

CHAPTER 14

Cognition as a Collaborative Process

BARBARA ROGOFF

CLASSIC THEORETICAL APPROACHES TO COGNITION AS A COLLABORATIVE PROCESS 681

Cultural/Historical Theory of Vygotsky, Leont'ev, and
Their Colleagues 682

Piaget's Foray into Development
through Co-Operation 684

SOCIOCULTURAL AND SOCIAL "INFLUENCE" CONCEPTUALIZATIONS 686

Nondependence versus Independence of Individual,
Interpersonal, and Community Processes 687

Learning as Changing Participation IN Activities versus
Internalization ACROSS Boundaries 689

Observing Dynamic Processes of Understanding versus
Locating Stored Knowledge 689

Changing Participation versus Competence in Reaching a
Developmental Goal 690

Relating Participation across Activities versus
Transferring Knowledge across Situations 691

RESEARCH QUESTIONS AND ASSOCIATED WAYS OF OBSERVING DEVELOPMENT 692

Examining Development in Social
Influence Approaches 693

Observing Development as Transformation
of Participation 695

THE STATUS OF RESEARCH TO DATE 697

ADULTS AS EXPERTS SUPPORTING NOVICES' LEARNING 698

Sociocultural and Scaffolding Approaches to Experts'
Support of Novices' Learning 698

Techniques through Which Experts Structure Novices'
Problem Solving: Scaffolding, Tutoring, and
Socratic Dialogue 700

Adult Experts Adjusting Support of
Novices' Development 702

The Mutual Roles of Children and Adults in Structuring
Adult-Child Interaction 704

The Role of Adult Expertise 708

PEERS ASSISTING EACH OTHER IN LEARNING 709

Children Learning with Each Other in Peer Play and
Child Caregiving 709

Peers' Similar Status in Collaborative Argumentation 711

Peers Facilitating Each Other's Learning in
the Classroom 715

INTERPERSONAL AND COMMUNITY ASPECTS OF COLLABORATION IN SOCIOCULTURAL ACTIVITIES 722

Specialized as Well as Symmetrical Roles
in Collaboration 723

Discord as Well as Harmony in Collaboration 724

Collaboration among People of Different Eras
and Locations 726

CONCLUSION 728

ACKNOWLEDGMENTS 729

REFERENCES 729

As civilized human beings, we are the inheritors, neither of an inquiry about ourselves and the world, nor of an accumulating body of information, but of a conversation, begun in the primeval forests and extended and made more articulate in the course of centuries. It is a conversation which goes on both in public and within each of ourselves. . . . [Each new generation enters] an initiation into the skill and partnership of this conversation. And it is this conversation which, in the end, gives place and character to every human activity and utterance. (Oakeshott, 1962, p. 199)

This chapter asks how cognitive development occurs in and is promoted by individuals' collaboration with others. I examine theory and research on processes of collaboration and their implications for cognitive development, as well as on how collaborative processes develop as people participate in the activities of their communities.

My definition of collaboration is broad—including face-to-face mutual involvements such as routine conversation, teaching, tutoring, and cooperative learning; side-by-side

engagements; and participation in shared endeavors without physical copresence (such as occurs between correspondents, between authors and readers of articles, or in remembered conversations). These engagements may or may not strive to promote cognitive development (or learning—a term that I use interchangeably with development in this chapter).

Cognitive development occurs as new generations collaborate with older generations in varying forms of interpersonal engagement and institutional practices. For example, in some communities, conversation between adults and young children is common, but children seldom have the opportunity to observe and participate in adult activities; in other communities, engagement between adults and young children occurs in the context of children's involvement in the mature activities of the community, but not in peerlike conversation (Rogoff, 1990). The topic of cognition as a collaborative process necessarily includes all such forms of collaboration.

The idea that cognition is a process involving more than the solo individual is still new to many cognitive developmentalists. For some, it is a foreign concept to think of cognition as something other than an individual activity. For others, the idea of cognition involving social processes is comfortable, but somewhat inchoate. As I will argue, a great deal of research simply adds social factors to the default unit of analysis of the field—the individual—thereby assimilating but not accommodating sociocultural ideas that shift from the individual to sociocultural activity as the basic unit of analysis.

This chapter attempts to elucidate the conceptual shift from individual to sociocultural activity as unit of analysis, as well as key themes in research on cognition as a collaborative process. The paradigm shift required to move from thinking of cognition as a property of individuals to thinking of cognition as an aspect of human sociocultural activity (without attempting to locate the process only in individuals) is at the edge of the “zone of proximal development” of the field at this point. This chapter is primarily addressed to those who are interested in exploring this edge.

Sociocultural scholars are currently struggling with issues of how concepts of cognition and of individual development need to be reformulated to be consistent with assumptions of a sociocultural approach and appropriate empirical methods. Sociocultural research involves integration across topics that have traditionally been segregated

in different disciplines, such as psychology, anthropology, sociology, sociolinguistics, and history (see Rogoff & Chavajay, 1995). It also integrates topics traditionally treated as distinct phenomena—such as cognitive, social, emotional, motivational, and personal identity processes. Although research may focus on one of these, it is recognized that they are not independent phenomena.

