

1 Perspectives for viewing intellectual development throughout the life course

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What has one voice and is four-footed, two-footed, and three-footed? The task of characterizing intellectual development throughout the life course can be likened to the situation that faced the Thebans as they tried to solve this riddle of the Sphinx. Oedipus gave the correct answer to this riddle: man, as man is four-footed as a baby, crawling on all limbs, is two-footed during the vast majority of the life-span, and in old age occasionally uses a cane as a third foot. Theorists and researchers of intellectual development, however, have largely addressed the riddle of intellectual development by segregating the life-span into two major periods, those of child development and adult development. This book brings together theorists who focus on these different portions of the life-span in an attempt to illustrate how work on intellectual development can benefit from issues and problems that arise from an examination of how intelligence is formed, is maintained, declines, and improves throughout the course of life. The hope is that by the viewing of intellectual development as occurring in the same organism through time, a deeper look at the consistencies and inconsistencies in the descriptions and explanations of intellectual development will be possible.

In addition to presenting a picture of intellectual development throughout the life-span, the book offers a fairly diverse representation of intellectual development from a variety of different perspectives. Perhaps now more than at any other time in the history of work on intellectual development, great diversity exists in the types of theoretical perspectives that guide research, with no one perspective dominating the field. Six different theoretical perspectives on intellectual development are offered: psychometric, Piagetian, neo-Piagetian, information-processing, learning, and contextual. Although these encompass a fairly broad view of the major theoretical perspectives guiding the field of intellectual development, clearly some perspectives are missing (e.g., comparative, biological, artificial intelligence). The six perspectives presented here are included because of their pre-

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dominance in guiding current research on the developing human's intelligence. In this introduction, I aim (1) to survey what is meant by intellectual development as seen from each of these perspectives, providing some historical background on the perspectives, and (2) to examine what we learn by considering intellectual development across childhood and adulthood.

Perspectives on the nature of intellectual development

To some individuals the word “intelligence” may be synonymous with intelligence testing and how well one scores on an intelligence test. The intelligence testing movement, however, and the psychometric perspective associated with it, is only one perspective of many employed in examining intellectual development. Although there is great diversity currently in the perspectives used to approach intellectual development, diverse views have existed since the early 1900s, when the field of intelligence testing first began. For instance, in 1921 the editors of the *Journal of Educational Psychology* (Intelligence and its measurement, 1921) solicited definitions of intelligence from several experts within the psychometric and “classical learning perspective” on intelligence. Their views included elementary cognitive processes (e.g., sensation, perception, attention), higher-order cognitive processes (e.g., abstract reasoning, problem solving, decision making), knowledge, speed of mental processing, the ability to adapt to one's environment, biological and physiological prewiring, and emotional and motivational components, among others. Sternberg and Detterman (1986) replicated this study with experts in 1986, finding at least as much diversity among views of intelligence as was found in 1921, if not more.

Divergence in views of intellectual development is not restricted to experts, as revealed by investigations of the beliefs children and adults of various ages hold about intelligence. Yussen and Kane (1981) found that young children believe intelligence consists of physical characteristics as well as the way in which individuals manage specific tasks. Sternberg, Conway, Ketron, and Bernstein (1981) found that lay adults see intelligence as a large constellation of behaviors reflecting practical problem solving, verbal ability, and social competence. Berg and Sternberg (in press) found that adults across the life-span view intelligence as consisting of dimensions such as interest in, and ability to deal with, novelty, verbal competence, and everyday competence, among other factors. The diversity present in laypersons' views of intelligence matches, if not exceeds, the diversity present in experts' views of intelligence.

The six perspectives on intellectual development offered in this volume entail differing views on how intelligence is formed, maintained, declines, and improves across the life-span. Even within a particular perspective, often a slightly different focus is adopted by those who use the perspective

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to study intellectual development during childhood from that adopted by those who use it to study development during adulthood. The differences in views of intelligence result, at least in part, from the perspectives' being at different points in development, with some in their relative infancy and some in advanced old age. That is, some perspectives have existed since the inception of formal psychological work on intelligence, whereas others are quite new in their formulation and empirical instantiations. These perspectives are also intertwined in that many of them developed in direct response to perceived inadequacies in other perspectives.

