



Principles of Developmental Psychology

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PRINCIPLES OF DEVELOPMENTAL PSYCHOLOGY

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*For Annetta, Harry and Francesca
—at different stages in their development*

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Preface

Developmental psychology is a science of broad scope which aims to explain how children and adults change over time. The discipline offers a particular method of scientific enquiry, unique in psychology, in that it focuses on the biological and social processes generating stability and change in people as they grow. The different forms of psychological organisation typical of different periods of the lifespan are the core phenomena to be explained.

This book is an introduction to a very wide field and we have had to be selective in order to illustrate some of the essential features of developmental psychology. We begin by situating the discipline in its historical context. We cover the influence and impact of evolutionary theory in order to help the student to understand the origins of the issues that still preoccupy developmental psychologists. Subsequently we focus on contemporary research with particular, critical, reference to three major developmental theorists: Piaget, Vygotsky, and Bowlby. Their theories overlap in some ways, but they also differ in their relative emphasis on intellectual, social, and emotional aspects of development.

Piagetian theory tends to dominate our book because so much contemporary research has been directed to a critical examination of his work. Piaget has set the agenda in developmental psychology but his is by no means the only voice. We draw attention to the way in which the child gains understanding through more immediate, intuitive processes than the reasoning abilities that Piaget emphasised. Perception, language, and social communication have their own important parts to play in acquiring knowledge. These psychological processes situate the child in a physical, social, and cultural context. At different ages, and in different cultures, the child may draw upon these abilities in different ways.

There is not yet a single "correct" theory of development. However, there are two distinctions that are often made, and which we chose not to pursue because they are misleading. First, we prefer not to polarise a distinction between "individual" and "social" development. Rather, we favour a view that sees the individual and the social as reciprocal domains. What the child knows of self is often a function of society, and what the

child knows of society is, at least in part, a function of self. The interdependence of the individual and the social aspects of development should be apparent in our discussions of language acquisition, moral development, play, attachment theory, gender identity, and parenting, and in the many references to cultural factors that influence growth.

A second distinction, between biological and psychological aspects of development, is commonly made, but is misleading. These are not alternative accounts; they are mutually embedded and it is important to make the effort to accommodate both levels of explanation. Biological aspects of psychological development are discussed at various points, notably in stressing the importance of a proper account of evolution and its implications. The interdependence of biological and psychological processes also arises in pre-natal development, in motor development, in language acquisition in the chimpanzee, in the contribution of ethology, in the development of gender identity, and in ageing.

We have tried to be up to date and this has influenced the balance of topics. Most contemporary research has been on infancy and childhood, and the structure of the book reflects this. If space had allowed, we would have included more on adulthood and later periods of the lifespan. It would also have been fun to explore further such important issues as: the evolution of humans; the genetics of development; the development of the central nervous system; comparative development in different species, in different cultures and over different historical periods; and abnormal development. These omissions will at least alert the reader to some of the many fascinating topics to which further study of the principles of human development can lead.

George Butterworth and Margaret Harris
Brighton, April 1994

PART

1

History and
Methods of
Developmental
Psychology

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The origins of developmental psychology

1

Defining the subject

Developmental psychology is concerned with the scientific understanding of age-related changes in experience and behaviour. Although most developmental theories have been specifically concerned with children, the ultimate aim is to provide an account of development throughout the lifespan. The task is to discover, describe, and explain how development occurs, from its earliest origins, into adulthood and old age.

Two strands of explanation are involved in developmental psychology. The discipline takes some of its inspiration from the biology of growth and evolution, but other aspects of explanation are concerned with the ways in which different cultures channel development. Explaining human development not only requires us to understand human nature—because development is a natural phenomenon—but also to consider the diverse effects that a particular society has on the developing child. In truth, development is as much a matter of the child acquiring a culture as it is a process of biological growth. Contemporary theories of development make the connection between nature and culture, albeit with varying emphases and, of course, with varying degrees of success.

This book will examine modern approaches to human development with particular reference to children and their social, physical, and intellectual growth. Intellectual development is concerned with the origins and acquisition of thought and language. This field of study is known as cognitive development and it includes such important abilities as learning to read and write. Problems of cognitive development, for example mental retardation, or the effects of deafness or blindness on the child's understanding, also fall within this domain. Social development is concerned with the integration of the child into the social world, and explaining how the child acquires the values of the family and the wider society.

