CHILD DEVELOPMENT

CONCEPTS & THEORIES

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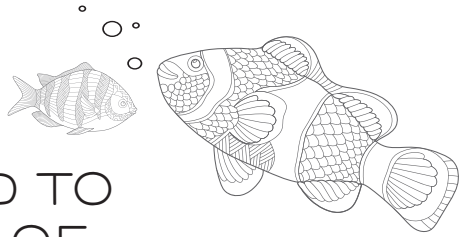
CHAPTER 5



CONCEPTS RELATED TO THE DEVELOPMENT OF COGNITION AND PERCEPTION

Chapter 5 is concerned with concepts that contribute to our understanding of children's development of thinking, memory, and other cognitive processes. Theory plays an important role in the study of cognitive development, with valuable concepts having been contributed by the Swiss theorist Jean Piaget, by behaviourist thinkers, by dynamic systems theorists, and by others. Research methods specific to the study of cognitive development have been created. As these have shown, memory, thinking skills, communication, and language use all typically change developmentally from birth to age 12, following predictable developmental trajectories. Atypical cognitive development may interfere more or less severely with other aspects of children's development.

INTRODUCTION

The concept of **cognition** is a broad one that includes a range of **mental** and intellectual states and processes, including learning, memory, problem-solving, and symbol use. Cognition also includes the idea of concept use and formation that is the focus of this book. The extent of developmental change in cognition during childhood is evident when we think about the limited capacities of a 1-year-old and compare them to the much more advanced, almost adult-like, cognitive skills of a 12-year-old. **Perception** is a concept less frequently used in everyday thinking about child development; it may be thought of as involving processes that combine the sensory abilities discussed in Chapter 4 with cognitive advances, allowing the individual to make sense of the complex sensory world.

Development story 5.1

Five-year-old Oliver's teacher, Ms McDonald, felt that he was 'different' soon after she met him. She noticed that he did not play much with other children at breaks, and did not even watch them as though he were interested but too shy to make friends. He

(Continued)

seemed to be focused on his own concerns and would watch beetles or worms carefully. He did not seem unhappy and would answer briefly if asked a question. However, when frustrated Oliver would have a screaming tantrum, and Ms McDonald could usually not even understand what had frustrated him. Ms McDonald arranged a meeting with Oliver's parents in the hope that she could find out more about him and understand what he needed before he got much older.

Oliver's parents reported that he had never been very sociable and that he did not really talk until he was 3 years old, although he knew where everything was in their house and garden and could turn on any appliance or light in the house. He did not imitate things either of the parents did, except that he learned by watching them how to use household machines. Ms McDonald asked Oliver's parents whether he liked any kind of pretence play, such as dressing up or pretending to be a horse or a lion. (She had noticed that he did not do any of this at school when the opportunity occurred.) No, the parents replied, he had never been interested in that kind of thing. Oliver's father volunteered that he had been much the same as a child and that he had not really played with other children until he became interested in football and began to memorize statistics about professional games.

Oliver's father was not convinced that Oliver had any special educational needs, but he was willing to have Oliver assessed by the local educational authority. The result of the assessment was that Oliver was diagnosed with a mild form of autism spectrum disorder (ASD). This was frightening to his parents, who thought of autism as a condition that makes normal life impossible for anyone with that diagnosis. However, they were reassured that Oliver's level of ASD was very mild and might be helped by improvement of his speech and other communication, which would help him in social play and in understanding behaviour rules. Oliver was assigned a speech and language therapist who worked with him regularly. He was also assigned a classroom assistant who could pay attention to his frustration and guide him to better communication of what he needed.

GENERAL DEVELOPMENTAL CONCEPTS AND COGNITIVE DEVELOPMENT

Like other aspects of development, changes with age in cognition are based on both **maturation** and **experience** with environmental factors. These factors **interact**, so that the developmental outcomes of experiences depend on a child's maturational level at the time of the experience; studying French grammar at age 5 does not have as successful an effect as studying it at age 10, but hearing French spoken at age 1 has a much better impact on vocabulary and pronunciation than hearing it at age 10.

Cognitive development shares with other aspects of development the concept of **developmental trajectories**, predictable changes in development that allow us to predict a child's cognitive abilities over a period of years. Characteristic cognitive **developmental tasks**, such as learning to speak or to read, are associated with age periods (Havighurst, 1972). Cognitive changes also display **individual differences** in developmental change and in the cognitive abilities that are eventually achieved. In industrialized societies, where cognitive abilities are much prized and formal education is provided to facilitate children's cognitive development, there is concern about whether an individual's cognitive development is **typical** or **atypical**. Children who are atypically rapid in cognitive development are praised and often given extra resources to help their development, whereas children who are atypically slow in cognitive development are given **interventions** in the form of **special education** in the hope of helping encourage developmental progress.

As was the case for physical growth, **normative** information about cognitive development is available and allows comparisons between individual children and the larger population of children. Normative information allows the calculation of **mental age**, a form of **developmental age** based on comparisons between the individual and children of various chronological ages.

Genetic factors play a role in cognitive development, but there has been little discussion of **epigenetic** factors affecting cognition. The **stage** concept has been much used in work on cognitive development, but the idea of **critical periods** has been applied in a very limited way and is confined to the study of language development.

Other, less general concepts that have been discussed in earlier chapters are sometimes applied to cognitive development. The idea of **plasticity**, generally applied to the understanding of brain development, is exemplified by the capacity for **learning** and the shaping of behaviour by experience. There have been a number of attempts to apply ideas based on brain functioning to education, but these have not been particularly successful.

THEORIES OF COGNITIVE DEVELOPMENT

The complexities of cognitive development and the difficulties of measuring children's cognitive abilities have made an understanding of **theory** an essential part of the study of this topic. Theories, or conceptual frameworks that organize observable childhood behaviour and help us address issues of cognitive development, share some concepts but have other concepts unique to each theory. Students need to be able to recognize and use these concepts, so brief summaries of ideas belonging to major theories are presented here.

Piagetian theory of cognitive development, initially discussed almost a hundred years ago by the Swiss biologist and epistemologist Jean Piaget, is the source of a range of concepts used on descriptions of cognitive development from birth

through adulthood. It is a theory with an **organismic** approach. An essential and often misunderstood aspect of Piagetian theory is that cognitive development results from **maturation** and an **intrinsic motivation** for practising abilities; **reinforcement** through events in the environment plays no role in this view of cognitive development, although experience with events plays an important part in cognitive development. Piagetian theory also sees cognitive development as biologically-based, with its foundation in newborn **reflexes**, as discussed in Chapter 4 of this book. Cognitive abilities, including reflexes, are described as **schemas**, or ways of responding to the world. Schemas multiply and change as they are used, through the processes of **assimilation** (discovering that a schema can be applied in new situations) and **accommodation** (the altering of schemas so that it produces new schemas that are specialized to situations).

Like some other theorists of child development, Piaget cast his view of cognitive development in the form of **stages** that follow each other in a predictable sequence and during each of which characteristic, and qualitatively different, behaviour occurs. Like most other stages, the ones Piaget suggested are only roughly associated with chronological ages and may overlap with each other. Piaget described a **sensorimotor** stage, during which cognition remains at a simple level of sensory stimulation followed by movement. This period, from birth to about age 2 years, includes cognitive developments like **object permanence**, the understanding that objects still exist when they cannot be seen. Towards the end of the sensorimotor period, **symbol** use begins, permitting the development of language as the child comes to understand that a sound, gesture, or image can represent something else. The period from about 2 to about 7 years was termed **pre-operational** by Piaget. Children in the pre-operational stage are beginning to solve problems by thought as well as by hands-on methods, but are limited in their abilities. Children during this period develop capacities such as **conservation**, the understanding that although some aspects of an object, like its shape, may be changed, other aspects, like volume or number, remain the same. Children of school age move into the **concrete operational** stage and are able to select operations (mental processes) to solve real-life problems. Towards age 11 or 12, some (but not all) children begin to use **formal operations** that involve the selection of more complex problem-solving strategies, conceptual skills that allow the use of scientific method, and abstraction that enables them to create **hypothetical** situations and think what their outcomes might be. Piaget's work was one of the sources of **constructivism**, a perspective that stresses the active role of learners in seeking and organizing knowledge. Piaget's stage emphasis has also been found in some theories of **moral development**, changes with age in children's thinking about right and wrong behaviour.