The advantages of viewing intellectual development from these six different perspectives are numerous. The primary advantage is that the picture constructed of what changes with age is much more complete when viewed from varying perspectives rather than from only one perspective. Each perspective affords a deeper look at a particular facet of intelligence. The psychometric perspective focuses on the intellectual products that characterize intelligence at different points during development (e.g., optimal performance on a particular measure of intelligent functioning). Other perspectives, such as the information-processing and neo-Piagetian, are more interested in the processes (e.g., mental processes, representations, and strategies) by which intellectual products are constructed. The Piagetian perspective focuses on the universal features of intellectual development characterizing most children or adults at a particular developmental period, whereas other perspectives focus on the differences among individuals. By examining all of these perspectives on intellectual development in one place, we may begin to understand a larger piece of the puzzle of intellectual development. In addition, such an integration of different perspectives on child and adult intellectual development may be a beginning step toward initiating theories of intellectual development that take into account multiple facets of intelligence across the full life course.

These six perspectives on intellectual development have been guided by different questions and issues. The following sections offer central questions guiding each perspective, as well as brief descriptions of the answers provided. In addition, a very brief historical view of the perspectives will be given in order to facilitate an understanding of the relation among the perspectives. Understanding the different questions directing each perspective, and the historical context of such questions, helps explain the variability in the methods and paradigms used in the following chapters to describe intellectual changes with age.

The psychometric perspective

The psychometric perspective has had the longest tradition in the field of intellectual development, with Sir Francis Galton's work on intelligence

tests in the 1880s generally regarded as the first on formal mental tests (Gardner & Clark, this volume; Kail & Pellegrino, 1985; Sternberg & Powell, 1983). Galton undertook his work in order to understand the implications of Darwin's theory of evolution for the study of intellectual development. Whereas Galton's mental tests consisted of basic physical–sensory abilities, Binet and others devised tests of intelligence that involved higher-order intellectual abilities such as attention, verbal comprehension, and reasoning. Binet is often recognized as the creator of the first intelligence test, when he was commissioned to identify children who would be unable to profit from public school instruction.

The question guiding the psychometric perspective to intellectual development has been that of how to characterize intellectual differences between individuals at various developmental periods. The view of intelligence coming from the psychometric perspective depends heavily on the tests used to measure intelligence. The psychometric perspective begins its investigation into the nature of intelligence by measuring the performance of individuals on specific intelligence tests. Statistical procedures such as factor analysis then summarize such individual difference data and illuminate the structure underlying the organization of individuals' performance on such intelligence tests.

As Gardner and Clark describe, the types of intellectual abilities found to characterize differences between individuals during infancy are perceptual–motor and sensory in nature (e.g., watching a ball swing from a string, grasping blocks and placing them in the correct cubicles). During later childhood a variety of different intellectual abilities distinguish individuals, such as verbal and mathematical skills, abstract and visual reasoning, and components of memory. Many of the intellectual abilities found to distinguish between individuals during childhood continue to distinguish between individuals during adulthood. As reviewed by Horn and Hofer, two broad constellations of abilities have been found to be useful during adulthood in characterizing differences between individuals: (1) crystallized intelligence, abilities that are influenced by acculturation and formal schooling (e.g., measures of vocabulary and world knowledge), and (2) fluid intelligence, abilities that require adaptation to new situations and that depend more on biological and physiological influences than on formal schooling (e.g., measures of abstract reasoning).

The Piagetian perspective

Piaget's perspective on intellectual development was formed during his early psychological studies in Binet's psychometric laboratory in 1919. Piaget's dissatisfaction with Binet and Simon's psychometric tasks, and the scoring of such tasks on a pass–fail system, led to the development of Piaget's

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“clinical method,” in which the reasoning behind a child’s answer was examined extensively. These investigations led Piaget to conclude that children’s reasoning at different ages represented qualitatively different ways of thinking.

