how such a model could learn conservation of number. In both cases, the systems’ learning resembled that of children, both in the types of problems that were easy or difficult to learn, and in the types of errors that were made.

Evolutionary theories are based on an analogy between biological and cognitive evolution. As emphasized in Siegler’s approach, the critical contributors to change in both cases are sources of variation and sources of selection. In children’s thinking, strategy discovery provides one source of variation; strategy choice procedures provide a means of selection. The two types of processes work together to change not only how often children use different strategies, but also when they use each approach. The theory has stimulated observations of how children construct new strategies and of how their use of existing strategies changes over time.

**Recommended Readings**


Scene: A mother is assisting her son as he attempts to construct a puzzle depicting a truck. They are using an identical, completed puzzle as a model, and their goal is to make the child’s puzzle correspond to the model. The child repeatedly attempts to place green, triangular pieces in the cargo section of the truck, even though no such pieces were used in the corresponding part of the model.

**CHILD:** (picks up two green triangles from the pieces pile without looking at the model) Another green one. Where’s the green?

**MOTHER:** Did we find any green up here? (points to the model)

**C:** (looks at model) This one. (points to an incorrect place in the model)

**M:** I think maybe that’s a leftover. Do you think so?

**C:** (nods)

**M:** Maybe we don’t need the green one, cause there isn’t any green one up there, is there. Remember?

**C:** (looks at pieces pile, puts green pieces back in it, and chooses two appropriate pieces) (Wertsch & Hickmann, 1987)

The boy in the vignette above eventually managed to complete the puzzle correctly. However, he did not do so on his own. His mother asked helpful questions, provided guidance, and directed his behavior in ways that made it
possible for him to complete the puzzle successfully. She directed his attention to the appropriate places in the model puzzle and helped him to make effective choices about what piece to place next. The social support provided by the mother extended her son’s abilities beyond the scope of what he could do independently.

As this example suggests, the social world has a profound effect on what children do, on what they think about, and on how they think. Interactions with other individuals provide children with opportunities for learning and help children to perform tasks that they are not able to perform on their own. The cultural context influences children’s typical activities and opportunities for social interaction and provides important tools that children can use for action and for thinking, including toys such as the puzzle in the vignette above, traditional tools such as hammers and silverware, and symbolic systems such as language and mathematics.

Developmental theories that emphasize the roles of the social and cultural world in children’s development are called sociocultural theories. Research guided by sociocultural theories investigates how social factors influence cognition and development, and how social and cultural practices shape and define thought. This chapter examines such theories and research.

Just as Piaget was the founding father of stage theories of development, the Russian psychologist Lev Semenovich Vygotsky (1896–1934) was the founding father of sociocultural theories. Although Piaget and Vygotsky were contemporaries, their theories pointed in different directions. Whereas Piaget depicted children as little scientists, trying to understand the world largely on their own, Vygotsky portrayed them as living in the midst of other people eager to help them acquire the skills needed to live in their culture. Whereas Piaget was largely concerned with the aspects of development present among all children in all societies in all historical periods, Vygotsky emphasized factors that differ among children growing up at different times in different circumstances. The approaches are complementary, in the sense that understanding cognitive development requires understanding both the universal aspects of development and the variable ones.

Vygotsky believed that humans share some elementary psychological processes with animals, including basic attentional, perceptual, and memory processes. His theory sought to explain the processes that he viewed as differentiating humans from other animals—what he referred to as the “higher psychological processes,” such as reasoning and concept formation. Vygotsky believed that the key difference in psychological functioning between humans and animals had to do with the social and cultural basis of human thought. In his view, all of the higher psychological processes had their origins in social interaction.

Organization of the chapter. The chapter is divided into three major sections. The first section introduces the central themes of sociocultural approaches to cognitive development, beginning with central themes of Vygotsky’s theory, and then addressing modern developments in sociocultural theory. The second major section describes several strands of contemporary empirical research in the sociocultural tradition, including research about learning in interaction with adults and peers, guided participation in cultural activities, and the use of language as a tool for thinking. The final section addresses educational implications of sociocultural theories. The chapter outline is presented in Table 4.1.

### Central Themes of Sociocultural Approaches to Cognitive Development

Sociocultural approaches to cognitive development share several common themes. This section begins with two of the central themes of Vygotsky’s sociocultural theory, which continue to be central within current sociocultural theories: (1) cognitive development occurs in social interaction, and (2) psychological functioning is mediated by cultural tools, including language. (Note that, although Vygotsky’s works were not translated into English until the latter part of the twentieth century, these works were written in the 1920s and 1930s. The publication dates for Vygotsky’s writings are sometimes misleading because they indicate the translation date, rather than the date when the original work was written.) The latter part of the section introduces two additional themes that have been emphasized primarily in sociocultural theories of the last two to three decades: (1) cultural norms and other people influence children’s opportunities for learning, and (2) social and cultural learning require particular cognitive abilities on the parts of learners and teachers.

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IV. Summary
Cognitive Development Occurs in Social Interaction

One of Vygotsky's central claims, and a theme of sociocultural theories more generally, is that development occurs in social interaction. Children engage in direct social interactions with many different individuals on a day-to-day basis, including caregivers, siblings, extended family members, neighbors, teachers, and peers. Sociocultural theories hold that these interactions with other people have a profound influence on the course of children's development.

It is worth noting, however, that this emphasis on the social world is not unique to Vygotsky's theory, or even to sociocultural theories more generally. As described in Chapter 2, Piaget also acknowledged that other people play an important role in children's development. In particular, Piaget believed that social partners could provide children with information that might provoke states of disequilibrium, and thereby elicit cognitive change. Piaget believed that interactions with same-age peers were more likely to promote disequilibrium than interactions with older children or adults. His reasoning was that children are more likely to unquestioningly accept the ideas espoused by older children and adults, but that they are more likely to critically analyze and think deeply about the views held by their peers, especially when those views differ from their own.

Note that Piagetian theory conceptualizes the social environment as an outside force that influences individual children's learning and cognition. The environment provides information to the developing child, but developmental change occurs within the individual child. Thus, the basic unit of analysis in Piagetian theory is the individual child. The external environment is important only as an influence that can elicit particular thoughts and new equilibria in the child. In contrast, sociocultural theories view the social environment as an integral part of children's thinking and behavior, such that the child's cognition and behavior cannot be separated from the social context in which they take place. Thus, in sociocultural theories, the emphasis is on the child in context as the unit of analysis. Social interaction is not simply an external source of information that plays a role in individual development, but is instead an integral part of development, as well as a source of developmental change (Gauvain, 2001).

Vygotsky proposed a mechanism for developmental change that is inherently social. Specifically, he argued that developmental change occurs via the internalization of socially shared processes. He argued that in the course of development, every psychological function occurs twice—first at the "intermental" level (between people who are involved in social interaction), and later at the "intramental" level (within the individual). Children initially perform cognitive tasks with support from social partners, and over time, these social interactions are gradually internalized, until children can perform the tasks on their own. Thus, individual psychological processes originate in, and derive from, social interactions. From this perspective, social interaction is not merely an outside force that influences the path of development; it is instead a causal mechanism for development itself.

One example that Vygotsky used to illustrate the process of internalization is the development of pointing during infancy (Vygotsky, 1978). According to his account, the development of pointing begins with an infant's unsuccessful attempt to reach a desired object. When an adult construes the infant's actions as an attempt to draw attention to the object, the meaning of the infant's action is fundamentally changed, from an instrumental attempt to obtain the object to an attempt to communicate with the adult. However, this meaning initially exists only in the social interaction between the infant and the adult, not in the infant's mind. Eventually, the infant links the reaching action to the social situation, and begins to understand the movement as aimed, not at an object, but at another person. When the social meaning of the action is internalized by the infant, the action is fundamentally changed, becoming a "true gesture" (Vygotsky, 1978, p. 56).

Thus, the meaning of the pointing action is first socially constructed in interaction between the adult and the infant, and then gradually internalized by the infant.

As a second example of internalization, consider a child learning to tie her shoes. At first, an adult assists the child, providing verbal guidance to the child about what to do next (as in "Now make a loop, and bring the other lace around it . . ."). With time, the child internalizes the sequence of steps, so that she can control her own actions without adult assistance. She may "hear" the adult's instructions in her "mind's ear," but she no longer needs the adult to provide external support for her performance.