The study of cognition as a collaborative process is still emerging, and researchers are not of one mind regarding how to proceed. I hope that my review of key research done from differing perspectives (with their internal tensions) will help the field to further articulate central sociocultural concepts and their use in research. This chapter includes my view of how a sociocultural approach leads to reformulations in concepts of cognition and of the individual's relation with the community, and to a recasting of research questions and methods. I anticipate that the next edition of this *Handbook* will contain extensive reviews of sociocultural processes spread through chapters on the development of literacy, planning, remembering, learning, interpersonal problem solving, and so on, incorporating the new lines of empirical work that are based on the assumption that cognition occurs in shared involvement in community/institutional endeavors.

The chapter begins with consideration of two historically central theoretical approaches to the study of cognition as a collaborative process that emerged in the early decades of the 20th century. These are (a) the cultural/historical theorizing of Vygotsky, Leont'ev, and their colleagues, who argued that individual development was an aspect of cultural/historical activity and (b) Piagetian theorizing about cognitive development occurring through co-operation as individuals attempt to resolve conflicts between their perspectives.

The next section examines the conceptual frameworks of two more recent approaches to understanding the collaborative nature of cognition. These are a family of sociocultural approaches that, for about two decades, have been building on the classic theoretical work of the early decades of the century, especially the cultural/historical theory of Vygotsky and Leont'ev. The other is less explicitly theoretical, but its underlying assumptions constitute a position that has formed the basis of a great deal of the research in this area for decades. I call this the “social influence” approach, because it uses the generic individual as the basic unit of analysis and adds social factors as external influences.

The next section of the chapter discusses the differences in research and methodologies for the observation or evaluation of individuals' development from sociocultural and social influence approaches. In social influence approaches, researchers struggle to standardize the social context and isolate the individual to assess learning; in sociocultural approaches, researchers attempt to study individuals' learning as they participate in ongoing and varied sociocultural activities.

The central section of the chapter addresses key concepts and research on cognition as a collaborative process, beginning with a brief overview of the nature and limitations of the available research. I first focus on how experts aid novices in learning and then go on to discuss how peers assist each other in learning.

The section on experts' support of novices' learning begins with a discussion of how sociocultural approaches to this question differ from closely related work on scaffolding. Then it examines findings from research on techniques that experts use to support novices' learning (scaffolding, tutoring, and so on). This section includes conceptualization and research on the ways that experts adjust their support to novices' needs for assistance, the mutual roles of children and adults in structuring adult-child interaction, and the role of the expert's expertise.

The section on how peers assist each other in learning addresses concepts and research on collaboration in peer play and child caregiving, the role of similarity of status in collaborative argumentation, and peers' facilitation of each other's learning in classrooms. It also includes consideration of how children and the adults and institutions that work with them learn to collaborate, emphasizing a central theme of this chapter—that individual learning occurs through participation in sociocultural activities that include individuals' own contributions as well as the developing contributions of other people and cultural institutions.

The concluding section focuses on collaboration in sociocultural activities beyond the didactic and dyadic interactions between children and adults or peers that have provided most of the research to date. I argue that collaboration involves groups larger than dyads and includes specialized asymmetrical as well as symmetrical roles between participants, discord as well as harmony, and collaboration among people of different eras and locations.

I begin by considering two central schools of thought of our predecessors, with whom we collaborate in advancing our understanding of cognition as a collaborative process.

CLASSIC THEORETICAL APPROACHES TO COGNITION AS A COLLABORATIVE PROCESS

This section focuses on the cultural/historical theoretical approach inspired by Vygotsky, Leont'ev, and their colleagues, and on the social interactional aspects of Piaget's work. It is a curious coincidence that these classic theoretical works were developed by scholars born in the same year—Vygotsky and Piaget were both born in 1896. Vygotsky's immediate personal involvement ended with his death in 1934, was carried on by his students and colleagues in the USSR for some years, and is now being transformed by a renaissance of international interest. Piaget's own oeuvre continued until his death about four decades after Vygotsky's, but most of his work on the social context of cognition occurred early in the century; his legacy in this area continues with his students and colleagues.

Although these two theories are often placed in opposition, they are compatible in many ways (see Tudge & Rogoff, 1989) and built on many of the same scholarly insights of previous generations. Their influence is pervasive in current sociocultural efforts that form the theoretical basis for much of the ongoing interest in cognition as a collaborative process.

One of the key commonalities between the cultural/historical and Piagetian approaches to cognition as a collaborative process is an emphasis on achievement of shared thinking. In the process of everyday communication, people share their focus of attention, building on a common ground that is not entirely shared (for each person works with a somewhat unique perspective). To engage in shared endeavors, there must be some common ground, even to be able to carry out disputes. Lomov (1978) argued that the first stage in communication is:

the determination of common "coordinates" of joint activity (reference points, reference models). These serve as a basis that, in a certain sense, guides the construction of the entire process of communication and the distribution and coordination of the operations carried out by each member of the communicating group. (p. 20)

Mutual understanding between people in communication has been termed *intersubjectivity*, a process that occurs *between* people; it cannot be attributed to one person or the other in communication (Berger & Luckmann, 1966; Newson & Newson, 1975; Riegel, 1979; Rommetveit, 1985;

Trevarthen, 1980; Wertsch, 1979b). Some modifications in the perspectives of each participant are necessary to understand the other person's perspective. The modifications can be seen as the basis for development—as the participants adjust to understand and communicate, their new perspectives involve greater understanding and are the basis for further growth (Wertsch, 1984). Newson and Newson (1975) argued that from infancy, children are guided by intersubjectivity in social interaction:

Knowledge itself originates within an interaction process (highly active on the part of the infant) between the infant himself and other, more mature, human individuals who already possess shared understandings with other communicating beings. . . . In short, the child only achieves a fully articulated knowledge of his world, in a cognitive sense, as he becomes involved in social transactions with other communicating human beings. (p. 438)

Although cultural/historical and Piagetian theories differ in their conceptions of shared thinking (discussed later), both emphasize its role in cognitive development (Forman & Kraker, 1985; Perret-Clermont & Schubauer-Leoni, 1981; Rogoff, 1986, 1990; Tudge & Rogoff, 1989; Wertsch, 1984; Youniss, 1987).