A central question guiding the Piagetian perspective on intellectual development has been that of how to characterize the universal changes in mental functioning that take place from infancy to adolescence. Piaget (1952) characterized intellectual development as a process of constructing knowledge from our interactions with the environment, a process resulting in cognitive structures that were representative of a particular developmental period, or stage. Piaget viewed intelligence as the instrument that enables people to achieve an equilibrium between their cognitive structures and their environment: Intelligence “is the form of equilibrium towards which the successive adaptations and exchanges between the organism and his environment are directed” (1950, p. 6). Piaget identified four broad stages of intellectual development, which differed in the types of cognitive structures (described in terms of their logical properties) used to interact with the environment: (1) sensorimotor stage, (2) preoperational stage, (3) concrete operational stage, and (4) formal operational stage. Piagetian theorizing and research have focused on the similarities in cognitive structures among individuals at a given developmental period or stage. As Bidell and Fischer so eloquently discuss, the Piagetian focus on similarities between individuals of a given age has drawn attention away from the extensive literature illustrating variability in cognitive development.

Because Piaget posited that people achieve a final state of equilibrium between their cognitive structures and environment during the formal operational stage, occurring typically during adolescence, theorizing and research on intellectual development during adulthood were not given priority. But researchers who examine adult development and aging have investigated adults’ performance on many of the tasks designed to tap the last two stages in Piaget’s model – concrete operations and formal operations – in order to understand how Piaget’s theory applies to adult development. Blackburn and Papalia point out that the Piagetian perspective was found to need revision in order to address issues of concern during adult intellectual development (see also Labouvie-Vief).

The neo-Piagetian perspective

As both Case and Labouvie-Vief detail, the neo-Piagetian perspective evolved sometime during the 1970s as an increasing number of concerns and criticisms were raised about Piaget’s theory. Such concerns centered around the logical nature of the cognitive structures posited to underlie intellectual development and the viability of Piaget’s universal theory of intellectual

development for all children and for individuals past adolescence. The question directing theorizing and research in this area has been that of how best to revise and extend Piaget's perspective in order to address criticisms of Piaget's theory. Although the neo-Piagetian perspective preserves general Piagetian ideas of intellectual development (e.g., the essential concept of cognitive structures), several underlying postulates have been modified, with specific neo-Piagetian theorists extending Piaget's theory in different directions. (See Case for an extensive discussion of similarities and differences between neo-Piagetian and Piagetian perspectives.) In general, however, neo-Piagetian theorists can be characterized as being particularly interested in (1) understanding how cognitive structures are applied more locally within a domain and not universally across domains, (2) understanding individual differences in cognitive structures or their application, and (3) characterizing the integration of cognitive and emotional or affective structures.

Within child development, much of the neo-Piagetian research has involved a more fine-grained analysis of several Piagetian tasks, which were designed to illuminate cognitive structures representative of a particular stage. As Case's chapter illustrates, the detail of such an analysis is aimed at revealing the activation, integration, and consolidation of substructures operating for a given individual on a particular task. Such refined analyses elucidate processes of intellectual development not only between stages, but also within stages.

In the adult development literature, neo-Piagetian research and theorizing describes cognitive developments that occur beyond the last stage in Piaget's model (i.e., formal operations). Cognitive development during adulthood involves dialectical forms of thought, which are characterized by contradiction and change rather than by thinking that attempts to resolve contradictions, as in Piaget's equilibrium model. Labouvie-Vief reviews neo-Piagetian theories and research that illustrate how logical reasoning is integrated with affective and emotional ways of understanding.

The information-processing perspective

Although roots of the information-processing perspective can be traced back to nearly the late 1800s (see Lachman, Lachman, & Butterfield, 1980; Sternberg & Powell, 1983), most pinpoint its revival and current conception to two works published in the 1960s (Miller, Galanter, & Pribram, 1960; Newell, Shaw, & Simon, 1960), with much of the developmental work occurring in the 1970s and 1980s. This approach grew, in part, out of dissatisfaction with the classical learning perspective's emphasis on intellectual behaviors, to the exclusion of the mental processes by which such behaviors are produced.