Note that this framework emphasizes the transfer of responsibility for cognition from more skilled individuals to less skilled ones. To characterize this process, Vygotsky introduced the concept of the zone of proximal development. The zone of proximal development is defined as the distance between what a child can do independently, and what the child can do in interaction with an adult or a more advanced peer (Vygotsky, 1978, see Figure 4.1). This concept was based on the observation that children can often reason in more complex ways or perform more complex behaviors when they receive assistance than they can on their own. For example, the preschooler in the vignette at the outset of this chapter was able to complete a complex puzzle with assistance from his mother, but he might not have been able to complete it had he worked on his own. Similarly, a middle school student might be able to solve a complex, multi-operation algebra equation with guidance from her teacher, but she might be able to solve only much simpler equations when working alone. Solving the complex problem with the teacher's help would provide an opportunity for the student to internalize the solution procedure, and perhaps eventually to solve it on her own.

Vygotsky believed that, to accurately characterize a child's knowledge at a given point in time, it is essential to consider the child's potential competence, as manifested in the zone of proximal development, as well as the child's actual competence in independent performance. The two children depicted in
Figure 4.1 display comparable levels of independent performance, but dramatically different levels of potential competence. Thus, an accurate characterization of each child’s knowledge requires assessments of both levels. As discussed later in the chapter, Vygotsky’s views have had an important impact on knowledge assessment in educational settings.

**Psychological Functioning Is Mediated by Language and Other Cultural Tools**

Vygotsky believed that human behavior is shaped not only by direct social interactions but also by the range of cultural tools that are available in the time and place that development occurs. Cultural tools include both technical tools, which are tools for acting on the environment (such as plows, hammers, and silverware), and psychological tools, which are tools for thinking. Language is the prime example of a psychological tool, in that it is used as a means for regulating behavior, planning, remembering, and solving problems. However, people have invented many other psychological tools besides language, including maps, diagrams, number systems (Arabic numerals, Roman numerals), algebraic symbols, programming languages, tools for solving mathematical problems (protractors, slide rules, calculators, computer software), systems for conceptualizing dates and time (calendars, clocks), systems for filing and organizing information (the Dewey Decimal system, the Linnæan classification system for living organisms), and so forth.

Psychological tools influence the way we organize and remember information. Think for a moment about reciting the alphabet. Chances are, the “alphabet song” just popped into your mind. Research has shown that people use the alphabet song to organize their knowledge of the alphabet, so that when asked, for example, “What letter comes before K?” people typically enter the alphabet at the letter H, imagining the “chunk” of the alphabet song that consists of “H I J K” (Klahr, Chase, & Lovelace, 1983).

Material artifacts can also serve as psychological tools. Some good examples are appointment books, abacuses, and rosary beads. These tools sometimes become internalized and influence thought, even in situations in which the material artifacts are absent. One compelling example of this phenomenon comes from individuals who are skilled at using the abacus.

Abacuses are commonly used in East Asian countries to solve arithmetic problems. Figure 4.2 illustrates the type of abacus that is most commonly used. Its columns represent a base-10 notation, like that used in standard computation. The column at one end (it can be either end) is the 1s column, the next column inward is the 10s column, the next column inward is the 100s column, and so on. Each column is divided into the single bead above the divider and the four beads below. The bead above the divider represents a value of 5; each of the four beads below it represents a value of 1. When the value of a column is zero, the 5s bead is at the top of the abacus and the four 1s beads are at the bottom. To represent numbers greater than zero, the operator moves beads toward the divider in the middle. Thus, if a girl wanted to add 4 + 3, she would first push four 1s beads from below the divider up toward the middle with an upward finger motion (to represent the 4). When her finger reached the top of the column, she would make a downward motion, pushing the 5s bead down toward the middle and returning two of the 1s beads that had been pushed up near the divider to their original position (to represent the 3, as 5 minus 2). This would leave the 5s bead and two 1s beads in the middle, indicating the answer, 7.

Following a hypothesis advanced by Hatano, Miyake, and Binks (1977), Stigler (1984) investigated whether individuals who are skilled at using the
abacus use a “mental abacus” when they solve problems in their heads. He presented 11-year-old Taiwanese abacus experts with arithmetic problems to solve mentally. The children’s pattern of errors suggested that they formed a mental image of the abacus and imagined carrying out the same finger movements on it that they would on a real abacus. First, many of the children’s errors were off by exactly five in one of the columns. This type of error is easy to make on the abacus, because only the single 5s bead discriminates between 2 and 7, 3 and 8, and so on. Second, the children were three times as likely as American undergraduate and graduate students to err by leaving out a column altogether. If an answer to a problem was 43,296, a common type of error for the Taiwanese children was 4,396. This type of error would occur if the children read their answers from a mental image in which a column of the abacus had faded. Thus, the children’s errors suggest that they did indeed use a mental abacus when they needed to perform mental arithmetic. For these abacus experts, the abacus had become internalized, and it influenced their performance even when the physical abacus was not present.

Children growing up in East Asian countries are much more likely to learn to use the abacus than their peers who are growing up in North America. Thus, this example also highlights that different cultural tools are available in different cultural settings. Such tools are an important means through which culture shapes and defines human behavior. Over the course of history, as new cultural tools became available, human behavior changes. For example, the ready availability of calculators has led to a decreased emphasis on computation in mathematics instruction in many American schools. People’s behavior is shaped in large part by the cultural tools that are available to them.

Because of humans’ abilities to learn from social interactions, they are able to pool their cognitive resources and build on past achievements in ways that members of other animal species cannot. Thus, cultural tools can be passed on to younger members of the cultural group, and they can also be refined further. As a result, cultural tools increase in effectiveness as well as in number, over historical time. As an example, consider the wide variety of writing instruments that are available to the modern student (wooden pencils, mechanical pencils, ballpoint pens, markers, fountain pens, and so forth). Now think about the types of writing instruments that were available 300 years ago, or 3000 years ago. The same pattern of change over time also applies to psychological tools. For example, many of the mathematical symbols that are widely used today (+, −, =) were first developed in the fifteenth and sixteenth centuries. Such innovations are preserved and shared, not only across individuals, but also across generations. This evolutionary process that applies to cultural tools has been termed the “ratchet effect” (Tomasello, Kruger, & Ratner, 1993).

Among cultural tools, Vygotsky accorded language special significance in psychological development. Indeed, he claimed that the moment when language becomes integrated with action is “the most significant moment in the course of intellectual development” (Vygotsky, 1978, p. 24). After this point, language is not simply a means for communication but also a means by which children can control and regulate their own actions. Language is a tool that children can use to plan their actions, remember information, solve problems, and organize their behavior. In these respects, it can be said that children’s behavior is mediated by language. Some of the ways in which this mediation occurs will be discussed in more detail later in the chapter.

CULTURAL NORMS AND OTHER PEOPLE INFLUENCE CHILDREN’S OPPORTUNITIES FOR LEARNING

Modern sociocultural theorists have focused not only on the tools that culture provides, but also on how cultural norms and social practices influence the activities in which children engage, and the opportunities that children have for learning. For example, the society as a whole dictates whether or not formal schooling is available and if so, whether it is compulsory. Cultural norms influence many aspects of children’s day-to-day activities, including infant care practices, child care arrangements, and expectations about work, study, and play.

Cross-cultural comparisons and in-depth studies of different ethnic groups have documented that children in different cultural communities spend their time in different ways (Gaskins, 1999; Stevenson & Stigler, 1992). Even among societies that are similar in important ways (such as industrialized societies in which all children receive formal schooling), there are wide variations in children’s typical activities. One study compared the daily activities of children from Greensboro, North Carolina (United States), Suwon (Korea), Omsk (Russia), and Tallinn (Estonia). There were differences across cities in the amount of time spent in each of the activity categories examined, including play, lessons (including both formal and informal instruction), work, and conversation (Tudge et al., 1999). Play was the most common activity in all four cities, but the amount of time spent at play varied, with the Korean children spending the greatest amount of time, and the Russian children the least. Russian and Estonian children spent more time in lessons and work than did Korean and American children, and Korean children spent less time in conversation than did children in the other three sites. Thus, children’s typical activities varied across cultures.

Across all four cities, there were also systematic differences between middle-class and working-class children in all of the activity categories except work. On the whole, children from middle-class families spent more time in lessons and conversation, and children from working-class families spent more time at play. Thus, different cultural communities, defined both in terms of different societies and different social classes, provide children with varying types of opportunities for learning.

Within the framework provided by the culture as a whole, parents, teachers, and other caregivers select and organize activities and social interactions that they deem appropriate for children. At times, these choices are made with
explicit instructional goals in mind. For example, many North American parents
arrange for their children to participate in music lessons or to visit children's
museums and libraries. However, choices about activities and social partners are
often made without explicit intentions to foster children's learning.