Cultural/Historical Theory of Vygotsky, Leont'ev, and Their Colleagues

In contrast with much of the tradition of research in child development, which has focused on the individual as the unit of analysis, cultural/historical theory posits that individual development is a function of participation in and extension of cultural/historical as well as phylogenetic processes. Vygotsky (1978) argued that rather than deriving explanations of psychological processes from the individual's characteristics plus secondary social influences, analysis should focus on the social, cultural, and historical processes in which individual functioning develops (Wertsch, 1985; Wertsch, Tulviste, & Hagstrom, 1993).

Vygotsky proposed the integrated study of four interrelated, dynamic levels of development involving the individual and the social world in their different time frames—microgenetic, ontogenetic, phylogenetic, and sociohistorical development (Scribner, 1985; Wertsch, 1985; Zinchenko, 1985). Developmental psychologists traditionally deal with ontogenetic development—changes in thinking and behavior arising in the history of individuals, such

as across childhood. This is merely a different grain of analysis from the other three developmental levels: Phylogenetic development is the slowly changing species history that leaves a legacy for the individual in the form of genes. Cultural/historical development is the changing cultural history that leaves a legacy for the individual in the form of technologies such as literacy, number systems, and computers, as well as value systems and scripts and norms for the handling of situations met by the individual. Microgenetic development is the moment-to-moment learning of individuals in particular problem contexts, built on the individual's genetic and cultural/historical background.

From this perspective, since human development necessarily builds upon both the historical endowment with which humans are born as members of their species and their communities, it is a false dichotomy to focus on "nature" and "nurture" as separable influences on development. Babies enter the world equipped with patterns of action from their genes and prenatal experience, as well as with caregivers who structure their biological and social worlds in ways deriving from their own and their ancestors' phylogenetic and cultural history (Rogoff, 1990). As Als (1979) stated, the human newborn is biologically a social organism. At the same time, new generations transform cultural institutions and practices, and contribute to biological evolution.

Central to Vygotsky's theory is the idea that children's participation in cultural activities with the guidance of others allows children to "internalize" their community's tools for thinking. Thus, efforts to understand individual cognitive development must consider the social roots of both the tools for thinking that children are learning to use and the social interactions that guide children in their use. Vygotsky's concept of the zone of proximal development posits that development proceeds through children's participation in activities slightly beyond their competence with the assistance of adults or more skilled children (Laboratory of Comparative Human Cognition, 1983; Valsiner & van der Veer, 1993; Vygotsky, 1978; Wertsch, 1979a).

Interactions in the zone of proximal development are the crucible of development *and* of culture (Cole, 1985) in that they allow children to participate in activities that would be impossible for them alone, using cultural tools that must be adapted to the specific practical activities at hand, and thus passed on to as well as transformed by new members of the community. People working together use and adapt tools provided by predecessors and, in the process, create new tools and new uses for old ones.

Vygotsky proposed that the most basic unit of analysis of human development and learning should be not the individual, but one that preserves the inner workings of larger events of interest. He argued that using the individual as the unit of analysis separates human functioning into elements that no longer function in the ways that the larger living unit does. He sought a unit that

designates a product of analysis that possesses *all the basic characteristics of the whole*. The unit is a vital and irreducible part of the whole. The key to the explanation of the characteristics of water lies not in the investigation of its chemical formula but in the investigation of its molecule and its molecular movements. In precisely the same sense, the living cell is the real unit of biological analysis because it preserves the basic characteristics of life that are inherent in the living organism. (Vygotsky, 1987, p. 46)

Vygotsky attempted to determine the psychological analogue of the living cell, and focused on the unit of word meaning. Although other scholars following Vygotsky have questioned this particular unit of analysis or emphasized others—such as practical activity, use of intellectual tools, propositions, or dialogue—the basic concept of using a unit of activity that maintains the functions of the larger system is one of Vygotsky's important contributions (Bakhtin, 1981; Cole, 1985; Leont'ev, 1981; Wertsch, 1985; Zinchenko, 1985). Bakhtin's approach has been used to extend the unit of analysis from Vygotsky's focus on the *word* to a more satisfying focus on *dialogue*, in which people engage with each other (even in monologue), building on cultural genres (Wertsch, 1991; Wertsch et al., 1993). Leont'ev (1981) extended Vygotsky's search for a unit of analysis by elaborating the concept of *activity*. He stated that an activity is:

a system with its own structure, its own internal transformations, and its own development. . . . If we removed human activity from the system of social relationships and social life, it would not exist and would have no structure. With all its varied forms, the human individual's activity is a system in the system of social relations. (pp. 46–47)

Similarly, inspired by the work of Vygotsky, Leont'ev, and Luria, the Laboratory of Comparative Human Cognition (1983) focused on cultural practices as a unit of analysis. Cultural practices were defined as learned systems of activity in which knowledge consists of standing rules for behavior appropriate to a particular socially assembled

situation, embodied in the cooperation of individual members of a culture.