The **Neo-Piagetian** theory of cognitive development came into being because the Piagetian approach did not adequately address the **individual differences** known to be part of cognitive development or the differences in individuals' cognitive performance in different **domains** (areas of knowledge that may require different cognitive skills). Neo-Piagetian approaches have included an

emphasis on individual differences in **information processing** speed, the ability to understand and remember new information, which increases with age, and in individual differences in various aspects of development. These approaches to cognitive development emphasize the use of **concepts** in learning and mastery of mental operations.

The use of concepts and other cognitive abilities is also a focus of **evolutionary psychology**, a theory that proposes that modern human behaviour and mental abilities are the result of **natural selection** through better survival rates of individuals with these cognitive characteristics in the environment in which humans evolved. The capacity of very young infants to learn concepts and categories quickly has been attributed to natural selection by some authors.

Vygotskian theory places cognitive development in a social context and assumes that learning occurs best when supported by good emotional relationships with adults. This theory suggests that in addition to skills that are performed easily under all circumstances and skills that cannot yet be performed at all, children have a set of skills that are under development and that can be performed only with the support of a familiar adult; these skills are said to be in the **zone of proximal development (ZPD)**.

Connectionism is a theory that employs a brain metaphor in discussing learning and that has a **mechanistic** focus. Events in learning are thought to be analogous to underlying events in the brain, such as **parallel distributed processing** occurring as neurons and synapses deal with information. An offshoot of connectionism is the idea of **brain-based learning**, a view that proposes without much evidence that characteristics of the brain, such as cortical dominance (discussed in Chapter 4), can determine individual differences in learning. This approach has also been associated with the idea of **learning style** in older children and adults, a claim, little supported by evidence, that some individuals may learn best by sight, others by hearing, others by touch, and so on.

Behaviourism, another mechanistic approach, is a general theory of psychological events that has been applied to cognitive development by suggesting that **classical conditioning** is a foundation of infant cognitive development and that **operant conditioning** shapes cognitive ability from the time the infant can perform voluntary movements. Behaviouristic views of language development have presented language learning as due to a series of conditioning events.

Dynamic systems theory, an organismic approach that has most often focused on motor development, can also be applied to cognitive development. A dynamic systems concept relevant to cognitive development is the idea of the **attractor state**. An attractor state is a condition or behaviour that occurs frequently, is preferred by the individual or is in some way made more likely by the environment. The existence of an attractor state helps to guide or organize aspects of cognitive development. For example, a home in which adults speak frequently in ways that interest babies creates an attractor state of increased attention to speech, more learning about speech, and perhaps less involvement in non-speech behaviours. Children's preference for play behaviours creates an attractor state in which repetitions of particular acts become

more frequent and increased learning about those acts occurs. Formal schooling prohibits most play during school time and creates an attractor state in which non-play skills are fostered; formal schooling also increases children's interactions with other children of the same age and limits contacts with children of different ages or with a range of adults, increasing learning about matters of interest in a particular period of development.

RESEARCH METHODS

As is the case for most aspects of child development, the methods useful for research on cognitive development depend on the chronological and developmental ages of the children under study. In early infancy, children's measurable behaviour is limited to a few items, such as **looking**, that can be measured by photographic and other techniques. Measuring where a baby looks and how long she continues to look at the same things allows researchers to understand whether the baby can tell two things apart, whether she remembers something that was seen earlier, and whether she is surprised by an unusual event (like finding a large stuffed animal where there seemed to be only a small bump under a blanket) or was not surprised because she does not understand relationships between sizes. These research approaches are often made difficult by the tendencies of babies to cry or fall asleep or get hungry when a research appointment has been scheduled, but because infants and children cannot be forced to perform cognitive tasks when they are uncomfortable, research plans must take these issues into account.

When babies are a few months old or more, they have enough control over their movements to allow some **operant conditioning** methods to be introduced. In these methods, a baby's movements are followed by a **reinforcing** event, often a chance to look at something interesting. One of these methods, the **mobile conjugate reinforcement paradigm**, lets a baby learn that kicking a foot will make a suspended mobile swing in an interesting way (Rovee-Collier, 1997). Once the baby has learned this, the method can be used to explore aspects of cognitive development, for example, whether the baby can generalize what was learned to the movement of mobiles with other appearances, and how long the baby can remember what works with a particular mobile. Figure 5.1 shows what this research arrangement looks like.

Observation is an essential research method throughout the infant and preschool periods and has provided the foundation of a number of concepts of cognitive development. However, observation is a highly labour-intensive method and is rarely used with large numbers of children.

Preschoolers and school-age children typically have language development that is advanced enough for **interview** and test methods to be possible. Children may be asked to answer questions, to explain what they think or remember, or to give answers to problems. Studies of **school performance** can also be used in research on cognitive development.

Figure 5.1 Arrangement of ribbons and mobile figures. This arrangement of ribbons and mobile figures is of much interest to babies, who are happy and excited when they find that by kicking they can make the mobile move around. Having little ability to use concepts, however, they do not necessarily realize that if kicking makes a mobile with one set of figures move, it will probably do the same for another set. This method, the mobile conjugate reinforcement paradigm, makes it possible to study infant cognitive abilities like memory and generalization.

Source: Reproduced with permission of the American Psychological Association, Rovee-Collier, C. (1995) 'Time windows in cognitive development', *Developmental Psychology*, 31: 146–69.

Studies of **language development**, a crucial part of cognitive development, involve observing the youngest children, and interviewing and testing older children, as well as looking at school performance (for example, in reading) of the older children. These methods have made possible **normative** studies that show language achievement as it is typical of children of different chronological ages. These studies also help to define atypical development that needs intervention. In addition, the existence of normative studies makes possible future research that uses norms as standards of comparison.

Microgenetic methods involve minute-by-minute observation and data collection from children doing cognitive tasks (Siegler and Svetina, 2006). These approaches have yielded interesting information about learning in school.

Studies of **interventions** that seek to improve cognitive development ideally use experimental methods with randomized controlled trials, but not all meet this standard.

INTELLIGENCE TESTING

Research on **intelligence**, the ability to learn and use new information, is part of the study of cognitive development, and **intelligence tests** provide measurement methods that can be useful for cognitive development research. Like other studies of cognition, such tests are different for infants, for preschool children, and for school-age children. Intelligence tests for infants and preschool children are administered individually; they stress general developmental progress for infants and language use and problem-solving for preschoolers. Tests for school-age children, using paper and pencil or in electronic versions, are the best known and have existed for the longest time. These tests can be administered to groups of children simultaneously and therefore facilitate some kinds of research on cognitive development.

Intelligence tests used in research need to have been previously established as having both **reliability** and **validity**. These are essential concepts with respect to **standardized** testing of any aspect of development. Both reliability and validity are correlational concepts that refer to the predictability of test scores. Reliability is a measure of the extent to which additional administrations of a test would yield results similar to the first. Validity is a measure of the association between a test score and some other way of testing for the same purpose; in the case of intelligence testing, validity of a test may be investigated by looking at correlations between test scores and school achievement.

Research that uses and interprets intelligence test scores is based on statistical characteristics of the tests. Intelligence tests have developed through **normative** studies that show proportions of children of given ages who achieve particular test scores. Like the growth charts discussed earlier in this book, this normative material allows a given child's performance to be compared to the performance of other children of the same age and to be stated in terms of **percentile rank**. A child whose score is at the 50th percentile has a higher score than half of the children of the same age; one at the 90th percentile has a higher score than 90% of children of the same age. Percentile rank allows the definition of atypical development that designates some children as intellectually or educationally challenged or **disabled**. Intelligence tests also provide a measure called the **intelligence quotient (IQ)**, which is obtained by dividing a child's chronological age into her mental age, a number derived from evaluating the chronological ages of children who have achieved the same test score. If chronological age and mental age are the same, so that the child has a score typical of others of her age, the IQ is 100; if her mental age is greater than her chronological age, the IQ will

be greater than 100; and if the mental age is less than the chronological age, the IQ will be less than 100.