A good example of this latter type of activity is Girl Scout cookie drives.
Their main goal is to raise money for the troop. However, in participating in them,
the scouts learn a variety of values and skills (Rogoff, 1995; Rogoff, Topping, Baker-
Sennett, & Lacasa, 2002). The learning occurs through direct interaction with troop
leaders, parents, customers, and other children; through the use of tools devel-
oped by other people, such as the color-coded order forms that are provided to
indicate how much of each kind of cookie is being ordered and how much money
is owed; through planning routes to deliver the cookies; through figuring out how
much change is needed when customers pay for their orders; through trying vari-
ous sales strategies; and so on. While engaging in these activities, children acquire
not only skills but also values: responsibility, courtesy, efficiency, precision, and
promptness, among others. As with the skills, these values are not explicit goals
of the cookie drives. Rather, they are useful byproducts, acquired in the course of
pursuing the main goal of making money. Different cultures provide different
learning activities, but in all cultures, children learn a wide range of values and
skills through participation in activities that reflect the values of their society.

Social and Cultural Learning Require Particular Cognitive Abilities

A major focus of modern sociocultural theories has been to specify the mech-
anisms involved in social and cultural learning. One approach to this issue is to
delineate the cognitive abilities required for social and cultural learning, both on
the part of learners and on the part of teachers.

Perhaps the most basic cognitive ability needed for social and cultural
learning is the ability to establish intersubjectivity, which is the shared under-
standing between people that emerges through processes of mutual attention
and communication. Not surprisingly, social interactions that involve a high de-
gle of intersubjectivity lead to greater learning than interactions characterized
by less intersubjectivity (e.g., Tudge, 1992).

The capacity for intersubjectivity emerges at an early age. Starting when in-
fants are about 2 months old, they and their caregivers begin to display contingent
interaction—reciprocal actions and reactions that resemble the mutual give-and-
take of conversation (e.g., Bateson, 1979; Trevarthen, 1979). By about 9 months,
infants can readily follow adults' gaze and pointing gestures (Butterworth, 2001;
Morissette, Ricard, & Gouin-Decarie, 1995; Murphy & Messer, 1977). Through
these behaviors, infants contribute to establishing joint attention, a state in which
they and their caregivers share a common focus on particular objects or events,
and a key component of intersubjectivity. Children's ability to achieve and

maintain intersubjectivity continues to develop through the early childhood
years, as they become increasingly able to take the perspectives of other people
(e.g., Gómez, 1993).

Further insights into the cognitive abilities required for learning from so-
cial interaction have been gained from comparative studies of human children
and non-human primates. Like humans, members of many other primate species
can learn simply by observing the actions of other individuals (e.g., Custance,
Whiten, & Fedman, 1999; Hirata & Morimura, 2000). However, according to
Michael Tomasello and his collaborators, only humans are capable of certain,
more advanced forms of social learning that require understanding of others as
individuals with intentions and goals (Tomasello, 1998, 1999; Tomasello et al.,
1993). According to this view, what is crucial in learning from social interaction
is humans' ability to understand other people as being like themselves, and in
particular, as having intentions and mental states like their own. Tomasello and
his collaborators have identified three forms of cultural learning that rely on this
understanding: imitative learning, instructed learning, and collaborative learn-
ing (Tomasello et al., 1993).

Imitative learning, according to Tomasello's definition, is learning that in-
volves reproducing another individual's behavior in order to achieve the same goal.
Thus, imitative learning involves understanding the relation between the other
individual's behavior and his or her goal. This form of learning can be distin-
guished from emulation, which is learning that involves focusing on the end re-
result of the other individual's behavior, without an appreciation of the relation
between the specific behavior and the intended goal. Thus, emulation involves
learning something about the task, whereas true imitative learning involves
learning about the other individual's behavior in the task (Nagell, Olguin, &
Tomasello, 1993). Tomasello has argued that most studies that purport to show
imitative learning in non-human primates (e.g., Boesch, Marchesi, Marchesi,
Fruth, & Joulain, 1994; Whiten, Custance, Gomez, Teixidor, & Bard, 1996) can be
explained in terms of emulation, rather than true imitative learning (Nagell
et al., 1993; Tomasello, 2001).

Instructed learning is learning that involves direct, intentional transmission
of information from one individual to another, with the learner attempting to
understand the task or material from the teacher's point of view. In instructed
learning, learners internalize their teachers' instructions, and later use them to
regulate their own behavior. Instructed learning takes place both in formal set-
tings (in lessons at school) and in informal settings (a father teaching his daugh-
ter how to cast a fishing line). Human adults in all cultures regularly instruct
their children, but non-human primates do not (see Boesch, 1991, for a different
perspective). Both the propensity to teach and the ability to learn via instruction
require at least some ability to understand other individuals' states of mind.

This ability is also required for the third type of cultural learning, collabora-
tive learning, which is learning that occurs when multiple individuals engage
in cooperative, goal-directed problem solving. As an example of such learning,
consider two children working together to set up a track for a toy train. The track the children make together is likely to be more complex than the one either child could make independently, and each child is likely to learn something in the course of working together. Whereas imitative and instructed learning involve a process of transmission from one individual to another, collaborative learning involves a process of joint construction of the new knowledge. This process involves establishing a common goal, sharing responsibility for goal-directed actions, and cooperatively carrying out those actions—all activities that require an ability to take the perspective of the other participants in the interaction.

All three forms of cultural learning require the ability to take the perspective of another individual. According to Tomasello, this is the key ability that differentiates humans from other primates, and enables humans to learn from social interactions.

**SUMMARY**

In his writings in the early part of the twentieth century, Vygotsky set forth two major themes that form the foundation of sociocultural theories of development. First, cognitive development takes place in social interaction. Vygotsky conceptualized social interaction not as an external force that provokes change within the individual but as integral to the mechanism of developmental change itself. Second, human behavior is mediated by cultural tools, including both technical tools, which are tools for acting on the environment, and psychological tools, which are tools for thinking. Vygotsky viewed language as the most important psychological tool.

Modern sociocultural theories have built on these themes in a number of ways. One important focus of modern theories is on the opportunities children have for learning and for participating in activities. These opportunities depend on both cultural norms and social practices. A second major focus is on the nature of the cognitive abilities that are required for social and cultural learning. These include the ability to establish intersubjectivity and the ability to understand others as being like oneself in terms of having goals, intentions, and mental states.

**Modern Empirical Research in the Sociocultural Tradition**

Many active lines of inquiry in modern developmental psychology have been inspired by sociocultural theories. This section reviews central findings in several important avenues of recent research, including children’s learning in interaction with adults and peers, children’s guided participation in cultural activities, and the use of language as a psychological tool.

**LEARNING IN INTERACTION WITH ADULTS**

When adults interact with children, they often structure their interactions in ways intended to foster children’s learning (Rogoff, Ellis, & Gardner, 1984; Wang, Bernas, & Eberhard, 2001; Wood & Middleton, 1975). Adults’ role in such interactions is sometimes characterized using the metaphor of a scaffold (Stone, 1998; Wood, Bruner, & Ross, 1976). A construction scaffold is a temporary structure that is used to support workers and materials high above the ground as a building is being constructed. As Greenfield (1984) noted, construction scaffolds provide support for construction workers, extend their range of activities, and allow them to perform tasks that would otherwise be impossible. Once the structure of the building is complete, the scaffold is no longer needed. Like a physical scaffold, adults provide social scaffolding to support children’s task performance. Such scaffolding allows children to extend the range of their activities and to perform tasks that would be impossible for them to perform alone. Once children can perform the tasks unaided, the social scaffold is no longer necessary.

The vignette at the outset of this chapter provides a concrete illustration of social scaffolding. The child in the vignette initially does not attend to the model that he is attempting to reproduce. His mother guides his attention to the model and gently corrects his inappropriate selection of a puzzle piece. With his mother’s assistance, the child selects the appropriate pieces, and uses them to construct the puzzle correctly. The mother’s behaviors extend the range of the child’s performance and make it possible for him to succeed at the puzzle.

**Sensitivity of adult support.** In scaffolding children’s performance, adults tend to tailor their support to children’s level of skill development (Greenfield, 1984; Karmeli, & Brenner, 2001). They sometimes provide children with simpler tasks, and they sometimes simplify tasks by reducing the number of steps required or by highlighting crucial elements of the task. Depending on children’s performance, adults adjust the directness and specificity of their instruction. For example, Mayan women offer more direct assistance to girls who are inexperienced at weaving than to girls who have already acquired some weaving skill, and they offer more assistance in the early, relatively difficult cycles of the weaving process than in later cycles, which tend to be easier (Greenfield, 1984). Such contingent interaction appears to help children advance their skills, especially when instruction is focused at a level just one step beyond the child’s current skill level. In a study in which mothers helped their 3- and 4-year-old children learn to construct complex block pyramids, children performed best on an independent posttest if their mother’s instruction had been sensitive to the child’s skill level (Wood & Middleton, 1975).