The balance of the book is towards the traditional study of the childhood years, but we will also introduce modern ideas about development in adulthood. However, most contemporary research concerns the period from birth to adolescence and this is the age range we have covered most

extensively. We were concerned to provide adequate coverage of the important recent work on the origins of development and so there is rather more detail on the pre-natal period and infancy than other periods of the lifespan.

It will also become apparent that much contemporary research in cognitive development has been concerned with detailed criticism of the important theory of Jean Piaget, and so his work receives rather extensive critical consideration throughout the book. We also give fairly detailed consideration to the ideas of Lev Vygotsky, who emphasised the importance of social factors in development, and to the work of John Bowlby on establishing social relationships. Wherever possible we introduce evidence from different cultures to illustrate the important principle that human development is both a biological and a cultural process. In a final chapter, we consider how development continues even into adulthood with such important life-events as becoming a parent, moving in and out of employment, and the effects of ageing.

The historical and social background

Human development as a biological process obviously has a long past but its systematic study has a short history. Our need to study development is often motivated by social and economic changes, even though the phenomena of reproduction and growth have always been available for observation.

Western societies did not study the childhood years—from the age of about seven to adolescence—until after the industrial revolution in the nineteenth century, even though early childhood had long been recognised as a distinct period in the life-cycle. Once the social changes in economic organisation induced by the industrial revolution such as population movement from the countryside to the towns were in place, the stage was set for the study of childhood. The industrial revolution led to a need for basic literacy and numeracy in the factories which was eventually to be met by universal primary education. This, in turn, made it important to study the mind of the child so that education itself could become more effective. No doubt other social factors such as increased wealth, better hygiene, and progressive control of childhood diseases also contributed to the focus on childhood.

Adolescence as a distinct stage interposed between childhood and adulthood can also be defined by biological, historical, and cultural changes. The distinctive biological changes of adolescence provide a

visible means of demarcation of a further phase in the life-cycle, and this became an object of developmental study in its own right as twentieth-century Western society became wealthy enough to protect the child from adult economic responsibilities. It was possible to postpone the entry of the adolescent into the workforce and also necessary to increase the period of education.

Development in adulthood—*lifespan development*—is an even more recent object of study. Social and medical changes that have allowed survival into great old age, long after the elderly person has ceased to make a direct economic contribution, have drawn attention to the problems and possibilities of old age. These, in turn, raise questions about the psychology of ageing for the developmentalist to address.

In summary, there are biological and cultural aspects of development at many points in the life-cycle. Biological processes contribute to development and provide "markers" for particular stages. These often acquire significance for reasons of our social history, which provides the impetus to acquire a deeper understanding of the life-cycle. The social structure has an impact on development at all stages of the lifespan. It provides a framework in relation to which distinctive stages, or periods of life, may be identified and studied.

Cultural and biological determinants of development

Present-day developmental psychology is a function of its recent ancestry. Obviously, people have always had children but it is only in the last century that we have moved away from anecdotal descriptions to systematic study of development. "Folk" explanations were very general and often rather prescriptive. For example, the English philosopher, *John Locke* (1632–1704), thought the child was born a *tabula rasa* (blank slate), whose every characteristic would be moulded by experience (Locke, 1690). On this view, the newborn is psychologically structureless and extremely malleable to the effects of the environment (Bremner, 1994). Locke's environmentalist view tends to deny that innate factors make any important contribution to psychological development. It places great emphasis on what can be learned as a way of explaining the acquisition of knowledge by the child.

In sharp contrast to the views of Locke, the Swiss philosopher, *Jean Jacques Rousseau* (1712–1778), was more inclined to a "natural" theory of human development (Rousseau, 1762). He considered that children are innately "good", requiring little by way of moral guidance or constraint

for normal development, and that they grow according to "nature's plan". Rousseau's account emphasises "natural" propensities and minimises the effects of upbringing or experience.

Such very general views as those of Locke and Rousseau set the stage for rather misguided debates about the relative contributions of "nature and nurture" to development. Contemporary developmental psychologists avoid such dichotomous approaches to explanation in favour of "interactive" or "dialectical" accounts which attempt more adequately to capture the complex interplay of factors contributing to development.