CONCEPTS SPECIFIC TO COGNITIVE DEVELOPMENT

Because cognitive development includes many loosely-related topics, it may be best to consider most concepts in the context of the most relevant topic rather than looking for shared concepts. However, work on cognitive development has generally involved emphasis on the concept of **theory**. A theory is a framework of ideas that is used to organize observable information about an event or process. Theory plays a role in the study of cognitive development that goes far beyond its place in prenatal or physical development, and this may be because cognitive processes are much less easily measurable or observable than physical ones, making the understanding of cognition heavily dependent on theoretical constructs.

Because cognitive changes may or may not be easily measured or even defined, the study of cognition has led to the concept of **operational definition**. This is a description or definition of an event in terms of the operations or measures used to study the event. For example, the normative studies of cognitive development mentioned earlier may define children's cognitive achievements in terms of performance on a named test, or a research approach may describe memory in terms of the number of syllables remembered one minute after a list has been read aloud to a child.

Some important concepts of cognitive development were derived from the study of infant cognitive development and have not been used often to address issues of childhood cognitive progress. Among these ideas are the **four As of infancy**. These 'A' words – arousal, attention, affect, and action – describe essential aspects of early development. Arousal and attention are critical concepts for the study of cognitive development, and action is an essential part of the communicative development that is part of cognition. Affect, or emotion, cannot be separated easily from cognition, but it is of such great importance in itself that Chapter 6 will be dedicated to that topic.

AROUSAL AND ATTENTION

The concept of **arousal** refers to an individual's level of responsiveness to the environment. When arousal is low, an infant or child seems preoccupied with internal events or simply 'dull' and unresponsive. High levels of arousal occur when the individual is very responsive to sights and sounds or other environmental events; he or she becomes increasingly active when arousal is high. A moderate level of arousal is considered the best for learning and problem-solving; when arousal is too low, an infant or child may not notice what is happening around her, and high levels of arousal involve responding to many aspects of the environment rather than the ones that are most salient to learning.

Attention is the capacity to respond selectively to events in the environment. Attention is most under control at times of moderate arousal, when an individual can respond to important events rather than being distracted by a range of simultaneous experiences. Effective use of attention includes the ability to maintain attentive focus in spite of distracting events, and the ability to transfer attention from one event to another as needed.

Infants in the first few months appear to have low arousal (to be difficult to get to respond) but to move quickly to high arousal when hungry or distressed, with high levels of activity but little responsiveness to specific aspects of the environment. They are dependent on caregivers to stimulate or to soothe them and to keep their arousal at a moderate level. With good care, infants begin to develop **self-regulation**, the capacity to moderate arousal on their own (although still with help from caregivers). As control over arousal develops, the infant's capacity for attention to environmental events emerges, and caregivers notice that he or she begins to respond socially, to look at people's faces, and to respond to voices and touches in a more obvious way. A change in responsiveness typically occurs at between 2 and 3 months of age and has been referred to as the **two-months shift**, a change in behaviour that signals increasing interest in the environment (Kaertner, Keller, and Yovsi, 2010).

Practical Purposes 5.1

Tom and Lily's first baby, Leo, was very fussy at age 6 weeks, and nothing his parents did seemed to soothe him when he got upset. Tom and Lily would try to think of everything they could imagine that might be the cause of his distress. Was he hungry? No, he spat out the nipple and screamed louder. Did he want to be rocked or carried? No, he still screamed when they rocked or carried him for a few minutes. How about a back rub – some babies are said to like that? But a minute of rubbing just elicited louder yells.

What was the problem here? Leo was unregulated and highly aroused. He was too young to be able to self-regulate and depended on his parents to help him reach a more comfortable level of arousal. Unfortunately for Tom and Lily's peace of mind, they did not understand that there was no one thing Leo wanted and that was upsetting him. They took the adultomorphic view, assuming that anyone who got upset had a specific goal in mind and would calm down at once when that goal was achieved. (They assumed this even though adults who are thoroughly distressed, perhaps by fear for another person's safety, do not calm down immediately when their needs are met.) Tom and Lily tried their list of possible solutions one by one, expecting one of the solutions to do the trick. But Leo's little trouble was not about a single thing he needed, it was about his inability to regulate his level of arousal, so Tom and Lily's methods did not work very well.

Fussy, highly aroused babies may be hungry, but they are not able to calm themselves well enough to nurse. Sucking and swallowing in a coordinated way requires organized behaviour, not the uncoordinated yelling and thrashing of high arousal. Leo needed caregivers to help to regulate his behaviour so he could manage nursing, just as a school-age child (who has much better self-regulation than Leo does) may need teachers to provide a quiet, relaxed environment that will allow her to do her best cognitively. One key to soothing a fussy, unregulated baby is to continue the rocking, carrying, or back-rubbing for more than a few minutes at a time. Because the fussy baby like Leo does not 'just want' a specific thing, soothing actions may take a while to work. A second key is that more than one soothing action in combination can work when a single one does not, so that rhythmic rocking, patting, and singing or whispering to the baby can help bring arousal down after some minutes in many cases.

As Leo gets older, he will gradually become more able to self-regulate, especially if Tom and Lily help him along by showing him that it's possible to calm down. Learning to self-regulate will be one of the most important steps towards later cognitive development.

INDIVIDUAL DIFFERENCES

In the course of childhood, children gradually increase their capacities for self-regulation and control over activity and attention, but continue to display **individual differences** in arousal and attention. These individual differences are related to qualities of **temperament**, or constitutional differences in personality and behaviour, to be discussed further in Chapter 6. Individual differences in arousal and attention may be within the typical range for a given age, but atypical characteristics are also possible. To decide whether a child's arousal and attention capabilities are typical or atypical, his or her characteristics must be compared to those of children of the same age; younger children are generally less self-regulated and less able to control and direct attention than older children.

A child who is atypical in arousal and attention development, in comparison to other children of the same age, may be described as having **attention-deficit hyperactivity disorder (ADHD)**. Problems in control of attention may also exist without high activity levels in the form of **attention-deficit disorder (ADD)**. In addition, some children with atypical attention and arousal characteristics show **sluggish cognitive tempo**, an unusual tendency to dreaminess, inattentiveness, and slowing of performance (Tamm et al., 2016). All of these atypical conditions of arousal and attention development create interactions with the effects of schooling on other aspects of cognitive development, as the affected children do not respond to school or to other adult guidance in typical ways and often do not succeed academically as a result.

Practical Purposes 5.2

Harry is a 10-year-old who is doing very well in school. His teachers praise his mathematical and reading skills and his ability to concentrate on his work, and predict that his interests will take him into engineering work. Harry's grandfather learned carpentry from his own father when he was a boy and still enjoys woodworking, and he would love to have Harry follow in his footsteps and do projects together with him. But when the grandfather tries to show Harry how to use a saw or a chisel, Harry does not seem to follow what is happening and soon loses interest, even though he says he would like to learn woodworking and it seems to be connected with a possible future in engineering. Harry's grandfather is puzzled and somewhat annoyed about this. He says, 'I learned this by watching my dad, and he learned by watching his. You can't just be told how to cut wood, you have to watch someone who knows how. Maybe Harry just isn't interested even though he says he is.'

Learning by observation is a skill that is valued and practised differently in different cultures, and although Harry and his grandfather live in the same country, some aspects of the culture may have changed over time. Comparisons of children in Central America and in the United States show real differences in the ways children 'learn how to learn' from their cultures. Watching and gradually joining into a work activity are skills that are much more emphasized in some cultures than in others, and children who have developed these skills may not expect to receive direct instruction or follow directions in the same way that formal schooling demands. The reverse may also be the case, as Harry's successful negotiation of school tasks does not seem to have equipped him to learn by observation as his grandfather expects him to do.