Sensitive adult-child interaction also plays an important role in children’s language acquisition (Hampson & Nelson, 1993; Murray, Johnson, & Peters, 1990; Nicely, Tamis-Lamonda, & Bornstein, 1999; Tamis-Lamonda, Bornstein, & Baumwell, 2001). When infants point to objects without producing words, their
mothers sometimes spontaneously provide labels for the indicated objects. Infants whose mothers do so most often tend to have larger vocabularies than infants whose mothers provide labels less often (Masur, 1982). Similarly, mothers sometimes label objects that are the focus of their children’s attention, even when children do not point to those objects. Toddlers whose mothers often “follow” their attentional focus in this way also tend to have larger vocabularies (Tomasello & Farrar, 1986). Relations between mothers’ talk to children and children’s language development also have also been documented for other, later-developing aspects of language skill, such as the ability to tell coherent, well-structured stories (Haden, Haine, & Fivush, 1997).

Although it is important that adult support is sensitive to the child’s skill level, appropriately sensitive support can take many forms. One recent study (Gonçalves & Rogoff, 1998) contrasted several types of structured interactions in which adults helped children group photos of items into categories (baking items, eating implements, and so forth). Adults provided support to the children in one of three ways: by articulating the category rationales themselves, by inducing the children to articulate the category rationales using leading questions, or by a combination of the two (that is, first articulating the rationales themselves, and then prompting the children to articulate the rationales). Children in all three adult-support conditions performed better on an independent posttest than did children in a control condition in which the adult provided little assistance. However, as seen in Figure 4.3, children’s performance was comparable in the three adult support conditions. Thus, various types of adult support are effective at fostering children’s learning.

Not surprisingly, adults do a better job of scaffolding children’s thinking than do the children’s peers. Direct comparisons of situations in which an adult or a peer attempts to teach a child a new skill typically show that children learn more when they work with adults (Radziszewska & Rogoff, 1988, 1991). The adults’ superiority as teachers is not just due to their knowing more about the problems that are being solved. Even when child and adult teachers understand a task equally well, the adults still teach more effectively (Ellis & Rogoff, 1986). This superiority appears due in large part to their style of interaction. Adults are more likely to outline the goals of the task, discuss strategies for meeting the goals, and involve learners in making decisions. In contrast, when children teach, they often just tell learners what to do without explaining the reasons, and they also frequently rely on nonverbal demonstrations (Ellis & Rogoff, 1982). Consistent with this interpretation of why adults are more effective, adults who share responsibility with learners to a greater extent promote more effective learning than adults who do not involve the children as much (Gauvin & Rogoff, 1989).

Adults’ interactions with children also vary as a function of the children’s characteristics. Kevin Crowley, Maureen Callanan and their collaborators documented this fact in a compelling program of research on children’s interactions with parents in science museums. When parents and children visit such museums together, parents support children’s exploration of the museum exhibits in several ways (Crowley, Callanan, Jipson, et al., 2001). First, parents help children to select and encode evidence, for example, by pointing out important features of the exhibits. Second, they aid children in generating evidence, for example, by helping the children to interact with the exhibit in ways that will yield evidence that they can observe. Third, they sometimes provide explanations about how the exhibit works or about the principles that underlie the exhibit. However, the way in which parents interact with their children varies depending on the children’s gender. Parents provide explanations that involve causal mechanisms much more often to boys than to girls (Crowley, Callanan, Tenenbaum, & Allen, 2001).

**Learning in Interaction with Peers**

Many of children’s social interactions involve peers rather than adults. Peer collaborations can be beneficial for children’s learning in a variety of ways: they can motivate children to try difficult tasks, provide opportunities to imitate and learn each other’s skills, enable children to fine-tune their understanding by explaining what they know, and allow children to participate in discussions that increase their understanding (Azmitia, 1996). These potential advantages have led to collaborative learning being widely used in many school systems.
But does peer collaboration have the desired effects on learning? The answer seems to be “sometimes yes, sometimes no.” Some studies have found that solving problems with other children produces greater learning than solving problems alone (Blaye, Light, Joiner, & Sheldon, 1991; Fleming & Alexander, 2001; Perret-Clermont & Schubauer-Leoni, 1981). Others studies have not (Russell, 1982; Tudge, 1992). Still other studies have found that either outcome can occur, depending on characteristics of the task, the children, and the children’s interaction (Glachan & Light, 1982; Levin & Dryan, 1993; Pine & Messer, 1998). In the following subsections, we discuss how the effectiveness of collaborations varies with the ages of the children, the quality of their interaction, their relative expertise, the difficulty of the task, and their cultural background.

Age. The ability to collaborate effectively with peers is a relatively late achievement. Even 5-year-olds, who are competent problem solvers in many circumstances, have difficulty working together to solve any but the simplest and most familiar problems (Tomasello et al., 1993). The difficulty stems from many sources, including limited ability to ignore distractions, to coordinate attention so that both partners are thinking about the same aspect of the problem, to use language sufficiently precisely to communicate ideas, and to cooperate.

Cooperation is often especially difficult for young children. Consider the following episode involving two preschoolers, one of whom had been taught how to build a copy of a Lego house and therefore was an “expert” at it. The children had been told to build a new copy of the Lego house together, but the expert was less than eager to let the novice help.

**Novice:** You gotta let me help. You said you would.

**Expert:** I will, after I finish this (the door).

N: (Sighs, sits back, crosses arms around chest and frowns. Twenty-two seconds later, takes some blocks and begins building a section of the model—correctly. After the section is completed, he hands it to the expert.) I built this for our house.

E: I’m the builder, you find Legos when I tell you, OK? Give me a yellow two-dot.

N: I wanna be a builder too. She (the experimenter) said work together. My window is good . . .

E: Well, it’s not going on my house (moves copy of house out of reach of novice).

N: (Starts shaking the table, making it impossible for the expert to continue building.)

E: Stop it! If you don’t quit it we won’t get finished. I’m almost done with the door.

N: (Stops shaking the table, observes the expert until he finishes the door.) My turn! My turn! (Azmitia, 1996, p. 142)

The novice eventually avenged the indignities done to him. When the expert continued to resist his requests for a larger role, he started pelting him with Legos. When the expert lifted his hands to protect himself, the novice smashed the copy of the Lego house. This ended the collaboration.

**Quality of interaction.** Even after children are able to cooperate well enough to not attack each other during collaborations, the quality of their interaction varies considerably. The nature of the interaction is an important factor in whether or not children benefit from working with a peer (Dimant & Bearison, 1991; Glachan & Light, 1982; Tudge, 1992). Children who share responsibility for the task and who become engaged in each other’s thinking are more likely to benefit from collaboration than those who pay each other’s reasoning less heed (Azmitia & Montgomery, 1993; Kruger, 1992; Tolmie, Howe, Mackenzie, & Greer, 1993). For example, Gauvain and Rogoff (1989) examined the efficiency of route planning among 5-year-olds who were asked to shop for specific sets of items in a toy grocery store. Children whose pairs shared responsibility for planning the route performed better than children whose pairs simply took turns performing the task.

Differences in the quality of interaction may underlie the fact that children learn more from interacting with older siblings than from interacting with other children whom they know and who are the same age as their older siblings (Azmitia & Hesser, 1993). In teaching younger children how to perform a building task, older siblings offered more explanations and more positive feedback than did the other older children. Younger children were also more likely to request explanations from their siblings than from the other older children. Thus, pairs of siblings displayed more shared involvement in the task than pairs of unrelated children.

Why does shared involvement in a task foster performance? Children who simultaneously focus on the same issues are more likely to combine each others’ ideas into new theories or rules, to identify the strengths and weaknesses in each approach, and to use the other person’s ideas to identify weaknesses in their own. Just talking does not improve problem solving by itself; when children solve problems alone, talking aloud about what they are doing is not beneficial (Teasley, 1995). Instead, the key seems to be the extent to which the participants actively think about each other’s ideas.