The history of sociocultural theory itself provides an interesting example of intellectual development through collaboration in ways that illustrate the theory. The cultural/historical theory initiated by Vygotsky in the 1920s and 1930s was elaborated as well as criticized by his students and colleagues. An outgrowth of the associated scholarly tensions (as well as the political realities of the Soviet Communist state) was the development of the psychological theory of activity, especially by Leont'ev (Vygotsky's student, follower, and critic). Leont'ev and Vygotsky themselves built on philosophical notions of activity available several decades before Vygotsky's work. The roots of Soviet cultural/historical theory included wide interdisciplinary reading and discussion of European and American authors in the arts, literature, philosophy, and the infant social sciences of the early 1900s. Further developments of the theory in the Soviet Union were influenced by national and worldwide political events, especially during Stalin's time. For a fascinating account of the development of these Soviet strands of cultural/historical and sociocultural theorizing through the twentieth century, see Zinchenko (1995; also John-Steiner, 1992; Kozulin, 1990; van der Veer & Valsiner, 1991; Wertsch, 1985).

The uptake of Soviet cultural/historical theory in the United States involved some contact in earlier eras of the twentieth century, with publications in English of Vygotsky's work in 1929 and 1962. However, deeper international interest awaited the translation of Vygotsky's work by Cole, Scribner, John-Steiner, and Souberman. Their 1978 volume, *Mind in Society*, marks the beginning of widespread use of Vygotskian ideas in the United States and Western Europe. Deep interest in the theory in the United States midway through the 20th century may have been prevented by incompatibility with the zeitgeist of psychology of the times (including behaviorism and information processing approaches). The change in receptivity may have been encouraged by the impact of efforts to examine cognition in widely varying cultural communities, which resulted in awareness of the limitations in then-contemporary theories to account for contextual variations in performance and the social nature of cognition (see Rogoff & Chavajay, 1995).

Contemporary approaches that have built on Soviet cultural/historical theory, in conjunction with other compatible theoretical views (especially from cultural theory and sociolinguistic approaches), are building a family of

sociocultural approaches (key among them are Cole, 1990; Heath, 1983; John-Steiner, 1985; Laboratory of Comparative Human Cognition, 1983; Lave & Wenger, 1991; Ochs, 1988; Rogoff, 1990, in press; Schieffelin, 1991; Valsiner, 1987; Wertsch, 1991, 1995). Valsiner and van der Veer (1993) provided an excellent account of how the concept of the zone of proximal development emerged in Vygotsky's own work and its further development in contemporary sociocultural theory.

Dewey's (1916) theory of development through experience developed concurrently with Vygotsky's (and was inspired by some of the same prior scholarship). Dewey's theory is quite compatible with cultural/historical theory and is providing further inspiration to current work in sociocultural theory development and research. Dewey emphasized a shift in focus from the individual to the event as the basic unit of analysis (Dewey & Bentley, 1949)—a very similar proposal to cultural/historical theory's emphasis on the activity as the unit of analysis. Both perspectives emphasized the importance of studying thinking in process, and both placed children and other people as active participants in shared endeavors of their communities and insisted that individual cognition depends upon engagement in such activities.

The social environment . . . is truly educative in its effects in the degree in which an individual shares or participates in some conjoint activity. By doing his share in the associated activity, the individual appropriates the purpose which actuates it, becomes familiar with its methods and subject matters, acquires needed skill, and is saturated with its emotional spirit. (Dewey, 1916, p. 26)

Bandura's social learning theory is sometimes erroneously considered part of the same family. It shares an interest in studying how children learn from the social world, but separates the person from the social world and maintains the individual as the basic unit of analysis. Although Bandura's concept of reciprocal determinism states that it is shortsighted to focus only on the individual or only on the environment, as each determines the other, the theory seems still to treat them as independently defined entities (see Tudge & Winterhoff, 1993a). The emphasis is on how other people influence the individual, and how the individual in *turn* learns from others. This is a marked difference from Vygotskian and Deweyan approaches, which view the individual as well as cultural tools and institutions as mutually constituting contributors to activities or events.

Piaget's classical developmental theory has also contributed to understanding cognition as a collaborative process. Although Piaget's theorizing on the role of collaboration in cognitive development was not central to his theory, it offered some important complementary ideas, discussed in the next section.

Piaget's Foray into Development through Co-Operation

In some of his early writing, Piaget focused directly on cognitive development through co-operation with peers. In the late 1920s, his writings examined the relation between the individual and the social. Piaget provided cogent speculation that individual development is facilitated by cooperation between peers in resolving cognitive conflicts provided by their differing perspectives.

When I discuss and I sincerely seek to understand someone else, I become engaged, not just in avoiding contradicting myself, in avoiding playing on words, etc., but also in entering into an indefinite series of viewpoints other than my own. . . . It is a moving equilibrium. . . . The engagements . . . that I make by nature of cooperation lead me I don't know where. (Piaget, 1977 [1928], p. 237)

Piaget's statements that reflection is internalized dialogue resemble Vygotsky's principle that higher mental functions are internalized from social interaction: "Reflection is an internal discussion. . . . In social conflict is born discussion, first simple dispute, then discussion terminating in a conclusion. It is this last action which, internalized and applied to oneself, becomes reflection" (Piaget, 1977 [1928], p. 219).