Assessment of children's learning, intelligence, and cognitive development may need to be different for children in school-oriented cultures and cultures that emphasize learning by observing adults, but there is little work that addresses this problem, even though it may be quite relevant to the education of immigrant children.

Further reading 5.1

Rogoff, B. (2016) 'Learning through observing and pitching in to community activities', http://stemforall2016.videohall.com/presentations/693.

This presentation and the written summary and comments show differences in learning attitudes and behaviours as they exist in differing cultures.

LEARNING

An essential concept for the study of cognitive development is **learning**. Learning is a change brought about by an experience, which may exist at the **mental** level of

which only the individual learner may be aware, or at a **behavioural** level that can be observed and measured. The concept of operational definition does not allow for non-behavioural measures of learning, so studies of learning at the mental level must 'convert' that learning into performance that can be observed – for example, choosing a toy the same as the one the child saw yesterday.

CONDITIONING METHODS

Learning as a simple result of **experience** has been shown to occur prenatally, with babies after birth responding differently to verses they heard their mothers read weeks before birth from how they respond to unfamiliar verses (DeCasper and Spence, 1986). Most learning in the early months of life is of this type, and some involves the kind of learning often called **classical conditioning**. Classical conditioning involves **associating** one event with another, so that when one event occurs, such as the mother pulling up her shirt, the baby expects to be breastfed and behaves accordingly. Some months later, the association between a doctor's white coat and the pain of an injection causes many babies to cry loudly when they see someone else, perhaps a waiter, wearing a white coat.

Classical conditioning involves learning of associations and expectations, but not of voluntary behaviour. A second form of learning, **operant conditioning**, is shown in behaviour. In operant conditioning, a child's behaviour is followed by an event that is reinforcing – an event that has an effect resulting in the child performing the behaviour more frequently in the future. That reinforcing event may involve something the child needs or wants, like food or attention, in which case it is called a **positive reinforcer**, or it may involve the removal of a painful or frightening event, in which case it is called a **negative reinforcer**. Both positive and negative reinforcers increase the frequency of a behaviour and can be used intentionally by adults for guidance of a child or as an intervention for a problem. **Punishment** is a much-misunderstood concept that is quite different from negative reinforcement. A punishment is an unpleasant experience that is given following the child's unwanted behaviour, with the intention of reducing the occurrence of that behaviour later on. The concept of **discipline** or guidance of children's behaviour may include both forms of reinforcement and punishment as well, depending on cultural and familial factors.

Practical Purposes 5.3

Many concerns about physical punishment have led to the rejection of practices like smacking and spanking. These, and more severe forms of punishment, have been classified as child abuse and prohibited by law. One of the reasons for this prohibition, of

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course, is the possibility that parents who escalate physical punishment from a mild to an intense form may actually injure children. But there are other reasons to be concerned not only about physical punishment, but about all kinds of punishment that act to frighten and intimidate children by assertion of power.

Millie is a single mother with two school-age children, Mia and Matt. As the children have grown bigger, Millie has sometimes worried that she will lose control over them. She has no one to back her up when household rules are broken and is anxious to keep the children obedient, foreseeing that when they are older they may want to be less compliant than they are now. Millie also worries that the two children may 'gang up' on her in order to get their own way.

Millie cannot think of any method for keeping order and authority in the house except punishment – but she knows that she must not use smacking or spanking. Instead, she punishes the children by loud yelling and threats of deprivation of food or toys. The children seem frightened and want to get away from Millie when she does this, so Millie thinks this kind of punishment ought to work, but Mia and Matt seem to be increasingly disobedient and continue to do things she has screamed at them about. They are afraid of their mum, but no more cooperative than if they were not afraid – possibly less.

There are several problems in what Millie is doing. Even very intense, physical punishment is ineffective if it is not timed right. To be effective, punishment needs to come immediately after an unwanted behaviour; ideally, it would occur while the behaviour is still in progress. Punishment also needs to be very consistent in order to be effective. However, most unwanted child behaviours, such as hitting a sibling, nose-picking, or using bad language are not noticeable until after they have happened, and they often occur in situations where immediate punishment is not practical. No matter how loudly Millie yells, and no matter how imaginatively she threatens events the children do not like, if her timing is poor, the punishment will not be effective. She would do better to use mild reprimands but make sure that they are timely and consistent.

One problem with punishing children by intimidation is that the children's emotional response to this interferes with their cognitive functioning. If very much distressed, they may not remember what they are being reprimanded for or may be unable to self-regulate well enough to do what is demanded of them. A second problem is that the children may imitate the adult behaviour and attempt to deal with other children as the punitive parent deals with them, which is likely to be unsuccessful and destructive of social relationships.

VERBAL LEARNING AND MEMORY

Verbal learning is a type of learning that can occur through simple experience, as when a story is heard many times, but is also carried out intentionally by children in school settings. Verbal learning enables the individual to repeat a series of words

orally or in writing, or to recognize and identify the word material. Intentional verbal learning occurs through **practice** and **rehearsal** of verbal material. Children develop skill at verbal learning through formal instruction and through the experience of successful learning as a result of practice.

MEMORY

The concept of **memory** refers to the ability to retain information when some time has passed after the information was learned and to display the information through some kind of behaviour. Understanding work on children's development of memory is helped by using several ideas about the measurement of behaviour showing memory. Behaviours displaying memory may involve **recall** methods, in which the child shows or tells what is remembered; recall is a challenging method which generally shows that less is remembered than would be seen using other methods. **Recognition** is an indication of memory in which the child simply names or points to material he or she has learned about before, indicating what is familiar, but not having to reproduce the information. **Savings** methods ask the individual to relearn forgotten material that cannot be recalled or recognized; if the material is relearned more quickly than it was originally learned, this is an indication that some memory has remained.

It is important to understand that memory is not generally 'photographic' in nature and that memories of experiences are gradually lost unless they are rehearsed frequently. The idea of **repression**, or forgetting of information because it is distressing, is questionable. In addition, it is important to realize that there can be **false memories** of events that did not actually happen (Brewin and Andrews, 2017). These issues are important when children are witnesses of or victims of crimes and are asked to testify about them (Brackmann et al., 2016).

Research example 5.1

How quickly do babies learn and how well do babies remember? These are questions that are difficult to answer, especially if we think about memory as involving verbal responses. Any study of infant memory has to focus on things that babies can show us through their behaviour. The researcher Caroline Rovee-Collier developed a technique to allow babies to learn and show what they remembered (as shown in Figure 5.1).

Although we often think of babies as influenced primarily by food and physical comfort, they respond strongly to interesting things to watch and to their own abilities to make interesting things happen. Rovee-Collier used that interest to motivate infant learning. A baby who accidentally makes a mobile move by kicking a foot tied to the

(Continued)

mobile by a ribbon will be interested and increase its kicking in order to see this interesting spectacle. They will remember what happened for a period of time and show their memory or forgetting by starting to kick at once – or failing to kick – when they see the mobile again. This technique, shown in Figure 5.1, is called the mobile conjugate reinforcement paradigm.

Babies of 2 months learned to kick and make the mobile move in 7 to 9 minutes and forgot within two days; 3-month-olds take 4 to 6 minutes to learn and remember for a week; 6-month-olds take 1 to 3 minutes to learn and remember for over two weeks. An additional point was that in another study of 3-month-olds, all the babies who learned to kick remembered after one day, but only those who did not cry at the time of learning remembered a week later (Singer and Fagen, 1992) – reminding us of the importance of self-regulation and moderate arousal in cognitive functioning.

Other work by Rovee-Collier used a memory reactivation technique that explored changes in memory after the kicking behaviour had been forgotten. This simply involved showing the babies the mobile on the day before they were to be tested. This considerably improves memory, but memory does not return instantly – a period of hours may need to pass before the re-tested baby again shows memory for the learned behaviour.

Rovee-Collier, C., and Boller, K. (1995) 'Current theory and research on infant learning and Memory', *Infants and Young Children*, 7: 1–12.