Schwartz (1995) has argued that individuals working in pairs often construct more sophisticated and more abstract representations of problems than do individuals working alone. He found that across several types of problem-solving tasks, students working in pairs often developed a common representation of the problem that they could use to coordinate their different perspectives on the problem. Because these jointly developed representations bridged different perspectives, they tended to be abstract. Abstract representations often facilitate task performance, and because children working in pairs often generate such representations, they tend to perform better than children who work alone.
Relative expertise. Another influence on the effectiveness of peer collaborations is the relative expertise of the collaborators. Children usually benefit from interactions in which they work with a more skilled or more knowledgeable peer (Fleming & Alexander, 2001; Golbeck, 1998; Manion & Alexander, 1997; Murray, 1972; Tudge & Winterhoff, 1993). For example, in one study, novice 5-year-old Lego builders who were paired with a more expert peer improved more in their ability to copy Lego constructions than did novices who worked alone or novices who worked with other novices (Azmitia, 1988). Such interactions are also often beneficial for the more skilled peer (Mugny & Doise, 1978; Weinstein & Bearer, 1985).

Children's initial knowledge state also plays a role in whether collaboration with a more skilled peer is beneficial. At some points in development, children's knowledge is highly resistant to change, so social interaction may not lead to learning. For example, Pine and Messer (1998) examined the effects of peer collaboration on children's ability to balance objects on a fulcrum. Most children profited from the opportunity to work with a more skilled peer. However, children who began the study with a "things balance in the center" theory tended not to learn from peer collaboration. This initial theory was highly resistant to change, even in the face of disconfirming evidence that was provided by the children's social partners.

Although children tend to benefit from working with a more skilled peer, it is not essential for children who are collaborating to have different skill levels in order for progress to occur. Children also learn when they work with others who have similar skills. Several studies have shown that pairs of children who both hold incorrect views about a task or problem often benefit from working together—thus, two "wrongs" can indeed make a "right." Most of these studies have examined pairs of children who hold different incorrect views of a problem (Ames & Murray, 1982; Enmler & Valiant, 1982). The findings suggest that conflicting views of a problem may be a trigger for knowledge change in social interaction, even if both views are incorrect.

However, at least one experiment has demonstrated that conflicting views are not essential for change to occur. Ellis, Klahr and Siegler (1993) asked pairs of fifth-grade students to collaborate in comparing the magnitudes of pairs of fractions. They found comparable patterns of success following social interaction for children in pairs in which both children used the same incorrect strategy at pretest and pairs in which children used different incorrect strategies at pretest.

One variable that may be important in integrating these findings is whether or not children receive feedback about the accuracy of their task solutions. When children receive such feedback, they often make progress, regardless of whether their knowledge is similar to or different from that of their collaborator (Ellis et al., 1993). When feedback is not provided, as in the studies by Ames and Murray (1982) and Enmler and Valiant (1982), conflicting views may be essential if peer collaborations are to foster change. Indeed, one experiment showed that peer collaboration was beneficial only when children did not receive feedback about whether their task solutions were correct (Tudge & Winterhoff, 1993).

Task difficulty. The difficulty of the task also influences the effects of collaboration. On tasks that are either already understood by one of the collaborators or that they would be expected to master relatively soon, collaboration tends to promote successful problem solving and learning (Ames & Murray, 1982; Perret-Clermont & Schubauer-Leoni, 1981). On tasks that neither child understands and that are well beyond either of their existing knowledge, collaboration often produces regression or no improvement in understanding (Levin & Druyan, 1993; Tudge, 1992).

The partners' relative confidence in their reasoning seems to be related to this effect. On the simpler tasks, children who answer correctly tend to be more confident than those who answer incorrectly. This may encourage the partners who are answering incorrectly to follow their lead. In contrast, on hard problems, children whose reasoning is less advanced tend to be more confident, because they fail to realize the plausibility of alternative perspectives (Levin & Druyan, 1993). This sometimes has the unfortunate effect of leading children whose reasoning is more advanced, but who are unsure of their understanding, to shift toward the less advanced reasoning of their confident collaborators.

Cultural norms. Cultural norms also influence children's collaborative styles and outcomes. One study that documented this phenomenon contrasted the collaborative problem solving of Navajo and Euro-American children (Ellis & Schneiders, 1989). The task involved a board game maze. Because the maze included many dead ends, it was useful to plan a route before trying to move through it. Children who had been taught part of the problem (the "teachers") worked with younger children who had not received any instruction in it (the "learners"). Since Navajo culture does not value speed as highly as mainstream American culture, and because Navajo culture values both individual autonomy and cooperation, it was expected that the Navajo teachers and learners would interact in a way that led to the learners spending more time planning without the teachers pushing them to make moves. These predictions proved accurate. Particularly on the most difficult problems, which required the most planning, the Navajo children planned for a longer time than their Euro-American counterparts. They also made fewer errors in solving the maze problems. Thus cultural values, as well as age, expertise, quality of interaction, and task difficulty, influence collaborative problem solving.

GUIDED PARTICIPATION IN CULTURAL ACTIVITIES

To characterize children's interactions in social and cultural context, Barbara Rogoff and her collaborators have introduced the concept of guided participation.
in culturally valued activities (Chavajay & Rogoff, 1999; Rogoff, 1990; Rogoff, Mistry, Güçlü, & Mosier, 1993). This concept incorporates two ideas: first, the notion that children's behavior is guided by other people, and second, the notion that children participate in activities that are routinely practiced and valued in their cultural communities. Guided participation refers not only to interactions in which adults explicitly attempt to instruct children, but also to interactions in which children observe and participate in routine, everyday activities under the guidance of adults or other more skilled members of their communities, such as older siblings and peers. Such activities include dressing, doing household chores, preparing meals, and attending religious services. Children's guided participation in such activities is an important means by which children are socialized into the practices of the culture in which they develop.

According to Rogoff (1990), adults in all cultures guide children's participation in culturally valued activities. However, the particular activities in which children participate vary depending on the cultural setting. In some cultures, including the United States, children tend to be segregated from adults' social and economic worlds, and many of their opportunities for learning take place in the context of formal schooling. In other cultures, children are routinely integrated into adult activities, and many of their opportunities for learning take place in the context of everyday situations.

**Cross-cultural research on patterns of guided participation.** Rogoff, Mistry, Güçlü, and Mosier (1993) studied children's activities and social interactions in two communities in which children are typically segregated from adults' activities (urban, middle-class communities in Salt Lake City, Utah, and Keçiören, Turkey) and two communities in which children are typically integrated into adults' activities (the indigenous Mayan town of San Pedro, Guatemala, and the tribal village of Dhol-Ki-Patti, India). Toddlers and caregivers in all four communities were observed performing routine activities (such as feeding and dressing), playing social games (such as peek-a-boo and finger games), and playing with novel objects (toys that the researchers provided, such as a puppet and a pencil case).

Rogoff et al. found that some aspects of guided participation appear to be universal across cultures. In social interactions in all four of the communities they studied, children and adults regularly attempted to bridge their individual understandings of situations, and to seek shared meaning or intersubjectivity. In all four communities, children and adults also adjusted their level of involvement with one another as their interactions progressed. This adjustment was achieved using both verbal and nonverbal forms of communication, as well as by adult structuring of children's activities.

However, there were also important differences in guided participation across the communities. In the two communities in which children are segregated from ongoing activities in the adult community (Salt Lake City and Keçiören), social interactions between adults and children tended to be structured by adults, who provided explicit verbal instruction and helped manage children's motivation using praise and other incentives. In the two communities in which children are integrated into adults' ongoing activities (San Pedro and Dhol-Ki-Patti), children took greater responsibility for social interactions, observing adults' ongoing activities and attempting to join in. Caregivers in these communities supported children's attempts to participate and often provided nonverbal demonstrations.

**Implications for attention management.** Rogoff et al. found that these differences in the nature of guided participation across the two pairs of communities were associated with differences in patterns of attention management. Children and caregivers in San Pedro and Dhol-Ki-Patti were more likely to attend to multiple events simultaneously than were children and caregivers in Salt Lake City and Keçiören, who tended to focus on one event at a time (see also Chavajay & Rogoff, 1999). Rogoff et al. hypothesized that observing multiple ongoing events may help children in San Pedro and Dhol-Ki-Patti to hone their attention management skills.

These cross-cultural differences in attention management underscore the potential implications of guided participation for the organization of behavior in a wide variety of settings. Indeed, some evidence suggests that there are long-term implications for experiencing different patterns of guided participation. A recent study showed that Mayan mothers who had received extended formal schooling tended to organize problem-solving interactions with children differently than did mothers who had received little formal schooling (Chavajay & Rogoff, 2002). Groups of three children and their mothers worked together to construct a three-dimensional jigsaw puzzle of a totem pole. Mothers who had received extended formal schooling were more likely to suggest a "division of labor" approach, such that different members of the group worked on different aspects of the puzzle, and they were also more likely to direct the children in what to do. In these groups, most of the proposals about what to do next were initiated by mothers. In contrast, mothers who had received little formal schooling tended to work together with the children, such that all members of the group were focused on the same aspect of the construction (such as the same row of the puzzle). In these groups, proposals about what to do next were as likely to come from the oldest child in the group as from the mother. Thus, experience with the hierarchical social structures characteristic of formal schooling appears to influence the nature of mothers' interactions with their children.