Despite the lucidity of Piaget's comments on collective activity, it did not become a major focus of his theory or research. In addition, there are key differences from cultural/historical theory in Piaget's conception of social processes. A major difference is that Piaget's speculations on the social world were largely limited to the interpersonal context, without substantial or sustained consideration of the cultural or historical context of the intellectual problems and solutions of cognitive development.

Piaget also differed from Vygotsky in his approach to treating the individual as the locus of change. According to Vygotsky's perspective, joint problem solving occurs *between* partners, whereas in Piaget's view, individuals work with independence and equality on each other's ideas. In

reference to Piagetian theory, Vygotsky (1987) stated: "The child is not seen as a part of the social whole, as a subject of social relationships. He is not seen as a being who participates in the societal life of the social whole to which he belongs from the outset. The social is viewed as something standing outside the child" (p. 83).

According to Piaget (1926), social influence fosters change through the induction of cognitive conflict and the logical operations carried out by children attempting to reconcile their differing views to achieve cognitive equilibrium. The Piagetian model of effective social interaction is thus cooperation between equals who attempt to understand each other through reciprocal consideration of their alternative views. Piaget considered cooperation to be a form of logic in which children discuss propositions that provoke cognitive conflict and its logical resolution, yielding equilibrium with a system of propositions that are free from contradiction and are reversible:

Cooperation itself constitutes a system of co-operations: putting in correspondence (which is an operation) the operations of one partner with those of the others, uniting (which is another operation) the acquisition of one partner with that of others, etc.; and in case of conflicts, raising the contradictions (which presupposes an operational process) or above all differentiating the different points of view and introducing between them a reciprocity (which is an operational transformation). (Piaget, 1977 [1963], p. 347)

Piaget laid out three conditions under which equilibrium is achieved in intellectual exchange (Piaget, 1977). First, the partners need a common language and system of ideas, providing a key that allows each to translate into common terms the differing views. Second, they need to recognize a conservation of their propositions in which one does not contradict oneself, and in which the partners search for agreement on propositions or find facts justifying their difference in points of view. The third condition for equilibrium is that there is a reciprocity between partners such that the propositions of each are treated interchangeably. Thus, for Piaget, cognitive development through collaboration occurs if the partners have a common language and system of ideas and use reciprocity in examining and adjusting for differences in their opinions.

According to Piaget, the very young child is largely impervious to social influence because egocentricity blocks the establishment of reciprocity and cooperation in considering differing points of view. Thus, according to Piaget

(1977), it is not until middle childhood that children routinely benefit from social interaction, when logical argument between children with varying points of view becomes more possible (see also Azmitia & Perlmutter, 1989).¹ Piaget thought that young children would usually either continue to see things from their own perspective or switch to the other person's perspective without understanding the rationale and, hence, without actually advancing developmentally (though occasionally entering into genuine exchange of ideas; see Tudge & Winterhoff, 1993a).

For Piaget, the meeting of minds involves two separate individuals, each operating on the other's ideas, using the back-and-forth of discussion for each to advance his or her own development. The discussion is the product of two individuals considering alternatives provided socially, rather than the construction of a joint understanding between partners. Forman (1987) contrasted Vygotskian intersubjectivity—a process that takes place between people—with Piagetian perspective-taking or decentering, which are individual processes working on socially provided information.

Several other authors have argued that individuals' use of other people's ideas to advance their own is not the same as collaboratively developed ideas that extend beyond the understanding of the individuals. For example, Crook

¹For the kind of argumentation on which Piaget focused, clarity of communication and taking others' perspective may be necessary in a way that differs from what is needed for the collaboration involved in young children's understanding of the language, concepts, and routines of their community from the first year of life. Although French and U.S. toddlers have been observed to collaborate in play through coordination of actions, elaboration of each other's ideas, co-construction, and guidance (Brownell & Carriger, 1991; Verba, 1994), studies of collaboration of 3- to 5-year-old children in cognitive tasks have been quite variable in their results (Cooper, 1980; Freund, 1990; Gauvain & Rogoff, 1989; Göncü & Rogoff, submitted; Mistry & Rogoff, submitted; Pacifici & Bearison, 1991; Perlmutter, Behrend, Kuo, & Muller, 1989; Rogoff et al., 1995; Wood et al., 1978; Wood, Wood, Ainsworth, & O'Malley, 1995). The age at which children learn from their interactions with other people may be a function of the nature of the activity as well as of the collaborative processes involved in communicating about the decisions and information at hand (Rogoff, 1990). The argumentation emphasized by Piaget may characterize a specific kind of discourse in a particular type of activity.

(1994) argued that turn-taking exchanges in which individuals try to compare the quality of their ideas fall short of collaboration, in which individuals seek a fusion of reference that creates a platform for subsequent joint action (see also Lomov, 1978). Matusov (1995) argued that intersubjectivity is a process of coordinating individual participation in joint sociocultural activity, not a relationship of correspondence of individuals' ideas or actions to each other. Similarly,

Each participant's thinking becomes more and more an integrative part of what everyone else thinks in the group, and therefore neither the meaning nor the mode of construction of each participant's cognition can be explained as isolated, individual mental entities. (Miller, 1987, p. 235)

In work groups or family discussions in which individuals participate in a joint construction, the participants change their understanding and may have difficulty determining "whose" idea an insight was (Rogoff, 1990).