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A central question for the information-processing perspective is that of how to characterize the processes by which an individual produces intellectual performance. More specifically, the focus is on what occurs between the input of information and the output of specific intellectual responses and how this changes across development. The information-processing perspective characterizes the process between input and output in terms of mental processes, representations, accessing knowledge, strategies, executive processes that monitor the system, and the availability of resources needed for this process. The information-processing perspective characterizes human thought as akin to the way in which computers access and process information.

As reviewed by Kail and Bisanz, during child development increases in performance on a variety of intellectual tasks are explained by changes in the strategies children use to approach tasks and by increases in mental effort that can be apportioned to tasks. Salthouse reviews how during adult development the concern is to describe the impairment in processing information with advancing age in terms of the use of ineffective strategies, deficits in processes that allow for retrieving information, and the amount of processing resources available for any given task.

The learning perspective

The traditional, or “classical,” learning perspective on intellectual development had its roots in the work of Thorndike and others in the early 1900s, with many of the learning theories of intellectual development published in the 1960s and 1970s by Bijou & Baer (1965), Gagne (1965), the Kendlers (Kendler & Kendler, 1975), and White (1965). (See Sternberg & Powell, 1983 for a review.) The learning perspective presented by Canfield and Ceci and by Charness and Bieman-Copland retains some of the concepts of the traditional learning perspective while adopting many of the cognitive constructs of the information-processing perspective, and it can best be viewed as a hybrid learning model. This hybrid learning model was addressed to weaknesses in the information-processing perspective, which had under-emphasized the content of knowledge as a locus of developmental changes.

A guiding question for the new learning perspective on intellectual development is, How does the amount and organization of knowledge affect intellectual development? Learning is depicted as the accumulation of information that is fine-tuned to be at the appropriate level of generality and specificity, and that can be restructured when new organizations of knowledge are needed. Development is likened to a process of becoming more expert with regard to one’s knowledge base, although experience will not always guarantee optimal performance on a particular task.

During child development, the interest is in how children accumulate knowledge and how content knowledge is restructured and fine-tuned into mature organizations of knowledge. In general, young children can be thought of as relative novices, whereas older children and adults can be considered relative experts in terms of their knowledge base (although Canfield and Ceci point out exceptions to this general rule). The message from the learning perspective is that differences in intellectual performance between young and older children are due, in part, to differences in the amounts and kinds of knowledge children possess about a host of concepts, knowledge that affects the efficiency of cognitive processes.

During adult development and aging, the main concern is with how to reconcile research that demonstrates decrements with adult age on a variety of intellectual tasks with the view that older adults should possess a richer and more extensive knowledge base due to their lifelong experience. Charness and Bieman-Copland note that there are disadvantages as well as advantages to having a larger knowledge base. Relevant to the advantages of learning, older adults' expertise in specific domains of knowledge (e.g., bridge, typing) often compensates for declining performance in lower-level cognitive processes. Related to the disadvantages of learning, Charness and Bieman-Copland discuss research that illustrates how a large and well-organized knowledge base may have negative consequences for the speed of using the knowledge base and for its proper activation.

The contextual perspective

The contextual perspective is perhaps the newest one on intellectual development in the field. Although the particular contextual perspective advanced by Wertsch and Kanner, the Vygotskian perspective, dates back to the late 1920s and early 1930s, its introduction to child development in the United States began in the 1970s and 1980s. The incorporation of contextual themes and research in adult intellectual development is also rather recent, as Dixon notes. The contextual perspective grew out of a concern that previous theories of intellectual and cognitive development were overly normative, in characterizing only universal aspects of intellectual development.

A guiding question for the contextual perspective has been, How does intellectual development reflect the specific contexts – sociocultural, biological, historical – in which intelligence is displayed? A distinctive component of this perspective is that intellectual development is posited to be disparate across groups of individuals who are situated in different contexts: Intellectual development might evince varying trajectories in different contexts, certain contexts may require the development of specific dimensions of intelligence, and different historical periods may have consequences for the form of intellectual development.