**Development as transformation of participation.** The central construct in Rogoff's framework is participation in cultural activities. From this perspective, developmental change involves transformations in the nature of children's participation. In many cases, children progress over developmental time from being observers or peripheral participants in activities to being more central participants. In some cases, children eventually take on major responsibility or leadership roles. For example, a toddler might simply observe meal preparation as it
takes place in her home, a preschool child might assist by setting the table, an older child might actually prepare some of the dishes, and a still older child might make decisions about what dishes to serve.

In addition to changes in the roles children play in activities, several other aspects of children's participation in activities may also change with development. These include their reasons for being involved in the activity (to obey a parent versus to accomplish a task that needs to be done), their attitudes toward taking on new roles and responsibilities, and their understanding of how different activities contribute to the larger whole (Rogoff, 1997, 1998). A complete understanding of developmental change will require understanding these dimensions of change in children's participation in sociocultural activities.

**LANGUAGE AS A PSYCHOLOGICAL TOOL**

In every culture, language is a pervasive feature of social interaction, and it is also pervasive as a tool for thinking and for organizing behavior. Indeed, language is generally viewed as the most important psychological tool. There are several reasons why this is the case. First, language is an integral component of most forms of social interaction, including guided participation, instructed learning and collaborative learning. As such, language is one channel through which social interaction results in learning. Second, people use language as a means of regulating their own behavior, making plans, and solving problems, as is evident in the phenomenon of private speech. And third, the structures of language appear to influence habitual patterns of thought, even in tasks and situations that do not overtly involve language.

**The linguistic regulation of behavior.** One source of evidence for the linguistic regulation of behavior is the phenomenon of *private speech*. Children frequently talk aloud to themselves as they play, explore, and solve problems. For example, a child presented with a two-digit addition problem that involves carrying (such as 17 + 28) might use private speech as she works out the problem: "7 plus 8 is 15, carry the 1, (pause) 2, 3, 4, so it's 45." Vygotsky viewed such private speech as a manifestation of children's use of language to regulate their behavior.

From this perspective, it is not surprising that children produce more private speech on more challenging tasks, for which self-regulation is more difficult (Berk, 1994). Furthermore, children's private speech declines or "goes underground" over developmental time (Bivens & Berk, 1990; Winsler, Carlson, & Barry, 2000; Winsler, Diaz, Atencio, McCarthy, & Chabay, 2000; Winsler & Naglieri, 2003). According to Vygotsky, private speech ultimately becomes *inner speech*, a silent, internalized dialogue with the self. One implication of this view is that much of thought is actually internalized language.

**Relations between language and thought.** If thought consists, at least in part, of internalized language, it seems possible that characteristics of the particular language an individual speaks may influence how that individual thinks. This view, known as the *linguistic relativity hypothesis*, holds that differences in how languages encode reality are reflected in parallel differences in how speakers of the languages think. As one of the leading proponents of this view, Benjamin Lee Whorf, put it: "We cut nature up, organize it into concepts, and ascribe significances as we do largely because we are parties to an agreement to organize it in this way—an agreement that holds throughout our speech community and is codified in the patterns of our language" (Whorf, 1940).

Does language really shape thought? There is growing evidence that variations in language-specific word meanings and grammatical patterns are indeed associated with variations in performance on cognitive tasks that involve thinking, but that do not directly involve language. One explanation for these associations is that structural patterns in the language give rise to habitual patterns of thought (Lucy, 1992).

A good illustration of this idea comes from Levinson's (1997) research among Australian aboriginal speakers of the Guugu Yimithirr language. In Guugu Yimithirr, spatial information is not linguistically encoded using words that mark position relative to the body, such as "left" and "right," as is typical in Indo-European languages such as English. Instead, terms that mark absolute orientation, such as "north" and "east" are used. Levinson investigated whether the linguistic system for marking spatial relations carried over into non-linguistic cognitive tasks. In one of many such tasks, participants viewed an arrangement of toy figures of a man, a pig, and a cow on a table. Participants were then taken to a second room and seated at a table facing in the opposite direction as they had faced in the original room. They were presented with an identical set of figures, and asked to arrange them just as they had been arranged in the first room (see Figure 4.4). Most Guugu Yimithirr speakers arranged the animals so as to preserve their positions in absolute terms (for example, a cow that was facing East in the first room was positioned facing East in the test room). In contrast, speakers of Dutch, a language that, like English, encodes spatial position relative to the speaker or listener, tended to arrange the animals relative to their own bodies (a cow that was facing to the speaker's right [and East] in the first room was positioned facing to the speakers' right [and West] in the test room). Thus, language-specific patterns for coding spatial relations in either absolute or relative terms carried over into the nonlinguistic task of arranging the toy figures.

Another compelling illustration of the influence of language on thought comes from research with child and adult speakers of Yucatec Maya and English. In English, the meanings of concrete nouns often incorporate information about object shape (for example, the word candle suggests something long and thin). In contrast, in Yucatec, information about material is incorporated in the noun, and information about shape must often be provided as a separate term (following the pattern of the English a cube of sugar). For example, the Yucatec expression for one candle can be translated as one long thin wax. Thus, it can be
said that the structure of English "invites" attention to object shape, whereas the structure of Yucatec "invites" attention to object material.

To test the impact of these linguistic differences on object categorization, Lucy (1992) presented adult speakers of Yucatec and English with triads of objects in which one object was designated the "pivot" (e.g., a small cardboard box), one object was of the same shape as the pivot but of a different material (e.g., a small plastic box), and one object was of the same material as the pivot but of a different shape (e.g., a small, flat piece of cardboard). Participants were asked to judge which of the other two objects was most similar to the pivot object. Almost all of the English speakers chose based on shape, whereas almost all of the Yucatec speakers chose based on material. Thus, language-specific patterns for encoding noun meanings in words appeared to influence performance on the nonlinguistic task of judging object similarity. Lucy and Gaskins (2001) used a similar task with English- and Yucatec-speaking children, and found that language-specific categorization biases emerged between ages 7 and 9 years.

In other tasks, language structure appears to influence task performance considerably before 7 years of age. One such task is spatial categorization. Choi, McDonough, Bowerman, and Mandler (1999) investigated this issue in toddlers ages 18 to 23 months who were learning either Korean or English. The two languages differ in terms of how they categorize spatial relationships. English prepositions distinguish between actions that result in containment (e.g., put in) and actions that result in support or attachment (e.g., put on). In contrast, Korean distinguishes between relations that involve tight fits (kkita) and relations that involve loose fits or other kinds of contact. The experiment assessed toddlers' comprehension of in (for English learners) and kkita (for Korean learners).

Children were presented with pairs of scenes as they heard sentences that included the target word. Some of the pairs of scenes contrasted in/on relations with tight/loose fit relations (such as putting rings loosely into a basket versus putting rings tightly on a post). For these pairs, English learners tended to look at the "putting rings into a basket" event while hearing sentences that included the word in, suggesting that the word in drew their attention to containment. In contrast, Korean learners tended to look at the "putting rings on a post" event while hearing sentences that included the word kkita, suggesting that the word kkita drew their attention to a tight-fit event. On control trials on which no target words were presented, the looking patterns of English learners and Korean learners did not differ. These findings indicate that, by 18 to 23 months, children are sensitive to language-specific ways of categorizing spatial relations. Thus, early spatial concepts appear not to be universal, as would be the case if they derived solely from characteristics of the human perceptual system. Instead, language plays a role in spatial categorization from an early age.

*The development of language as a mediating system.* The findings described above suggest that the relation between language and thought may itself undergo developmental change. As children become more fluent, and as they
become socialized into the conventions of their native language, they become better able to use language as a tool for thinking.

How do children acquire the ability to use language as a tool for mediating thought? One theorist who has addressed this question is Katherine Nelson. She proposed that during the toddler and preschool years, children progress through four levels of ability to use language as a representational system (Nelson, 1996). At the first level, young children’s world knowledge consists of mental models of events that are based in experience. At this level, linguistic forms (such as words) can be part of an experience, but they are not yet used to represent experiences (Nelson, 1999). For example, a child might associate the word “balloon” with an event in which she received a balloon from her father, but in this initial stage, she cannot yet produce the word, nor can she use the word to mentally invoke the event.