For Piaget, the social process provides individuals the opportunity to see alternatives and explore the logical consequences of their own positions in a meeting of individual minds, as opposed to a shared thinking process. To understand how individuals learn and develop through participation in the sociocultural world, it is necessary to grant that meaning is more than a construction by individuals. Piaget's use of the isolated individual as the unit of analysis, in my view, makes it impossible to develop a sociocultural approach to cognition using his theory as the basis; sociocultural aspects of cognition are not merely the addition of individual changes in thinking resulting from social interaction.

Nonetheless, Piagetian theory has added important ideas to the sociocultural theoretical endeavor. Most notably, Piaget's (1926) emphasis on peer interaction has drawn attention to the exploration of cognitive conflict between companions of equal status. Piaget asserted that only when children are able to discuss problems as equals are they likely to take into account new ways of thinking. Other scholars have extended Piaget's discussion to include the effects of peer interaction on the development of Piagetian concepts. Some of this work considers the sociocultural context in addition to the interpersonal context, developing the seed of Piaget's ideas about the social world beyond his own work. A later section of this chapter examines peers' similar status in collective argumentation and presents research and conceptual points of scholars closely influenced by Piaget.

Thus, it seems fair to say that the conceptual perspective offered by Vygotsky and his colleagues forms the theoretical inspiration of sociocultural work on cognition as a collaborative process, with the emphasis of Piaget on peer interaction adding substantively to the endeavor.

The next section presents the central concepts of contemporary sociocultural theories. It also contrasts them with another perspective—the social influence approach—whose implicit set of assumptions provides a widespread, though little-articulated, conceptual system for much recent research which is at odds in many ways with the tenets of sociocultural theories.

SOCIOCULTURAL AND SOCIAL "INFLUENCE" CONCEPTUALIZATIONS

In this section, I summarize the theoretical position of a family of sociocultural theories regarding cognition as a collaborative process, and attempt to distinguish it from the assumptions of the social influence approach. In sociocultural theories, individuals' cognitive development is regarded as inherently involved with the sociocultural activities in which they engage with others in cultural practices and institutions, in a mutually constituting relationship. The sociocultural activity is the unit of analysis (see also Rogoff & Chavajay, 1995).

The social influence approach uses the individual as the unit of analysis, and adds social interaction as an "influence" on individual development, treating the partner or their "input" as an independent variable, and the later performance of the target individual as a dependent variable (see also Wertsch & Toma, 1995). Researchers using social influence conceptualizations do not identify their approach as a theory. However, the implicit assumptions and questions within this approach are often treated as the default theory in empirical work. This often occurs even if the study's rationale refers to Vygotsky's or Piaget's theories. Nicolopoulou and Cole (1993) pointed out that in research referring to Vygotsky, the social context of development has often been reduced to face-to-face interaction in dyadic pairs, "a truncated and inadequate conception of the sociocultural dimension of Vygotsky's theory" (p. 283).

I have the impression that a unifying metaphor underlying social influence approaches is a tool of widespread use in U.S. psychological research: the Analysis of Variance (ANOVA). The ANOVA provides pervasive guidance for the research that has appeared in developmental journals,

and it seems, by extension, to provide a way of looking at the phenomena researched. One of the key tenets in the use of ANOVA is that human phenomena are to be divided into separate factors, defined independently of each other, and varied without respect to each other. The assumption is that by examining the effects of these independent factors one at a time or with a few others in (statistical) interaction, the nature of human phenomena can be determined.

My remarks here are not meant to criticize statistics, metaphors, or other tools of thought and communication, but to articulate the assumptions of a particular metaphor that is widely used but usually unexamined. We make use of tools such as ANOVA, graphs, two-dimensional diagrams, or analysis of transcripts to organize our ideas about the human phenomena we seek to understand. The tools (and metaphors of communication as well) are essential for our work, but the limitations of the tools should not become limitations in our understanding. I am simply suggesting that we reflect on the assumptions necessary to use metaphors and tools of analysis, rather than assume that the phenomena are structured in the same way as the metaphors and tools (see also Gellatly, 1989).

Sociocultural theory is still emerging and is not a single consolidated view. In this overview, I present my own views and those of others that are closely related. I have argued that development and learning entail individuals' *transformation of participation* in sociocultural activity; their roles are not separate entities from the activities in which they participate, although their contributions can become the focus of attention for particular analyses (Rogoff, 1990, 1995). Similar emphasis on transformation of participation has been made by Lave, Ochs, Shieffelin, Heath, and Dewey. For example, Dewey (1916) argued:

The living creature is a part of the world, sharing its vicissitudes and fortunes, and making itself secure in its precarious dependence only as it intellectually identifies itself with the changes about it, and, forecasting the future consequences of what is going on, shapes its own activities accordingly. If the living, experiencing being is an intimate participant in the activities of the world to which it belongs, then knowledge is a mode of participation, valuable in the degree in which it is effective. It cannot be the idle view of an unconcerned spectator. (p. 393)

Some sociocultural scholars may disagree with my points here—especially those who work within a social influence approach or something in between (as I myself have

done in my earlier work). So, this section should not be taken as representing the thinking of all members of the "sociocultural family," but as my efforts, along with those of some other scholars, to explicate how learning and development occur as a process of transformation of participation in sociocultural activity.

The remainder of this section examines conceptual issues that distinguish transformation of participation and social influence views:

- Nonindependence versus independence of individual, interpersonal, and community processes.
- Learning conceived as changing participation in activities versus internalization across boundaries.
- Observing dynamic processes of understanding versus locating stored knowledge.
- Changing participation versus competence in reaching a developmental goal.
- Relation of participation across activities versus transfer of knowledge.