Scientific foundations of developmental psychology

One of the main differences between a commonsense or folk psychological understanding of development and a scientific understanding is the extent to which theories are subjected to systematic test. Systematic investigations are directed specifically at understanding how, why, and what course human development takes, and this in turn requires rather sophisticated methods. Although anecdotal accounts have always been available, and obviously there is folk wisdom in all societies about child rearing, the scientific study of childhood is really very recent. It begins as a serious scientific study in the nineteenth century with Charles Darwin's theory of evolution (see Cairns, 1983).

Foundations: 1859–1914

Fig. 1.1 Darwin & his son Doddy. By permission of the Syndics of Cambridge University Library.

Charles Darwin is often credited with establishing the scientific approach to developmental psychology. Although his major interests were in evolutionary theory, he could be considered the first developmental psychologist because he published a short paper describing the development of his infant son, Doddy, in 1877. He was impressed by the playfulness of his baby son, and by his capacity for emotional expression.



Darwin's studies of his infant son were intended to help him understand, in particular, the evolution of innate forms of human communication. As we shall see, many basic developmental concepts, such as the idea that development can be understood as the progressive adaptation of the child to the environment, can be traced directly to Darwin and the influence of evolutionary theory. Another of Darwin's contributions was to introduce systematic methods to the study of development. The philosophical or anecdotal speculations of earlier theorists, such as Locke and Rousseau, were

replaced by actual observations of developing children and this set the discipline on a scientific path.

The major biological foundations of developmental psychology were laid in the period between the publication of Darwin's theory of evolution in 1859 and the first decades of the twentieth century. Darwin's theory of evolution located man firmly in nature and raised questions about continuities and discontinuities between man and the animals.

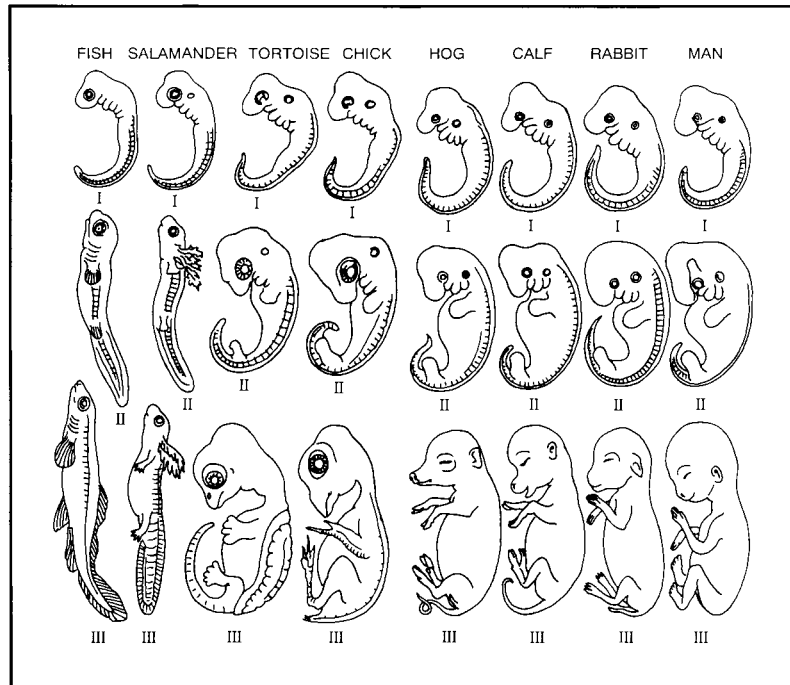
Another effect of the Darwinian revolution was that people became curious about the biological origins of human nature. Evolutionary explanation led naturally to an emphasis on changes that occur as a function of time, both in the extremely long time-scale of evolution and over the individual lifespan. Darwin's books on *The origin of the species* (1859), *The descent of man* (1871) and *The expression of emotions in men and animals* (1872), raised questions about the origins of the human mind in the evolutionary past. They posed the challenging problem of the relation between individual development (*ontogeny*) and the evolution of the species (*phylogeny*).

The question of the relation between phylogeny and ontogeny was pursued vigorously by late nineteenth-century embryologists, such as Haeckel (1874), who was impressed by the similar form taken by the embryos of many different species at certain times in their development. Haeckel argued that the development of the human embryo recapitulates its ancestry. The embryo successively takes the shape of various more primitive ancestors, before attaining its final human shape.

