurophysiological studies Hernandez-Peon, *et al.,* have found that distraction tends to shut out information. Similarly Galambos, *et al.,* have shown that stimuli that are not reinforced in terms of reward or punishment are extinguished and not recorded by the brain. The analogy is that unless language or sounds have meaning for the child they will not be integrated.

[4] See Chapter 49 American Handbook of Psychiatry Volume 1 for an exposition of these aspects of Werner's theories.

[5] These concepts clearly have their roots in biological theory. For example, primitive embryonic cells are undifferentiated and similar. Through maturation these cells differentiate and become capable of performing specific functions of the various organ systems. Furthermore, the cellular structure ultimately forms a hierarchy so that certain cells

control the activities of others and direct the organisms' behavior. These two principles, differentiation and hierarchization of parts, form the essence of Werner's definition of development.

[6] In a rigorous manner Piaget has been able to characterize formal operations as a system of four cognitive processes: i, identical transformations; n, inverse transformations; r, reciprocal transformations; and c, correlative transformations—each describing a process. Significant as this reduction is, a thorough exposition of it is beyond the scope of this summary.