Nonindependence versus Independence of Individual, Interpersonal, and Community Processes

Sociocultural theories, such as the transformation of participation approach, have in common a premise that individual, interpersonal, and cultural processes are not independent entities (Lave, 1988b; Packer & Scott, 1992; Rogoff, 1982, 1992; Valsiner, in press; Wertsch & Toma, 1995). Analysis may focus primarily on one of them, but not without reference to the others as if they could exist in isolation from each other (Rogoff, 1995). As Bakhurst put it, "the study of mind, of culture, and of language (in all its diversity) are internally related: that is, it will be *impossible* to render any one of these domains intelligible without essential reference to the others" (1988, p. 39).

With the view that individual, social, and cultural processes constitute each other, it is essential to note that individuals transform culture as they participate in its practices, altering the practices with their generation to fit their circumstances. Individuals develop as they participate with others in shared endeavors that both constitute and are derived from community traditions (Rogoff, 1990). For example, children's play occurs in organized social institutions that predate the children's involvement, but the children also elaborate the possibilities available to them (Packer & Scott, 1992).

Rogoff (1995) suggested that the examination of individual, interpersonal, and community/institutional developmental processes involves differing planes of observation and analysis, with any one plane being the focus, but with the others necessarily observed in the background (see Figures 14.1 and 14.2). In an analysis focusing on individual contributions to sociocultural activities, the individual's

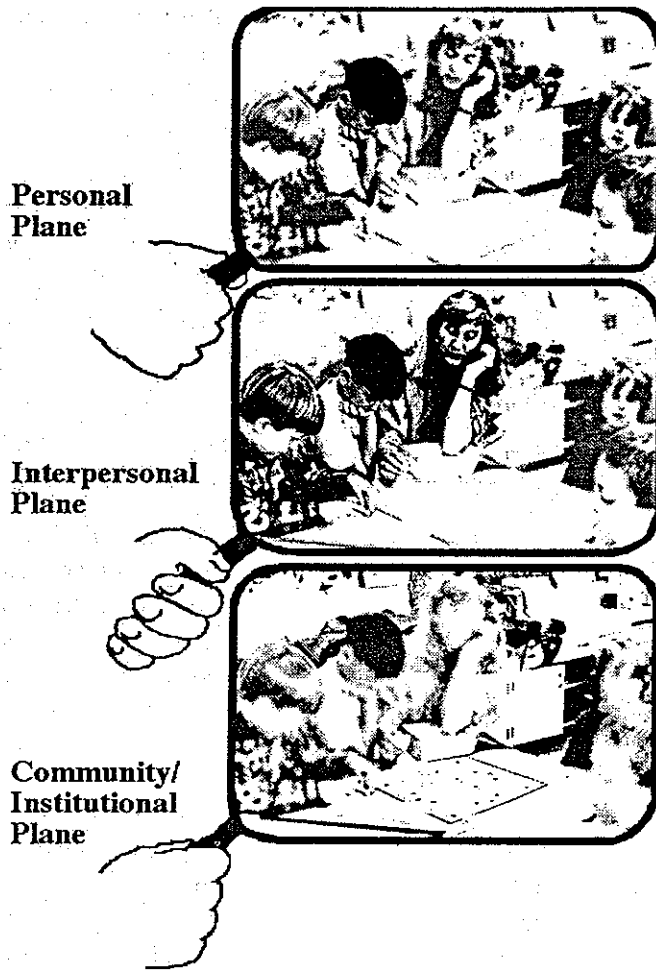


Figure 14.1 Using personal, interpersonal, and community/institutional planes of analysis involves focusing on one plane, but still using background information from the other planes, as if with different lenses. In this image, the viewer can focus on the boy planning a word to spell (a personal plane of analysis), the interaction between the boy and the woman helping him and his competitors (an interpersonal plane of analysis), or the scrabble game, dictionary, classroom arrangement, and middle-class U.S. version of a European-derived institution (a community/institutional plane of analysis). Analysis focusing on each of these planes requires some attention to background information regarding the others. (© Barbara Rogoff)



Figure 14.2 Analyzing the personal, interpersonal, and community/institutional planes in this activity could entail a focus on one child as she writes (personal plane), the engagement of that child with her classmates and teacher (interpersonal plane), or the classroom arrangements—such as seating arrangements and literacy and numeracy tools on the wall and desks—as well as the recent adoption of this European-derived institution in this Mayan community (community/institutional plane). (© Barbara Rogoff)

contributions are in focus while those of the other people are blurred, but one cannot interpret what the individual is doing without understanding how it fits with ongoing events. It is not as if the individual could be taken outside of the activity to have their development analyzed. They are involved—part of the activity. Individual, interpersonal, and community processes on which researchers focus do not entail “boundaries” between separate entities.² This is my reason for stressing the term *planes* of analysis, which contrasts with prevailing notions of *levels* of analysis that treat personal, interpersonal, and community processes as separate entities rather than simply analytic distinctions.

² Compatible units of analysis seem to be employed by some researchers studying events in the brain (such as the functioning of neurons or the development of brain matter) and perception-and-action (such as coordination of limbs in the context of action in real circumstances). For example, Pribram (1990) discussed the hologram metaphor, which he attributed to the parallel distributed processing approach: “The properties of holograms are expressed by the principle that ‘the whole is contained or enfolded in its parts,’ and the very notion of ‘parts’ is altered, because parts of a hologram do not have what we think of as boundaries” (pp. 92–93; see also Gibson, 1982; Winograd & Flores, 1987).