Today, it is no longer believed that "ontogeny recapitulates phylogeny" as Haeckel had argued. The more sophisticated view of the resemblances between different mammalian embryos is that the similarities reflect biological structures we still hold in common with our remote ancestors (Gould, 1977). Thus, there is no simple translation from the evolutionary past into present-day development. Nevertheless, clear stage-like changes in biological form led to the idea that other aspects of biological growth, such as cognitive and social development in humans, may also show distinct age-related stages in organisation.

The emergence of an independent developmental psychology is generally dated to 1882, with the publication of a book by the German physiologist, *Wilhelm Preyer*, entitled *The mind of the child*. This book was based on Preyer's observations of his own daughter and described her development from birth to two and a half years. Preyer insisted on proper scientific procedures, writing every observation down and noting the emergence of many abilities in his daughter. He was particularly impressed by the importance of the extended period of curiosity evident in human infant development.

Fig. 1.2
Embryos of
different species
at three
comparable
stages of
development
(after Haeckel in
Romanes, 1892).



Wilhelm Preyer's work was translated into English in 1888, one of a burgeoning series of publications by then amounting to 48 full-scale empirical studies of children that had been carried out in Europe, Britain, and the United States. Developmental psychology as a discipline was now in full swing.

Among other famous pioneers was *Alfred Binet* (1857–1911), who was working on experimental studies of thinking in young children in France. He is best known for developing the first intelligence test. Binet had been critical of diagnoses of mental deficiency made by medical practitioners responsible for placing feeble-minded children in special schools in Paris. No single sign of mental deficiency could reliably differentiate mentally retarded from normal children. In fact, the same child might carry a different diagnosis, depending on which physician had made it. The urgent practical need for a valid and reliable test of intelligence led him to construct the Binet and Simon scale which was published in 1905.

The main early application of Binet's work was to provide guidelines on the relative intellectual abilities and educational potential of mentally retarded children, but his work was soon to find much wider application in education and training. Binet developed tests that were based on norms

Mental age and IQ

The concept of mental age, which was first used by Binet, is best illustrated with some examples. Suppose that a child of 8 years 0 months is able to solve items in a test that are normally solved by children of the same age but is not able to solve items normally solved by older children. That child would be considered to have a mental age of 8 years. However, if the same child consistently succeeded on test items that were normally solved by 10-year-olds, he or she would clearly be functioning intellectually at a mental age level that was above chronological age. In this case, the child would be considered to have a mental age of 10 years. A child who is only able to solve items normally solved by younger children would have a mental age that was lower than his or her chronological age.

The psychologist *William Stern* (1871–1938) devised a formula for calculating the *intelligence quotient* (IQ) defining intelligence relative to age:

$$\text{IQ} = \frac{\text{Mental age}}{\text{Chronological age}} \times 100$$

In the example we have just considered, the 8-year-old with a mental age of 10 years would be credited with an IQ of: $10/8 \times 100 = 125$. Similarly, a 12-year-old with a mental age of 15 years would also have an IQ of 125 ($15/12 \times 100 = 125$) because he or she would have the same relative standing in relation to age peers. A child who has a mental age that is the same as his or her chronological age is considered to be of average intelligence. This is because, on average, intellectual development in the population proceeds at the same rate as chronological age. Children of average intelligence have an IQ of 100.

of performance for a given age, and this soon led to the idea of a child's *mental age* as distinct from *chronological age* (see the panel above).

Binet's work was very influential in making careful measurement a basic part of modern psychology. His intelligence scale (which was only one of his contributions) laid the foundations for the extensive psychometric tests now so useful in educational, medical and other applied fields.

Among the most important, but perhaps least well-known, of the founders of present-day developmental psychology was the American, *James Mark Baldwin* (1861–1934). Baldwin made a major intellectual and administrative contribution to setting up scientific psychology. He was the founding editor of the first scientific psychology journal, *The Psychological Review* (1895), and he was later the editor of the important journal *Psychological Bulletin* and one of the first presidents of the American Psychological Association (1897). He was influential in many ways in the new science of psychology, including establishing an international group of scholars who contributed to a four-volume *Dictionary of Philosophy and Psychology* (Baldwin, 1905). In 1903, a survey ranked Baldwin in the top five contributors to international research (Broughton & Freeman-Moir, 1982).