Singer, J., and Fagen, J. (1992) 'Negative affect, emotional expression, and forgetting in young infants', *Developmental Psychology*, 28: 48–57.

EARLY STEPS IN COGNITION: CONCEPTS RELEVANT TO INFANCY

The study of cognitive development involves somewhat different concepts with respect to the first year of life and later periods. Early steps in cognitive development are non-verbal and must be studied by careful observation under controlled conditions. An essential concept of early cognitive development is somewhat related to the idea of arousal mentioned earlier in this chapter; it is the idea of **state** (Emde, Gaensbauer, and Harmon, 1976). State is a concept based on the strong tendency of babies in the first few months to cycle through a predictable series of **stages** of arousal and activity rather than to have their actions controlled by environmental events (as is more characteristic of older children). An infant's state is defined by the stage he or she displays at a given time. The quiet alert period at the end of the stage of drowsy awakeness is the one when infant learning is most likely

to occur, but it makes up only a short period of the young infant's daily time. With increasing age, babies are less under the control of the succession of states, are awake and alert for longer periods of time, and are able to learn more from experiences. The predictable series of stages is the following: (1) Active sleep involving rapid eye movements (REM sleep); (2) Quiet sleep; (3) Drowsy awakeness; (4) Alert awakeness; (5) Fussing and high activity; (6) Crying.

A second important concept about early cognitive development is **habituation**. This term refers to the tendency of young infants to look or listen more to new stimuli and to stop attending to a stimulus after a period of time. After an infant has stopped looking at a stimulus (i.e., has habituated to it), replacing the old stimulus with a new one will cause the baby to look attentively once more. If a familiar stimulus is brought back after habituation has occurred in the past, the baby will look at it again, but will habituate more rapidly than in the original exposure. Habituation thus provides a way to find out whether young babies discriminate – tell the difference – between two colours, shapes, or sounds. If the baby has habituated to one image but then takes the usual length of time to stop looking at a new one, this is evidence that the baby can tell the difference between the two pictures.

Studies of habituation concentrate on a young baby's ability to look at an object for a longer or shorter period of time, and they demonstrate the importance of novelty in the baby's cognitive world. Using measures of infant looking, we can see a baby a few months old beginning to learn **concepts** that are foundational to later understanding of the physical and social world (Ferry, Hespos, and Gentner, 2015). These concepts may be described as **object properties**; once understood, they enable the child to predict how objects in the world, such as blocks or cups of juice, will react to circumstances (like dropping them). For example, **support rules** are concepts of the ways one object can be supported by another object. A 3-month-old apparently thinks that an object will be supported by another object as long as the objects touch somewhere at the top or side, and does not show surprise (by looking for a long time) if she sees a box that looks suspended in air but has only a small contact with a box below it. However, by 6 months she will stare in puzzlement at a box that does not fall when most of its bottom is not in contact with a supporting box.

Once a baby is able to sit and to reach for objects, his or her cognitive development can be studied in ways other than observation of looking. At this point, it is possible to study **object permanence**, the baby's understanding that a hidden object still exists somewhere. Like support rules and other infant concepts, object permanence develops gradually. A 7-month-old typically will look with interest at an attractive object like your phone, but will simply turn away to something else if the phone is covered with a scarf. In another month or two, she will snatch the scarf away to get at the phone, but if a second scarf has been added over the first, she will lose interest after the top scarf is removed.

Interest in the development of object permanence has led to the **'A not B' task**, a well-known method for studying early cognitive development (Wellman, Cross, and Bartsch, 1986). In this task, a baby is presented with two hiding places,

A and B, for an attractive object. An interesting toy is hidden in A while the baby watches, and the baby is allowed to reach for and find it. After this has been done several times, the toy is hidden in B – again while the baby watches. The baby of 9 or 10 months, however, reaches again to A, where the toy has been found before. By 12 months, the baby has learned to pay systematic attention to the place where the toy was last put and to solve this problem.

Concept and category development is already going on in young infants, but they tend to focus more on differences between objects than on similarities. For example, babies will react to a mobile as if it is new if it contains the same flowers or bunnies as before but they are arranged in a new pattern (Rovee-Collier, 1997). The use of concepts in the learning of language will be discussed further later in this chapter.

Imitation of other people's actions enables both early and later learning that occurs without either reward or punishment but through vicarious experience. Surprisingly, infants have been shown to imitate adult facial expressions as early as 36 hours after birth (Meltzoff and Moore, 1989; Nagy et al., 2012). Imitation is a foundation of later learning, whether in the home or in formal education.

An important concept for the understanding of cognitive development is termed **theory of mind** or **mentalization** (Wellman, Fang, and Peterson, 2011). This idea refers to the ability of human beings to realize that other humans have minds – knowledge, awareness, desires, and intentions – that help to determine their behaviour, and that behaviour is a clue to mental processes. These realizations guide older children and adults in their actions towards other people and in their understanding of the physical world around them. For example, watching where other people look can be a useful warning of danger or give other information. At what point in development infants begin to exercise theory of mind is a difficult question, but it has been suggested that they begin life with a primary **intersubjectivity**, or ability to respond differently to people than to inanimate objects (Trevarthen and Aitken, 2001).

LATER STEPS IN COGNITION: CONCEPTS RELATED TO PRESCHOOL AND EARLY SCHOOL AGE

Work on cognitive development after age 1 year has tended to focus on the cognitive immaturity that limits children's learning and problem-solving abilities. For example, young children show **egocentrism** in their view of the world – not selfishness (as the term might imply), but an approach that is literally centred around the self, so the child does not understand that his view of an object is different from the view of another person standing in another place. Before the age of 6 or 7, the child assumes that others see and know exactly what she sees and

knows. **Perspectivism**, the ability to take another point of view, develops gradually, and like most cognitive skills is initially evident only for simple problems. Problems with shifting points of view are also seen in the **scale errors** characteristic of preschool children. Children may treat small models of objects like cars or chairs as if they were full-size objects and try to get into them or sit on them.

Concreteness is the tendency to treat mental events as if they were concrete objects. A dream or story about a scary event may be found just as frightening as the real thing by preschoolers and even by older children. This child characteristic is related to the idea of **appearance-reality distinction** and the confusion of preschool children about how objects or people can be altered by disguises (Flavell, Flavell, and Green, 1983).

Before school age, and in the early school years, children show difficulties with the use of **conservation**. Conservation is the ability to understand that physical objects may be changed in many ways but retain ('conserve') certain of their original properties. For instance, a ball of clay may be rolled out into a long 'snake', changing its shape, while its original volume is conserved (remains the same). The number of a row of buttons is conserved when they are pushed closer together or spread further apart.

Transductive reasoning is a cognitive characteristic of preschoolers and only gradually disappears with age to be replaced with more advanced reasoning abilities. In transductive reasoning, children assume that if two things or events share one characteristic, they must share others as well – including a cause-and-effect relationship. For example, reasoning transductively, young children often assume that because tree branches move when the wind blows, the tree's movement is causing the wind rather than the other way around.

Having already begun in infancy, concept formation proceeds in early childhood through the development of **classification** skills. In this cognitive step forward, preschool children begin to put objects into groups that resemble each other, but initially can do this in only one way, so, for example, a child might be able to put all blue and all red objects together, or all squares together and all circles together, but cannot make four groups of red circles, blue circles, red squares, blue squares. **Two-way classification**, starting at about age 5, allows for more detailed concepts to be used.

Seriation is the skill of placing objects in order from the smallest to the largest or the reverse, from the red ones through the purple to the blue ones, from the sweetest to the least sweet, and so on. The seriation concept is foundational to arithmetic or other quantitative work, because although young children may be able to recite 'one, two, three…', they are able to combine numbers accurately only if they know that two is always larger than one and three is larger than two. The seriation skill is not usually mastered until the early school years and is different from simple counting. Seriation may be thought of as an aspect of the conservation concept, because it is related to a characteristic that numbers retain even when used in different combinations or to describe quantities of different objects.