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Wertsch and Kanner focus on a specific contextual perspective, the Vygotskian approach, which has greatly influenced the thinking of several contemporary contextual theorists and researchers in child development. The Vygotskian perspective emphasizes that individual intellectual functioning has its origins in intellectual interactions with other people. Individuals in a given culture provide guidance as to the efficient and appropriate means for solving intellectual problems, guidance that becomes internalized with development.

Dixon examines a variety of different contextual approaches to the study of intellectual development during adulthood. These contextual approaches share the notion that the intellectual performance of adults must be understood in the context of the relationship between changing (and perhaps declining) intellectual abilities and the changing contextual demands present in adults' environments (e.g., retirement, loss of spouse, declining health). Dixon reviews research that illustrates how older adults compensate for declining memory by using external aids (e.g., writing down information to be remembered) and by interacting with other people.

These six perspectives on intellectual development across the life course, when taken together, paint a complex, rich, and detailed view of the changes that occur across development in intelligence. Each perspective adds an important, if not essential, dimension of intelligent functioning. The psychometric perspective begins by surveying the landscape of intelligence with a focus on intellectual products and the organization of such products throughout the life course. Several perspectives, then, further examine the intellectual products, identified by the psychometric perspective, in an effort to understand the processes and structures that produce intellectual products at different ages. The Piagetian perspective posits that broad universal logical cognitive structures contribute to intellectual products across development, structures that change with development. The neo-Piagetian perspective also emphasizes that intellectual products arise from cognitive structures. However, such structures are not exclusively logical in nature nor are they universally applied across tasks or across persons. The information-processing perspective takes a more microanalytic approach at understanding how intellectual products are formed, examining the processes, representations, and strategies individuals use on specific intellectual tasks. The learning perspective adds an important component to the information-processing perspective in that the actual content of knowledge is extensively examined and the consequences of knowledge for the efficient use of processes, representations, and strategies. Finally, the contextual perspective takes the intellectual products and processes investigated by the other perspectives and reminds us that these take place in a larger sociocultural context. This larger context has enormous consequences for the form and content, as well as the quality of the intellectual products and processes.

Taken collectively, the six perspectives are in many ways complementary and advance a more complete picture of intellectual development than is possible within any one particular perspective. Work on intellectual development is also greatly enriched when understood in the context of a single organism developing intelligence across the life-span.

What do we learn by examining intellectual development across the life course?

The field of intellectual development is largely segregated into theorists and researchers who examine intellectual development during childhood and those who examine intellectual development during adulthood. This isolation is exemplified by two different handbooks that deal with issues in child development (*Handbook of Child Psychology*) and adult development and aging (*Handbook of the Psychology of Aging*) and two different societies and journals for researchers in child development (Society for Research in Child Development publishing *Child Development*) and adult development (Gerontological Society publishing *Journal of Gerontology*). Traditionally, the issues in child intellectual development were slightly different from those in adult intellectual development. That is, researchers examining intelligence during childhood described and explained the growth of intellectual functions, whereas researchers examining intelligence during adulthood described and explained the decline of intellectual functions. Aspects of growth, decline, and maintenance of intellectual functioning, however, can now be found in both the child and adult development literatures (see Baltes, 1987), as discussed in the chapters that follow.

Although, as yet, very few theories of intellectual development explicitly deal with intellectual development across child and adult development (see, e.g., Pascual-Leone, 1983, 1984), many theories of intellectual development now are beginning to address issues at both ends of the life-span. These theories include the neo-Piagetian theories of Case (1985) and Labouvie-Vief (1982), the triarchic theory of Sternberg (Berg & Sternberg, 1985; Sternberg, 1985), and the contextual theory of Baltes and his colleagues (Baltes, 1987; Baltes, Dittmann-Kohli, & Dixon, 1984). Viewing intellectual development as a process that needs to be described and explained across the life course reveals many lessons from which researchers in both child development and adult development can benefit. (See also Sternberg, 1988.) Three such lessons are explored in the next section: (1) that the development of intelligence does not stop in adolescence, (2) that there is great variability in the course of intellectual development, and (3) that similarities in performance between young children and older adults may not be due to similar mechanisms.