Fig. 1.3 James Baldwin. Courtesy of the Department of Psychology, Indiana University.

One of Baldwin's most important contributions to the founding of developmental psychology was made in the period 1903–1908, when he was professor of philosophy and psychology at Johns Hopkins University. He published the first of a three-volume series on "Genetic Logic", a difficult work on the development of thinking in children. In this series, Baldwin set out the foundations of a theory of the progressive development of knowledge in childhood. He proposed that development proceeds in a series of distinct stages, beginning at birth with the innate motor reflexes, and progressing to the acquisition of language and logical thought. He proposed that moving through successive stages of development depends on feedback from the stimulating environment.

In Baldwin's terminology, the essential mechanisms for development are *assimilation* (incorporation of effects of the environment into the organism) leading to *accommodation* (plastic change) of the organism. He emphasised that the child is as much a product of social experience as of biological growth. From 1912 Baldwin lived in France and he made periodic visits to the University of Geneva in Switzerland. He established a warm friendship with the Swiss child psychologist Edouard Claparède. Baldwin's books were translated into French and he was a major influence on a student of Claparède, the famous developmental psychologist, Jean Piaget (1896–1980). Piaget's theory of development will be considered in detail at various places in this book.

Other early developmentalists, such as *G. Stanley Hall* (1844–1924) in the USA, based their ideas on a misreading of evolutionary principles. Hall proposed the *biogenetic law*, another way of stating that "ontogeny recapitulates phylogeny", which also supposed that the course of human development involves a repetition of the ancestral, evolutionary timetable. This led, for example, to his thoroughly mistaken idea that children love to swing in trees because they recapitulate their monkey ancestry; or that the child has a primitive "savage" mind (or conversely, that the savage mind is childlike). He even argued that there is a scale of mental abilities with children (and women) at the bottom and men at the top!

As we have already stated, developmentalists need to guard against misplaced analogies between evolution, heredity, and development. This remains a problem even today in discussions about the inheritance of intelligence. Hall did have one very important influence though: as the president of Clark University, he was responsible for inviting Sigmund Freud to the United States in 1909 and thus promoted Freud's psychoanalytic ideas. The Freudian influence is perhaps most clearly seen in theories of social and emotional development, especially in research concerning attachment between parent and child. We will be considering contemporary ideas influenced by Freudian theory, especially the work of John Bowlby.

Formation of the major "schools": 1914–1927

From 1914 to 1927, the empirical basis of developmental psychology was established. This period coincided with an intense interest in theories of learning based on the work of the Russian physiologist, *Ivan Pavlov*. Pavlov's studies of learning in dogs established that some types of learning take place through the association of stimuli and responses, under conditions of reward and punishment. For example, in his famous studies of "classical conditioning" he showed that a hungry dog will readily learn that a signal, such as a bell, regularly predicts the arrival of food, and the dog will soon salivate in anticipation of food when the bell sounds. In this example, the dog has learned to associate the bell with food and the normal (unconditioned) response of salivation to food has become associated with (conditioned to) the sound of the bell.

This focus on the laws of learning led to the rise of a school of psychology known as *Behaviourism*, whose major figure was *John Watson* (1878–1957). Watson had distinct ideas about child development based on "learning" theory. He was very interested, for example, in whether infants naturally showed fear of animals or whether such fears were learned (see the panel on p. 12). He concluded that these fears were learned.

Fig. 1.4 John Watson. Photo courtesy of Ferdinand Hamburger, Jr., Archives of The Johns Hopkins University.



Watson believed so strongly in the potential of the child to learn through experience that he wrote:

Give me a dozen healthy infants, well formed and my own specified world to bring them up in and I'll guarantee to take any one at random and train him to become any type of specialist I might select—doctor, lawyer, artist, merchant-chief and yes, even beggar man and thief, regardless of his talents, penchants, tendencies, abilities, vocations and race of his ancestors. (Watson, 1930, p. 104)

As this quotation vividly illustrates, "nature" took rather a back seat to "nurture" in Watson's explanation of the causes of development. He believed, for example, that whether a person is left-handed or right-handed was a function of early training rather than of genetic factors. (This

Watson's studies of childhood fears

In his book, *Psychology from the standpoint of a behaviorist* (1919), Watson reported a study of three children who were introduced to novel birds and animals over a period of several days. In one case, Watson presented a 6-month-old baby called Thorne with a black cat, a pigeon, a rabbit and, later on, a whole series of animals at the local zoo including a camel and a zebra. He studied Thorne's reaction to their presence in a number of different conditions and found that, even in the dark, she did not display fear on any occasion, although she was very interested in all the animals and looked at them intently. She also reached out to touch the smaller animals.