Further reading 5.2

Mervis, J. (2017) 'No easy answers', *Science*, 355: 568–71.

This article discusses some of the problems of assessing cognitive interventions, such as those in the American Head Start and the British Sure Start programmes, and the difficulties of providing research evidence to support these preschool programmes. Students can compare some of the challenges of designing and implementing good research, such as that described in this article, with the discussions of research methods on p. 108 and in earlier chapters.

Theory of mind, the understanding that other human beings have knowledge and intentions that guide their behaviour, progresses during the preschool period. Between 3 years of age and about 4 or 5, children begin to understand the concept of **false beliefs**, that a person may have incorrect knowledge and therefore do things she would not do if she knew the truth. This understanding helps the child progress from a **desire psychology**, the assumption that people do things because they want to, to a **belief-desire psychology**, in which a person's actions are interpreted as guided by what he wants but also by what he thinks is true.

EXECUTIVE FUNCTIONS

Although older infants may be beginning to develop some beginning related abilities such as self-regulation, the concept of **executive functions (EF)** is generally applied to the cognitive abilities of preschoolers and schoolchildren. Executive functions include **inhibitory control** (the ability to suppress thoughts or actions that tend to dominate), **working memory** (the ability to retain and recall information over a short period of time), **shifting** (moving from one mental or physical action to another quickly and easily), and **planning** (identifying the steps needed to reach a goal). (The example of the 'A not B' problem given earlier shows how performance of a task may require executive functions like inhibiting the previously-learned reach to the wrong hiding place.)

COGNITIVE DEVELOPMENT IN SCHOOLCHILDREN

Memory ability advances during the school years. Such advances can be considered in terms of **declarative** functions, such as the ability to recall and recite learned material. Declarative memory improves with age, but it is also improved as children learn or develop **memory strategies** like practice or rehearsal of learned material. Children's **working memory**, the short-term ability to remember (for instance) a list of numbers or the words of a sentence that was just read, also

increases with age. A new ability of schoolchildren can be conceptualized as **metacognition**, or thinking about thinking. With this developing ability, schoolchildren begin to check their own memories and memory strategies for accuracy, as they did not do when younger.

Eyewitness memories have been an important focus of study of cognitive development. When children are interviewed as witnesses in criminal cases, interviewing methods must be cautious in order to avoid creating **false memories** through suggestion. However, adult eyewitnesses also may be suggestible and provide distorted recollections of events.

As a schoolchild's ability to apply **concepts** advances, he can solve problems that would have been too difficult earlier. For example, 7-year-olds can typically do **class inclusion** problems. If shown a set of wooden beads, of which more than half are painted red, a child of this age can correctly answer the question whether there are more wooden beads or more painted (but also wooden) beads.

Working with concepts and using metacognition also allows school-age children to solve problems by choosing **operations** or specific mental processes to apply. An operation is a mental manipulation of **symbols** that represent objects, events, or other aspects of the environment (symbol use will be discussed further later in this chapter). Rather than having to count how many toy cars there are in three groups of seven cars each, a child who has learned number facts and has chosen the correct operation can use mental operations to multiply 3×7.

The developing cognitive abilities of the school-age child begin to include **inference**, the understanding of events in the world without the need for the direct, concrete experience required by younger children. Examples of inference are **combinativity**, the idea that adding more of the same kind of category to a set of objects usually does not produce a new category; **associativity**, the idea that for some but not all operations it does not matter in what order they are done; **commutativity**, the idea that there are operations for which order does matter, such as multiplication and division; and **reversibility**, the understanding that there are some operations that can be 'undone', yielding the original situation. But these abilities are not always correctly applied, especially if the child is not familiar with the material. The idea that new problems and new skills are best performed with adult social support refers to the concept of the **zone of proximal development (ZPD)**, an area of partial mastery which can be performed successfully by a child only under ideal circumstances (Smit, van Eerde, and Bakker, 2013).

Executive functions are important for school success and typically improve as school-age children develop better working memory and the metacognition that helps them choose and order the operations they need for a school task. Children who lack inhibitory control or who are easily distracted (as is common in ADHD, discussed earlier in this chapter), are less likely to be able to deploy the needed executive functions for school success.

Practical Purposes 5.4

Eight-year-old Henry has a school assignment that includes a page of arithmetic problems to do. On the first two lines of the page, all the problems set are addition problems; on the second two lines, all the problems are subtraction problems. The rest of the page has a mixture of addition and subtraction problems. Henry is none too interested in doing this task and can hear his brother laughing at a video he is watching, but while his parents prepare dinner Henry gets to work and does all the problems. Later, his father asks him what prep he had to do and says he will check the arithmetic work. Surprised at what he sees, because he knows Henry is capable of good schoolwork, his father says, 'Henry! What's happening here? You did all the first problems correctly, but after that you must simply have added all the numbers. Half of these are subtraction, right? You had better sit here by me and do these over again, because half of them are wrong.'

Henry has no problem with the number facts. However, he failed to use his executive functions to inhibit his first impulse to treat (conceptualize) all the later problems as addition, simply because the first two of the problems were addition problems. Because he did not inhibit that impulse, although he knew the rule for doing the cognitive task, he did not choose the right operation or apply the rule properly. Also, because he was still in the process of learning this skill, he was working in his zone of proximal development (ZPD) – a situation in which adult social support can help children organize their cognitive functions. Henry's father guesses correctly that if Henry sits near him, that small amount of contact will help the boy choose and apply the right operations. With further practice and mastery of the problem, Henry will be able to do his addition and subtraction correctly on his own – but new problems involving less familiar material and tasks will enter the ZPD and be performed at Henry's best level when there is social support from an adult. This social support does not necessarily include helping in the tasks with hints or cues or suggestions, but may be nothing more than availability and occasional attention from the adult.

Theory of mind continues to advance through the school years. While 6-year-olds can handle **first-order false belief** tasks in which they have to answer questions about what a person will probably do if he incorrectly thinks something is true (for example, whether the person will look into the wrong drawer for an object he once saw placed there), by age 9 or 10 children can typically use a more advanced concept about mental states (Gruneisen, Wyman, and Tomasello, 2015). They can correctly answer questions about **second-order false beliefs** – what a person will

do if she has a false belief about another person's true or false belief (for example, what will a child do if he mistakenly believes that another person is about to accuse him of breaking a window that he did not break).

MORAL DEVELOPMENT

Moral development, changes in children's thinking about right and wrong behaviour, has been studied as an aspect of cognitive development. This work has not on the whole focused on whether children can 'tell right from wrong' in adult terms, or on how children actually behave in real-world moral decision-making, but instead has examined changes in responses to **moral dilemma** problems. These problems involve narratives in which there are two possible decisions, neither one obviously wrong; children are asked to make the choice which is 'better' or 'fairer', and to explain the choice. Studies of moral development generally focus on the child's reasoning about the choice and not on the choice itself. Although some approaches to moral development have taken a **stage** approach, and although there seems to be a predictable sequence of stages of moral reasoning, individual differences in the timing of moral development are much greater than those differences in other aspects of cognitive development, and many people do not reach high stages of moral development even in adulthood, much less before age 12. Moral development is associated with social development and will be discussed in more detail in a later chapter.

PLAY

When adults think about their own learning, they generally focus on intentional effort that they use to solve problems or to commit items to memory. Schoolchildren who develop effective strategies for learning, such as the rehearsal of material to be remembered, also use effort to achieve their goals. But most childhood learning before school age occurs is the result of **play**. Play is behaviour that occurs for its own sake – that is, without any extrinsic (environmental) reinforcement, and sometimes even when it is punished – that appears to be pleasurable for the child, and that is repeated frequently and given close attention. Older infants who drop or throw food and other objects are playing, but also learning about facts of the physical world. Preschoolers may play by 'dressing up' and imitating adult life, thus practising their understanding of social roles and rules. School-age children play with collections of toys or objects, categorizing them and practising concepts, as well as learning the skills of organized sports and other games. Children are powerfully motivated to play, even when adults do not want them to be, and are able to practise and develop a range of cognitive abilities without instruction.