At the second level, children become capable of transforming some aspects of their mental models into linguistic form, so that they can communicate their mental models to others. However, at this level, children’s mental models are still based in direct experience, and children are not yet able to alter them in response to information acquired via language. For example, a child might remember receiving a balloon from her father, and express this event by saying the word “balloon.” But if her father responds by saying, “Yes, the balloon man at the fair had lots of pretty balloons,” she is not able to alter her mental model of the event based on this information.

At the third level, children become capable of interpreting other people’s linguistic expressions, and they can use such information to alter their own mental models. To operate at this level, children must have acquired the grammatical forms and lexical items that make it possible to interpret and participate in conversations with others. In response to the father’s statement, a child at this level might call to mind the balloon man and imagine the colored balloons.

Finally, at the fourth level, children become capable of constructing entirely new mental models based on other people’s statements. At this final level, language is a means for representing events. Thus, a child who hears her brother say, “At Charlie’s birthday party, we each got three balloons,” can use this statement to construct a mental model of the event, even though she did not witness it or participate in it.

Note that, according to Nelson, the functions served by language as a psychological tool change over development. At the early stages, words are used simply to mark aspects of mental models that have been derived from experience. At later stages, linguistic forms can be used to construct novel mental models, and these models may incorporate linguistic representations as an essential component. It is also noteworthy that, according to Nelson, children learn to use language as a psychological tool by participating in even more complex interactions with other people. Thus, by interacting with other people, children learn to use language to mediate thought.

Educational Implications of Sociocultural Theories

Sociocultural theories have many potential implications for educational practice. One is that children’s knowledge can be conceptualized in terms of their ability to perform tasks with supportive social interaction. This view of knowledge implies that children’s knowledge should be assessed in terms of their ability to learn from social interaction, rather than in terms of their unaided level of performance. A second implication of sociocultural theories is that certain types of social interactions, such as guided participation or scaffolding within the zone of proximal development, should be especially beneficial for students’ learning. Therefore, it may be valuable to design classroom lessons and other types of educational activities to facilitate these types of social interactions. Sociocultural theories also have focused attention on how people use cultural tools, such as mathematical notation and writing. Much of formal education involves teaching children to use cultural tools, and different approaches to teaching children how to use such tools may have different consequences for their thinking. Finally, the sociocultural perspective provides a lens through which to observe and understand social interactions. This perspective may be useful for interpreting social interactions that take place in educational settings, and for explaining how such interactions produce knowledge change.

Sociocultural Approaches to Assessing Children’s Knowledge

Vygotsky believed that the diagnostic tests commonly used in educational settings are oriented toward processes and skills that are already fully developed—“yesterday’s development”—which he argued should not be the focus of educational practice. Instead, he argued, educators should focus on the child’s dynamic developmental state—that is, processes and skills that are just beginning to develop, and that are therefore in the child’s current zone of proximal development. In his view, “the only ‘good learning’ is that which is in advance of development” (Vygotsky, 1978, p. 89), because such learning creates new zones of proximal development. Thus, to gain information that is useful for educational purposes, one must assess children’s knowledge under conditions of supportive social interaction.

Vygotsky observed that children who appear to have comparable levels of knowledge when assessed independently might actually be revealed to have very different levels of knowledge when assessed in interaction with a more skilled partner. This implies that, if children’s knowledge or skill level is assessed through independent performance, as is traditional in educational settings, important information about children’s abilities may be concealed. The practice of assessing children’s potential for learning with assistance, rather than
their independent performance, has been termed dynamic assessment. A recent meta-analysis of 30 studies documented that students do indeed display more knowledge when tested using dynamic assessment, as compared to more traditional measures (Swanson & Lussier, 2001).

Dynamic assessment measures yield information about children's abilities that is not identical to that provided by more static measures, such as IQ tests. In one study of this phenomenon, Ferrara, Brown, and Campione (1986) determined the number of hints from the experimenter that children needed in order to learn how to solve letter series completion problems (for example, what comes next in the following series: N G O H P I Q J ?). After all of the children had learned to solve simple letter series problems correctly, they were given more challenging problems that involved relations that had not been used in the simple problems (such as sequences that included patterns with backwards alphabetical order, such as U C T D S E R F). Children who had needed few hints to learn the simple problems performed better on the more challenging problems than children who had needed many hints. Importantly, however, this pattern was not due to children who needed fewer hints having higher IQs than children who needed many hints—the pattern held even when children's IQ was controlled statistically. Thus, a measure of children's ability to learn from social interaction (in this case, number of hints) provided information about the children's abilities that was not redundant with the information that was provided by a more static measure (in this case, IQ).

Vygotsky's emphasis on dynamic measures of children's knowledge has had an important legacy in modern educational practice. Dynamic assessment provides valuable information about children's potential for learning (Day & Cordón, 1993; Day, Engelhardt, Maxwell, & Bolig, 1997). As such, it may allow more accurate identification and assessment of children with language impairments or learning disabilities than do standard methods (Peña, Iglesias, & Lizzi, 2001; Swanson, 1995). Teachers can use dynamic assessment to enhance children's performance and to tap abilities that might otherwise go unnoticed.

Educational Interventions Based on Sociocultural Principles

Many educational interventions have been designed to incorporate insights about learning and development drawn from sociocultural theories. Some incorporate opportunities for particular types of social interactions that are intended to foster students' learning. One good example is the fostering communities of learners (FCL) approach, developed by Ann Brown and Joseph Campione (Brown, 1997; Brown & Campione, 1994, 1996).

Students in FCL classrooms engage in research on different aspects of a larger topic of inquiry, so that expertise is deliberately distributed across members of the class. For example, students in one FCL classroom investigated the "big idea" of animal-habitat interdependence. Various small groups of students researched the subtopics of defense mechanisms, predator-prey relations, protection from the elements, reproductive strategies, communication, and food gathering (Brown & Campione, 1994). Individual students in the FCL classroom are then required to share their expertise in small group interactions with their classmates, so that all students have access to all of the research findings. This sharing is done in "jigsaw" groups that are composed of one student "expert" on each of the major subtopics. Finally, all students are required to perform a complex task that requires mastery of the broader topic, including information that they have learned from their peers. In the classroom studying animal-habitat interdependence, students were asked to design an animal of the future, and to justify their design decisions.

The types of activities used in FCL classrooms were designed based on sociocultural principles. One goal was to create variations in expertise across children, so that children would have opportunities to learn from one another. Another goal was to make social interaction among the children essential in order for the children to complete their work. Evaluations of the FCL approach have documented greater gains in knowledge acquisition, critical thinking skills, reading comprehension, and argumentation skills among children in FCL classrooms, compared to those in more traditional classrooms (Brown & Campione, 1994). Thus, classroom activities designed on the basis of sociocultural principles can lead to important benefits for learning.

Learning to Use Psychological Tools

The sociocultural perspective has also focused attention on how children learn to use psychological tools. Such tools vary greatly in their ease of acquisition and use. A good example comes from research on cross-linguistic differences in number-naming systems and their implications for children's acquisition of counting skills (Miller & Paredes, 1996; Miller, Smith, Zhu, & Zhang, 1995). In English, the names for numbers between 10 and 20 are not as systematic as those above 20. The names for 11 and 12 are idiosyncratic, and the names for 13 through 19 are formed with the unit value before the decade value (as in fourteen), which is opposite the pattern used in higher decades (as in twenty-four). In contrast, in Chinese, number names above 10 follow a consistent base-10 rule. A literal translation of the sequence 11, 12, 13 from the Chinese would be "ten-one, ten-two, ten-three."

Miller et al. (1995) hypothesized that if the complexity of the English number-naming system makes it difficult for children to grasp the underlying base-10 number system, then differences in Chinese and American children's counting performance should emerge only when children begin to learn the teens decade. As predicted, they found that American preschoolers had greater difficulties learning the teens than did Chinese preschoolers. As seen in Figure 4.5,
up until age 3, when most learning is focused on acquiring the arbitrary set of digits 1–10, the counting of children in the two cultures is comparable. However, after age 3, the counting of children learning the rule-governed Chinese system takes off, whereas that of children learning the arbitrary English terms for 11–20 remains gradual. The complexity of the English number system plainly is not the only reason that mathematics learning of children in the United States lags behind that of children in China and other East Asian countries. However, the characteristics of the symbolic system do appear to pose an obstacle for American children’s learning.