Having shown that children did not have any innate fear of animals, Watson went on to study the acquisition of irrational fears through learning. He reports the case of a 6-month-old baby who had a small dog tossed into her pram. (How this came about Watson does not reveal.) The baby became terrified and subsequently showed a fear reaction not only to dogs but also to rapidly moving toy animals. At 18 months, the unfortunate baby was tested by having a tame white mouse placed on the floor near her. She responded by crying and rushing into her father's arms.

A similar—and more famous—study was carried out on a baby called "Little Albert", and reported by Watson and Rayner (1920). They showed that after Albert was frightened while playing with a furry toy, he also learned to be afraid of other furry objects (such as a beard) and animals.



Fig. 1.5 "Little Albert" © Ben Harris, 1980.

theory receives rather less support today—see Chapter 5 on motor development.) Watson's views were partly based on inherent American optimism and partly on an extreme view of the extent of human plasticity. That is, the developing child was considered to be extremely malleable and highly susceptible to the effects of environmental influences.

Learning-theory approaches to development continued to exercise great influence, especially in the USA, until quite recently. They still find useful application in dealing with some developmental problems, such as bed wetting, or fears and phobias, where techniques based on the laws of conditioning first described by Pavlov, and developed by Watson, have been applied. However, the contemporary influence of learning theories on development is rather limited by comparison with other more recent schools of thought.

The diametric opposite to an extreme learning theory approach is the maturational school, led by *Arnold Gesell* (1880–1961). His main idea was that the time-locked processes of biological growth are particularly important for the appearance of various abilities. Gesell was most interested in motor and perceptual development, which he saw as inevitable and rather automatic under normal circumstances.

Unlike the environmentalists, such as Watson, maturationists tended to emphasise "nature" at the expense of "nurture" as a cause of development. The nativist view of Gesell—and his insistence on the importance of evolution in shaping the course of development—is illustrated by the following quotation which stands in stark contrast to the earlier quotation from Watson:

The child grows ... The capacities and, to no small extent, the directions of growth are the end products of ages of evolution.
(Gesell, Ilg, & Bullis, 1949, p. 44)

As a comparison of the views of Watson and Gesell reveals, the middle period in the founding of developmental psychology produced a polarisation between, on the one hand, an extreme environmentalism—somewhat similar to Locke's view of the child as a *tabula rasa* on which experience would have a major effect—and, on the other, an extreme maturationist view. The influence of maturation was most strongly espoused by those interested in such aspects of development as hand-eye coordination and the acquisition of motor skills like walking, which seemed to proceed according to a strict biological timetable. (It should be noted, however, that Gesell recognised the significant individual variation in the age at which children reached particular developmental milestones.)

These sharply polarised views of nature versus nurture, although out of date now, were important because they led to distinct fashions in child-rearing and education each based on the rival views. The environmentalists emphasised habit training as a means of teaching children, for example, in toilet training or the acquisition of basic skills like reading and writing. Maturationists emphasised the biological need for the child to be "ready" for particular types of experience before learning could occur.

Conclusion and Summary

Developmental psychology is concerned with age-related changes in experience and behaviour. The origins of the discipline are in philosophy but the scientific study of children was founded on the insights of evolutionary biology in the nineteenth century. Social and economic changes since then have made it imperative to understand better the processes of growth and development in children, adolescents, and adults.

By the 1920s, developmental psychology was well established as a scientific discipline, although by then it had broken up into various schools, each emphasising a different aspect of nature or nurture. The field had become fragmented and needed synthesis, so that the biological and social factors which actually interact in development could be more adequately understood. This work of synthesis was mainly accomplished by the "grand" theories of the middle twentieth century, which will be described in the next chapter.