Practical Purposes 5.5

How old should children be when they start school and begin formal education about reading and mathematics? This practical question has become increasingly important as family roles have changed and most mothers work outside the home. Families look to schools to provide child care during the day, and the earlier children can go to school, the better for the families' finances.

However, children starting formal education at age 4 or 5 may not be ready either socially or cognitively to take advantage of instruction. For example, for many children, perceptual development at 4 or 5 years is not yet advanced enough to make it easy for them to tell the differences between some confusing letters in the Roman alphabet: lower-case b and d are the same shapes but right-left reversed, as are p and q (in some typefaces, g and q are also similar shapes). Four- and 5-year-olds may not have progressed in cognitive development to the point where they can use the seriation and conservation concepts that allow them to understand that 5 is always more than 3. Typically developing children, within the normal range, may be less advanced than a school curriculum assumes they must be, and therefore may have many experiences of failure early in their school careers. Such experiences reduce their motivation for schoolwork and, if no remedial teaching is done later, may force them on to later curricula without the foundations they need.

Some national educational policies delay formal education until age 7 and use the earlier years for learning through play. Structured play offers lessons in social skills that make later school experiences easier, such as turn-taking and waiting to speak. Pretence play provides opportunities to develop and use concepts and categories as well as imitation and memory. Educational theorists in the past have recommended this approach, with its emphasis on play and free exploration, and the well-known Montessori, Waldorf, and Reggio Emilia schools are organized in this way. There may be excellent developmental reasons for delaying formal education with its stress on direct instruction.

Further reading 5.3

Whitebread, D., and Bingham, S. (2011) 'School readiness: A critical review of perspectives and evidence', TACTYC Occasional Paper No. 2. TACTYC (Association for the Professional Development of Early Years Educators), http://tactys.org.uk/occasional-paper/occasional-paper2.pdf.

This article reviews some of the developmental issues that affect education in the earlier school years as well as some of the theoretical foundations for thinking about school readiness. The authors consider the outcomes of earlier and later beginnings of formal instruction. They conclude that the question is not when a child is ready for school, but how schools can be made ready to deal with children's educational needs.

COMMUNICATION AND LANGUAGE DEVELOPMENT

The capacity for **communication** is among the developing cognitive abilities of childhood. The concept of communication refers to a category of events in which the behaviour or state of one living organism influences the behaviour or state of another. The way in which communication occurs and its outcome may be described as a message or as information which is passed from a sender to a receiver. Communication may or may not be intentional on the part of the sender, and the receiver may or may not be consciously aware of the message received. Even after language develops, much of communication is non-verbal. Methods of communication belong to the **action** component of the 'four As' of infancy, discussed earlier in this chapter.

Newborn infants already communicate to their caregivers by crying, body movements, and flushing or paling of the skin. Caregivers use these messages to determine what an infant needs and to act accordingly. Infants do not need to have intentions to communicate in order to send messages to attentive caregivers. Within months, infants typically begin to look often at their caregivers' eyes, and the caregivers typically respond by 'making eye contact', using a **sustained mutual gaze** that sends a message of interest in each other. Smiling and responding to a smile are other early, non-verbal communications. By the end of the first year, babies have begun to use **gaze direction** for communication and to achieve **joint attention** of adult and child to interesting events; the baby manages the latter by looking to the caregiver's eyes, back to the interesting object, and so on, until the adult joins in looking at what interests the baby. Using the gaze direction to 'point' is followed by pointing with the finger or hand. Older babies also communicate non-verbally by pulling an adult in the direction of something they want, or handing an object to the adult while looking at the adult's face. In addition to sending messages in these ways, babies towards the end of the first year can receive non-verbal messages and seek information by looking at adults' facial expressions, especially of happiness or fear; this behaviour of looking for an adult's reaction to unfamiliar events is called **social referencing** (Murray et al., 2008). All of these methods of non-verbal communication continue to be used throughout childhood and in adulthood in addition to speech or gesture language.

Young children's ability to communicate advances with the beginning of **symbol use**. A symbol is a visible feature, like a gesture or a picture or a printed letter, or an audible feature, or even a touch of some kind, that represents or refers to an object or event (the symbol's **referent**) and can be responded to in ways similar to responses to the event. Spoken, written, or gesture **languages** are systems of symbols, with referents agreed upon by a group of people who use them to communicate, and with agreed-upon ways of combining symbols for the communication of information.

Understanding and using spoken, written, or gesture languages depends on **perception** of the components that make up the language. In the case of spoken

language, sounds called **phonemes** are perceptual units that are learned in infancy, and every language uses a characteristic group of phonemes, not all possible phonemes being found in every language (Ortiz-Mantilla et al., 2016). A phoneme should be thought of as a concept or a category rather than a simple sound pattern. For example, the phoneme represented in English by the letter T involves a somewhat different sound pattern when spoken by a man, by a woman, by a child, or by a parrot, but by the end of infancy children who have been hearing English spoken have begun to categorize all these versions as 'the same sound', the same phoneme. Children whose hearing is impaired or who are socially isolated and do not hear much speech are delayed in this process. **Infant-directed talk (IDT)** helps children notice phonemes (see Figure 5.2).

Figure 5.2 Preverbal stage. Infants are most attentive when spoken to in infant-directed talk (IDT), which is high-pitched, repetitious, and involves many changes in intonation. It's most interesting to babies when accompanied by a lively, excited, positive facial expression and gestures. Infants do not pay so much attention to adult-directed talk (ADT), which is lower-pitched and less 'exciting' to listen to. Because babies learn language by listening attentively, IDT can play an important part in early learning.

Practical Purposes 5.6

Layla and Mahmood were expecting a baby when they arrived in Britain from their Arabic-speaking native country. They were concerned about the baby's future and their assimilation into their new country. Mahmood's English was fluent but heavily accented, and he found it fairly easy to talk to people, but Layla was fluent only in

Arabic, which limited her socially and gave her many concerns about whether she understood doctors and social workers. When little Maryam was born, Layla suddenly realized that she had a new worry: what language should this baby learn to speak? She would need English to go to school and to be a real member of the society where she lived, but did that mean she would not be able to talk to her mother or her mother to her? This concern was almost overwhelming for Layla, who already felt terribly isolated because of her language limitations. One of her Arabic-speaking neighbours told her that Maryam would only be confused if she heard two different languages, that her parents must choose just one to speak to her or she would have trouble speaking at all.

Research on bilingualism, the mastery of two languages, shows that the well-meaning neighbour was quite wrong about this. Young children who hear two languages spoken regularly learn both languages well. Early bilingual learning ensures excellent articulation of the sounds of both languages, whereas most people who learn additional languages after early childhood never achieve perfect pronunciation of the sounds of the second language. In addition, children who are bilingual from infancy have been shown to have increased cognitive flexibility, the ability to shift attention and to inhibit a first, impulsive response. Hearing Layla speak Arabic and hearing Mahmood speak both languages will have real developmental advantages for Maryam.

Symbol use, an important advance in cognitive development, begins gradually in infancy, with the baby's recognition of and response to his or her name, and followed by observable responses to other family names and to words describing interesting things like 'kitty' and 'doggy'. Infants receive symbol messages before they can send them, but typically begin to articulate understandable words during the second year and to have a **vocabulary explosion** during that year, acquiring many new words rapidly. Infant communications begin with **holophrases**, single words that convey a complex message to interested adults, but begin to acquire **syntax** (rules about the meaning conveyed by word combinations) soon. Like many other aspects of cognitive development, symbol use involves concepts and categories, as any symbol has the capacity to be used for a range of similar referents, especially when it is used in combination with other symbols.

Understanding and development of complex rules of syntax begins by about age 2 years and continues throughout childhood. Early learning in these areas depends largely on listening and not on correction by adults, but later and more advanced learning typically involves **direct instruction** in school. **Reading**, a more advanced form of language use that associates referents with **graphemes** or written representations of sounds as well as with the phonemes themselves, is typically learned by direct instruction in school and moves gradually towards adult levels of speed and comprehension during childhood.