Regardless of the particular symbol systems children learn, most children learn about the number system during the preschool and early elementary years. However, individual children vary in their ability to use the number system, and these differences may depend on how well children have elaborated the “central conceptual structure” that underlies it (Griffin, Case, & Siegler, 1994). This central conceptual structure incorporates the mental number line and several related concepts, such as the idea that each successive whole number represents a set that contains more objects or that has an incrementally greater value along some dimension. To foster understanding of the number system among economically underprivileged children, Griffin, Case and Siegler developed a curriculum, entitled Rightstart, made up of interactive games that targeted the components of the hypothesized central conceptual structure, and in particular, the mental number line. Kindergarten children in classrooms that used the Rightstart curriculum showed substantial gains in number knowledge and in strategies for solving arithmetic problems, compared to students in control classrooms that used more traditional curricula.

In this example, an innovative, theoretically guided curriculum fostered students’ understanding and use of an important psychological tool, the number system. Other ongoing programs of research are investigating effective ways to teach students how to use other psychological tools, such as the symbol system of algebra (Nathan, Stephens, Masarik, Alibali, & Koedinger, 2002) and systems for representing and interpreting data (Lehrer & Schauble, 2002). A better understanding of how psychological tools mediate thinking can help guide the design of educational opportunities that promote students’ learning and use of such tools.

**SOCIOCULTURAL INTERPRETATIONS OF CLASSROOM PROCESSES**

Sociocultural theories have also been applied to interpreting and explaining the social interaction processes that produce knowledge change in classroom settings. Some researchers have analyzed classroom discourse from a sociocultural perspective, examining how teachers socialize students into particular ways of speaking and thinking.

As an example, Strom, Kemeny, Lehrer and Forman (2001) analyzed a classroom discussion among second-grade students who were trying to decide whether three different rectangles (measuring 1 × 12, 2 × 6, and 3 × 4 square units, respectively) all had the same area. The students’ teacher scaffolded the students’ thinking in a variety of ways as the students attempted to reason about the mathematical properties of the rectangles. The teacher outlined and clarified the mathematical argument as the students developed it, and she supported their actions in order to highlight mathematically valuable ideas. She also linked students’ everyday language for describing the area of a figure with more precise, mathematical language for describing the concept, sometimes “revoicing” students’ comments in more mathematically sophisticated ways. For example, the teacher linked students’ informal notion of “the amount of space taken up” with the mathematical term “area,” and she introduced the idea of a square unit as a tool that could be used to quantify area. Like scaffolding in parent-child interaction, these teaching practices appear to foster students’ developing understanding. Over the course of the lesson, the students’ contributions to the discussion became more mathematically sophisticated, and they gradually assumed “responsibility” for articulating the mathematical argument.

As these examples indicate, sociocultural theories have much to offer educators. The sociocultural perspective provides a new way of thinking about assessment, a source of inspiration for the design of classroom interventions, a spotlight on important questions and modes of thinking, and a conceptual framework for understanding what goes on in classrooms and in small group collaborative learning sessions.
Summary

A central theme of Vygotsky’s theory, and of sociocultural approaches more generally, is that cognitive development occurs in social interaction. Social interaction is conceptualized not simply as an external force that provokes change within the individual, but as part of the mechanism of developmental change itself. According to Vygotsky, developmental change occurs in the internalization of socially shared processes. Children initially perform cognitive tasks with support from social partners. Over time, these social interactions are gradually internalized, until children can perform tasks on their own. Thus, psychological functions take place first at the “intermental” level (between people in social interaction), and later at the “intramental” level (within the individual).

A second major theme of Vygotsky’s theory is that human behavior is mediated by cultural tools. These include both technical tools, used to act on the environment, and psychological tools, used for thinking. Language is the prime example of a psychological tool, in that it is used as a means for planning, remembering, forming concepts, solving problems, and regulating behavior.

Modern sociocultural theories have emphasized that the opportunities children have for learning depend on both cultural norms and social practices. Characteristics of the society and the cultural context in which children develop influence the activities in which the children participate. Within the framework provided by the society and culture, caregivers select and organize activities and social interactions that they consider appropriate for children.

Modern sociocultural theories have also addressed the cognitive abilities that are required for social and cultural learning. One of these is the ability to establish intersubjectivity, the shared understanding that emerges through processes of mutual attention and communication. The foundations of intersubjectivity are evident in early infancy, and children’s ability to establish and maintain intersubjectivity continues to grow throughout early childhood. Another ability that is important in learning from social interaction is the ability to understand others as being like oneself, and in particular, as having intentions and mental states like one’s own. According to Michael Tomasello, three forms of cultural learning are made possible by this understanding: (1) imitative learning, which involves reproducing another individual’s behavior in order to achieve the same goal, (2) instructed learning, which involves direct, intentional transmission of information from one individual to another, and (3) collaborative learning, which is learning that occurs when multiple individuals engage in cooperative, goal-directed problem solving.

Many active lines of inquiry in modern developmental psychology have been inspired or guided by sociocultural theories. Research on children’s learning in interaction with adults and peers has focused on how variations in social interactions relate to learning outcomes. When adults interact with children, they often structure their interactions in ways intended to foster children’s learning. Indeed, sensitive adult-child interaction is associated with greater learning on the part of the children. However, children also learn a great deal in interaction with peers, both when they work with more skilled peers and when they work with peers of similar skill level. In general, interactions that are characterized by high levels of shared involvement lead to greater learning. In addition, age, task difficulty, and cultural norms also influence learning from peer collaborations.

One strand of research on adult-child interaction has focused on how adults guide children’s participation in culturally valued activities. Cross-cultural studies have shown that the process of guided participation varies depending on how children tend to be integrated into adults’ activities in the culture. In communities in which children tend to be segregated from adult activities, social interactions are typically structured by adults, and they often include explicit verbal instruction. In communities in which children tend to be integrated into adults’ activities, children typically observe the activities and attempt to join in. Caregivers in these communities often support children’s attempts to participate, and provide nonverbal demonstrations to help them.

Research on language as a psychological tool has focused on the linguistic regulation of behavior, the relation of language and thought, and the development of language as a mediating system. Children use language to regulate their behavior, as is evident in the phenomenon of “private speech,” in which children talk aloud to themselves as they explore and solve problems. According to Vygotsky, private speech eventually becomes a silent, internalized dialogue with the self; thus, much of thought is actually internalized language. If this is the case, then characteristics of the particular language an individual speaks might influence habitual patterns of thought. Indeed, there is evidence that variations across languages in word meanings and grammatical patterns are associated with variations in performance on cognitive tasks that involve thinking but that do not directly involve language. The nature of language as a psychological tool changes over developmental time. Early on, words are used simply to label or mark aspects of mental models that have been derived from experience. Eventually, language is used to construct novel mental models of situations that have not been experienced.

Sociocultural theories have many potential implications for educational practice. First, they suggest that children’s knowledge should be conceptualized in terms of their ability to perform tasks with supportive social interaction, and it should be assessed in interaction, rather than in independent performance. Second, sociocultural theories hold that certain types of social interactions (such as collaboration with more skilled peers) may be especially beneficial for students’ learning. Third, the sociocultural perspective has focused attention on how children learn to use cultural tools and on how different approaches to teaching children how to use such tools have different consequences for their thinking. Finally, the sociocultural perspective provides a framework for observing and understanding the social interactions that take place in educational settings and for theorizing about how they produce knowledge change.
Recommended Readings


Gauvain, M. (2001). The social context of cognitive development. New York: Guilford Press. Gauvain argues that social processes are involved in the mechanisms of learning, and she reviews evidence for this position from the domains of attention, memory, problem solving, and planning.


Tomasello, M. (1999). The cultural origins of human cognition. Cambridge, MA: Harvard University Press. Tomasello argues that humans possess a unique ability for cultural learning, and that this ability allows them to pool their cognitive resources with other members of their social group.


A 4-month-old girl is shown two movies with their screens side by side. In one movie, a woman is playing peekaboo. She repeatedly hides her face with her hands, uncovers it, and says, “Hello baby, peekaboo.” In the other movie, a hand holds a stick and rhythmically strikes a wood block. The experimenter plays either the sound track with the woman saying “peekaboo” or the sound track with the drum beat, but not both at the same time.

Somehow, the 4-month-old knows which sound track goes with which visual sequence. She demonstrates this knowledge by looking more at the screen that displays the movie that goes with the sound track than at the screen showing the other movie.

Spelke (1976) found that almost all 4-month-olds behave as the girl in this story did. Of the 24 infants she tested, 23 looked for more time at the screen with the appropriate video accompaniment than at the alternative. Apparently, even in their first half year, infants connect sights and sounds in meaningful ways.

This example is representative of current findings about perceptual development in a number of ways. The children in the study were less than 6 months old. The investigator used a simple experimental procedure, yet asked a fundamental question about human nature: Are infants able to integrate sights with sounds from very early in life? The results of the study showed greater perceptual abilities in young infants than might have been expected.