Further reading

Cairns, R.B. (1983). The emergence of developmental psychology. In W. Kessen (Ed.), *Handbook of child psychology, Vol. 1*, (pp. 41–101). (Series editor: P.H. Mussen). New York: John Wiley.

The modern synthesis

2

Until quite recently, developmental psychology has been dominated by grand theories. These have attempted to interrelate "nature" and "nurture" in a manner more appropriate to the post-Darwinian age than the extreme maturationist or environmentalist accounts that preceded them (see Chapter 1). The major influences to the present-day can be summarised by considering the work of three developmental psychologists, each of whom offered very broad theories.

Although grand, all-encompassing theories of development have now given way to more circumscribed, detailed examination of particular developmental phenomena, the best way to introduce late twentieth-century developmental psychology is still in terms of the major historical figures who have shaped contemporary ideas.

The main twentieth-century developmentalists

The three major developmental psychologists are the Swiss psychologist Jean Piaget (1896–1980), the Russian psychologist Lev Vygotsky (1896–1934), and the English child psychiatrist John Bowlby (1907–1990). Each of these theorists, in his own way, offered a more satisfactory account of development than any before. All were influenced by biological and evolutionary theories and each takes a particular focus on the developmental process.

Piaget sought to show how logical thinking in children develops out of its biological roots; Vygotsky was preoccupied with the special role that language plays in human society and social thought; Bowlby was most concerned with the role of social relationships between parent and child in the formation of personality and mental well-being. Much current research continues to be influenced by these three theorists.

Jean Piaget

Jean Piaget has had the most profound influence on our understanding of development. He lived such a long and productive life that he straddled

the whole of the modern history of developmental psychology, almost from its foundations to the present. He based his ideas on the work of James Mark Baldwin and, over the years, developed a major centre devoted to developmental psychology research at the University of Geneva, in Switzerland.

Piaget's ideas have been the focus of much controversy and empirical investigation. One measure of how much impact ideas have in science is how much new research they generate. There can be no doubt that Piaget had a major influence by this criterion. Even though a lot of contemporary workers disagree with the detail of his theory, there is no doubt that he has acted as a catalyst for some of the most exciting work in the field.

In 1921, Piaget returned from France to Geneva, to begin his lifetime's work at the university. Piaget developed his theory of how knowledge is acquired, which he called "genetic epistemology", based on his observations of children. His first books were about thinking and language in pre-school and early school-age children: *The language and thought of the child* (1923) and *Judgement and reasoning in the child* (1924). These were widely influential and much to his surprise were acclaimed the world over (see the panel on page 17).

In 1923, Piaget married Valentine Chatenay and in collaboration they studied the development from birth of their own three children, Jacqueline, Lucienne, and Laurent. These observations on the origins of thought and language in infancy formed the basis for three of Piaget's most influential books: *The origins of intelligence in children* (1936/1952), which describes how intelligence progressively arises in the baby's repetitive activities; *The construction of reality in the child* (1937/1954), which describes how elementary concepts of space, time, causes, and physical objects arise in development; and *Play, dreams and imitation in childhood* (1945/1951), which describes the beginnings of fantasy and symbolism in infancy. In this trilogy he outlined the theory that the precursors of thinking and language lie in the elementary actions, perceptions, and imitations of babies.

Many other influential books were to follow, especially those that had an impact on educational theory and practice in mathematics and science teaching, such as *The child's conception of number* (1941/1952 with A. Szeminska) and *The child's conception of geometry* (1948/1960 with B. Inhelder and A. Szeminska).

In some of his later works, Piaget outlined his theory of the relation between the acquisition of knowledge as a biological process and evolution (e.g. *Biology and knowledge*, 1971). Piaget is sometimes unjustly accused of recapitulationism (see p. 7) because he tried to draw parallels between evolution and developmental theory. His key theoretical idea

Brief biography of Jean Piaget (1896–1980)

Jean Piaget was born on 9 August 1896 at Neuchâtel, in Switzerland. In a very long and scholarly life he wrote more than 75 books and literally hundreds of scientific papers in which he elaborated his theory of cognitive development in children. His father was a university professor of mediaeval history who taught him the value of painstaking work. Unfortunately, his mother suffered poor mental health and her main influence was to lead him “to prefer the study of normalcy and the workings of the intellect to that of the tricks of the unconscious”. Although he showed a passing interest in studying psychopathology, he devoted his research to the study of normal intellectual development.