ATYPICAL LANGUAGE DEVELOPMENT

Individual differences in language development are large, although **receptive** language, the understanding of speech, tends to be more predictable than **expressive** language, the use of words and syntax for communication. When children are outside the normal range and on the slow side in language development, their atypical pattern is concerning, because language use has so many social and educational implications.

When children are much delayed, not only in receptive and expressive speech but in communicative gestures and the use of gaze direction for communication, there are concerns about **autism**, sometimes called **autism spectrum disorder (ASD)**. ASD is a mental and behavioural disturbance involving some **developmental delays** and atypical behaviours, especially in the area of communication. ASD is most often diagnosed after a child passes the usual age for language development without typical advances in either receptive or expressive language. The seriousness of ASD varies considerably, with some children appearing socially awkward while educationally successful, and others unable to achieve independent living in adulthood. Some success in the treatment of ASD has been shown for the intervention **applied behaviour analysis (ABA)**, which uses operant conditioning methods to improve communication skills (McPhilemy and Dillenburger, 2013).

It is usually assumed that **early intervention**, treatment of potential childhood problems at the earliest possible age, can be expected to be more effective than later treatment, given when a problem has already become apparent. With respect to autism spectrum disorder, the possibility of very early intervention is limited by the fact that the diagnosis of ASD is not reliable until about the age of 3. Researchers continue to seek for early indicators that suggest that a child is likely to develop ASD; the hope is that if such indicators can be found, early intervention can be used as a preventive measure. Language delays are a feature of ASD; language delays can also occur without ASD, but in all cases severe language delays indicate developmental problems and therefore are of research interest.

Research example 5.2

Because infants do not speak and understand relatively little speech even at 1 year of age, non-verbal communication, like gesture, may be studied to see if they are predictors of language delays later. In a study by Lueke and colleagues in 2017, babies' use of pointing was studied as a possible predictor of language delays.

Babies of about 1 year of age may point because they want something, or simply in order to show or indicate something interesting to another person. They may also vary in the way they use their hands in pointing, using the whole hand or the index finger. Finger-pointing typically increases with age. The researchers carried out a longitudinal

study in which they assessed pointing in a group of children at about 12 months of age and again at about 24 months. At 24 months, the children were also assessed for language skills like vocabulary. The children were drawn from families in which one or more people had language delays, making it more likely that some language-delayed children would be found. Children who at age 12 months pointed with their index fingers to show something interesting to another person were more likely to have good language development at age 2 years than were children who at age 12 months pointed with the whole hand. Pointing with the index finger seems to be a milestone in the development of communication.

Lueke, C., Grimminger, A., Rohlfing, K., Liszkowski, U., and Ritterfeld, U. (2017) 'In infants' hands: Identification of preverbal infants at risk for primary language delay', *Child Development*, 88: 484–92.

A less obvious form of atypical language development is **dyslexia**, a reading problem that is considered a **specific learning disability** and is not associated with low intelligence or general learning delays. Children with dyslexia confuse letters and letter order, and as a result have difficulty learning topic areas by reading, as they are expected to do in most school settings.

Development story 5.1 (continued)

With improvement in his use of speech, Oliver became more able to interact with other children in situations and his tantrum behaviour was much reduced, making him more socially acceptable to both adults and other children. He remained one of the less sociable members of his class and had few friends at age 9, but this did not seem to bother him. He was successful enough in school to be able to continue in a mainstream school rather than needing a special school. Oliver continued to be uninterested in pretence play or other open-ended interactions with other people.

Oliver's mother was pleased with the progress he made, but she continued to hope that there would be a miraculous new treatment for ASD, and that Oliver could be made into the bright, sociable little boy of her dreams. She often looked at Internet sites that claimed complete 'cures' of ASD but never tried any of these because of the expense. She also joined a parent support group for people whose children had ASD and heard about evidence-based treatment like applied behaviour analysis (ABA), but Oliver's progress suggested that his mild ASD did not need that kind of intervention.

ASKING THE RIGHT QUESTIONS: LANGUAGE DEVELOPMENT

Read through these questions and answers as practice for applying the questions to other aspects of child development.

1. **What develops?**

   Use of communication develops from early signalling behaviours of infants to the use of symbols in the form of speech, gesture, or images like writing or pictures. Symbol use changes with age and becomes increasingly organized into syntactic patterns in which changes in combinations change meaning; the rules of syntax are different for different languages.

2. **What is the pattern of development?**

   Language development is rapid in the early years and slows with age. Periods of rapid development, such as the vocabulary explosion and the beginning of reading, are notable, but there are also periods of gradual change. During a critical period in the first two or three years, familiar phonemes are mastered and used in listening and speech; although a language's vocabulary and syntax may be learned later, perfect mastery of characteristic phonemes is no longer likely. Mastery of increased vocabulary, of reading, and of additional languages comes gradually during the school years.

3. **What are the mechanisms of development?**

   Human beings have a capacity for language development that is thought to be a genetic result of evolution. Brain functions are essential to language, whether it is in the form of speech, gesture, or writing. Because experiences with the environment guide language development, adequate sensory functions are also needed so that spoken communications can be heard and gestures or facial expressions seen. Experiences of these kinds in the early years determine phonemes or gesture patterns that will be learned and used symbolically, as well as the syntax that will be learned. Learning reading and writing, and learning languages not encountered in infancy, generally occur as a result of direct instruction and intentional practice rather than simple experience.

4. **Are there individual differences in development?**

   Typically-developing children show variability in early language development, especially with respect to the development of expressive language. However, there is a normal range of development, with normative information allowing assessment of individuals. Young children whose atypical development involves delays in speech or gesture and in understanding communications are of concern because of the possibility of hearing impairment, intellectual disability, or autism spectrum disorder. Later individual differences may result from limited exposure to speech or gesture languages and limited experience with reading, all associated with educational problems.

5. Are there population differences in development?

Girls' language development has been shown to be slightly superior to that of boys on average, but the distributions of each gender's language abilities are wide, and overlap is such that there are boys whose language development at any stage is superior to that of some girls. Children with ASD, hearing impairment, or intellectual disabilities are slower in language development at all ages than children without these challenges. Social class differences favour the language development of children in more educated families. Children in bilingual households are not disadvantaged in language development.

ARE YOU LEARNING FROM YOUR READING? TEST YOURSELF

1. Students will be able to apply relevant general concepts to information about cognitive development. (Can you discuss how maturation and learning each contribute to cognitive development?)
2. Students will be able to apply specific concepts to information about cognitive development. (Can you explain how arousal and attention contribute to cognition?)
3. Students will be able to supply concrete examples of events from which concepts are abstracted. (Can you describe the kinds of behaviour that suggest the concept of self-regulation?)
4. Students will be aware of sources of further information about the topic.
5. Students will have practised asking and answering appropriate questions about a specific aspect of cognitive development.
6. Students will be aware of research methods used to study cognitive development. (Can you define reliability and validity as they apply to assessments of children's cognitive abilities?)
7. Students will understand how concepts in this chapter are related to each other. (Can you choose three or four concepts from Chapter 5 and create a conceptual map showing their connections?)

CHAPTER SUMMARY

Chapter 5 explores a range of aspects of cognitive development. The range of topics included as aspects of cognition means that although general developmental concepts are applied to all cognitive functions, more specific concepts are needed for particular areas of development. Although biological foundations for cognition are suggested in the study of language and in Piaget's theory of cognitive development, on the whole, cognitive development is seen as having a high degree of plasticity, with experience playing a strong role in the development of cognitive abilities. Behaviouristic views give great stress to the effect of learning

from experience on cognition. Developmental trajectories involving either continuous or discontinuous, stage-like cognitive change are a subject of research on cognitive development and are related to normative measures used to ascertain whether a child's cognitive progress is typical or atypical. Atypical development of cognitive abilities, including those of language and communication, can be approached with interventions intended to bring individual children's development into the typical range. The chapter concludes with organizing questions about language development and with a list of learning objectives.