While still a child, Piaget became interested in natural history and at the age of 11 years, in 1907, he published his first paper “On sighting an albino sparrow”. The curator of the local natural history museum was so impressed with this precocious affinity for natural history that Piaget became his part-time and unpaid assistant! On Saturday afternoons he collected and catalogued the molluscs of the Swiss lakes, becoming especially interested in the way that their shapes varied with the depth of water where they lay. At university he studied biology and philosophy and in 1918 he was awarded a doctorate for his work on the special adaptations evolved by the molluscs in the shallow waters of the Swiss lakes.

Perhaps influenced by his mother’s poor mental condition, Piaget then went to Zurich where he worked as an experimental psychologist with the famous psychoanalyst C.G. Jung and assisted in the psychiatric clinic. These experiences were to be influential in helping to combine the rigour of the laboratory experimental method with the more informal interviewing techniques typical of psychiatry, which were to feature strongly in his early studies of children’s thinking.

The most influential event in Piaget’s own development occurred in 1919 when he was invited to work in Binet’s laboratory in Paris, deriving the age norms for items on the Binet–Simon intelligence tests of Parisian school children (see p. 8). The test

included many simple items which measured children’s ability at logical reasoning and Piaget became fascinated by the systematic nature of children’s errors. Problems that seem totally simple to an adult, such as the syllogism: “John is taller than Mary and Mary is taller than Jane. Who is the tallest?”, were not solved by the child until 11 or 12 years of age. This led Piaget to the theory that logical thinking develops slowly, and his background in biology soon led him to conceive of intellectual development as a gradual, stage-like evolution. He was particularly interested in how children acquire scientific knowledge, an aspect of advanced cultures. The slow accumulation of scientific knowledge over the centuries was conceived by Piaget as reflecting the human’s progressive understanding of reality.



Fig. 2.1 Jean Piaget, circa 1978. From J.J. Ducret (1990) *Jean Piaget: Biographie et Parcours Intellectuel*, published by Editions Delachaux et Niestlé, Lausanne.

was that human knowledge can be considered as if it were a biological "organ" of the mind. Acquiring knowledge can be thought of as an evolutionary process in the sense that knowledge is adaptive. It consists of a relation between the individual and the environment (or, more specifically, between the knower and the known). Just as organs, such as the liver and the heart, ensure an adaptive equilibrium between organism and environment in the metabolism of air and food, so the process of acquiring knowledge can be thought of as one of equilibration, as the knower slowly arrives at more adequate descriptions, explanations, and predictions about reality.

Piaget argues that how children acquire knowledge, particularly scientific ideas, may show important parallels with the historic progress of science, but there is no suggestion that the sequence of stages in acquiring knowledge recapitulates the history of ideas (for an extensive discussion of recapitulationism and Piagetian theory, see Butterworth, Rutkowska, & Scaife, 1985).

Piaget's technical vocabulary, which he adopted from James Mark Baldwin (see pp. 9–10), is biological. For example, the assimilation of information by the structures of the mind is seen as analogous to the assimilation of food as nutrition for the body. Equilibrium is achieved through accommodation, as the organism adapts to, or incorporates the effects of, the environment. The notion of equilibration is also based on the idea of achieving a natural balance between the individual and the world, just as there is a balance of the forces that sustain life in nature.

Piaget's model of development is of a self-regulating interaction between the child and the physical and social environment, which gives rise to new forms of knowledge. His theory is analogous to the formation by natural selection of new species in evolution, where new forms of life arise from pre-existing ones under the influence of pressures from the environment. In evolution, only those species that can adapt to the new environment survive. By analogy, new forms of knowledge arise in development because they are better adapted to the demands of the environment than the forms they replace. The main stages described in his theory are listed in the panel on page 19. Each of these stages will be discussed in detail later in the book.

Piaget's key biological ideas about development. A key biological idea in Piaget's theory is that intellectual development can be thought of as an evolutionary process. Later stages succeed earlier stages because they are more adaptive, that is, more adequate to the demands of reality. Piaget argued that the acquisition of knowledge proceeds in a manner analogous to the evolution of species. He was much influenced