An example of how individual cognitive processes constitute and are constituted by interpersonal and community processes was provided by a study of planning Girl Scouts' cookie sales (Rogoff, Baker-Sennett, Lacasa, & Goldsmith, 1995). The individual Scouts' cognitive activity in planning and keeping track of orders, money, and routes occurred in close collaboration with other Scouts, family members, customers, and adult troop leaders, and involved cognitive tools provided by the institution (such as memory and calculation aids on the order form). At the same time that the girls' work fit existing practices, it contributed to transforming them with use of new technologies (such as using post-it notes to organize orders). Attention to the individual, interpersonal, and community/institutional planes of analysis was necessary to understand the complex problem solving of this activity, each becoming the focus of different analyses; treating them as independent entities would not have resulted in a coherent understanding of the roles of individuals, other people, and the community.

Learning as Changing Participation IN Activities versus Internalization ACROSS Boundaries

The concept of internalization has been used in a variety of theoretical approaches to account for how shared thinking results in changes in an individual (Aronfreed, 1968; Bandura, 1986; Zinchenko, 1985). However, the concept of internalization often involves a strict boundary between the individual mind and the external world. Individuals are considered to possess preexisting knowledge, then have a social experience, and then internalize it so that it becomes a part of their own bag of tricks. The internalization process is necessary in social influence approaches to account for the movement of information from outside the boundary to inside it.

From the transformation of participation perspective, learning from shared thinking does not involve *taking* or *being given* something from an external model. Instead, by participating in shared endeavors in sociocultural activity, the individual is continually in the process of developing and using their understanding. In the process of participation, individuals *change*, and their later involvement in similar events may reflect these changes.

Participation in sociocultural activities does not involve copying what is already invented or available in the thinking of the participating individuals; it is a creative process. Leont'ev (1981) stressed the creative process when he claimed that the very form of mental reflection of reality

changes in the course of each person's development in each new generation, as he or she participates in practical activity developed in human society. The social influence view is not usually a copy theory either—"incoming" information is often treated as being transformed by the individual, but this occurs within the individual's acquisition of the external information. This is a different process than in sociocultural theories, where individuals are regarded as transforming their understanding and roles, becoming people that play varying roles in the community with changing understanding and interpersonal relations, as an inherent aspect of their participation in sociocultural activity (Forman & McPhail, 1993; Lave & Wenger, 1991; Litowitz, 1993; Rogoff et al., 1995).

Observing Dynamic Processes of Understanding versus Locating Stored Knowledge

The central research questions raised in the social influence model deal with attempting to locate where knowledge resides and how it moves from one location to another through the impact of social interaction—from external events to the brain, from the brain to executed action, and from one situation to another (Rogoff, in press).

These questions are premised on a storage metaphor, in which learning and development are conceived as the accumulation of mental objects such as plans, memories, or reading skills (Kvale, 1977; Rogoff, Baker-Sennett, & Maturov, 1994; Wertsch & Toma, 1995). The storage metaphor seems to be necessitated by the assumptions of a boundary between the person and the rest of the world, accompanied by assumptions that the present is bounded off from the past and future. Gauvain (1993) discusses the storage model in her account of spatial thinking from a sociocultural perspective:

Spatial knowledge is not a general, underlying "piece" of knowledge that exists inside the head, to be externalized for use when needed. Spatial understanding may not be separate from the activity in which the knowledge is used and, thus, may be less like a representation, such as a route or a map, and more like a problem-solving process. (p. 70)

The storage metaphor rests on an assumption that time is segmented into past, present, and future, with boundaries between them. Relations across time periods are handled by assuming that the individual stores memories of the past that are somehow retrieved and used in the present, and that the individual makes plans in the present and (if they

are stored effectively) executes them in the future. This involves crossing boundaries between time periods, like the boundary between the person and the rest of the world in social influence approaches (Rogoff, Baker-Sennett, & Matusov, 1994).

From a transformation of participation perspective, change and development in the process of participation are assumed to be inherent, with prior and upcoming events involved in (not independent of) the ongoing present event. Any event in the present is an extension of previous events and is directed toward goals that have not yet been accomplished. As such, the present extends through the past and future and is not independent of them (see Ochs, 1994; Pepper, 1942; Rogoff, in press). When a person acts on the basis of previous experience, their past is present. It is not merely a stored memory called up in the present: the person's previous participation contributes to the event at hand by having prepared it. The present event is different than it would have been if previous events had been different; the explanation does not require a storage model of past events. Thinking and acting in the present involves reference to prior events and activities, as well as others that are anticipated in the future.

The contrast between treating interacting people as separate individuals versus contributors to a dynamic, integrating event is illuminated by Felton (personal communication, October 1993), who suggested that it is necessary to think of cognitive development as a process, as people move *through* understanding rather than *to* understanding (seen as a platform, or level of achievement). In discussing the concept of intersubjectivity, she argued that "the difficulty in working with intersubjectivity as a concept is that it isn't located in space; it may be inferred through activity, or seen in the products of creative endeavour" (p. 2). She illustrated her points with observations of dance:

Contact improvisation [is] a dance form founded on and directed towards an articulation of the intersubjective process. (A way I'd never describe it in other circles, but this is essentially what it is.) The locus of attention and activity resides between two partners moving in unrehearsed concert with each other. This improvisational form is based on moving without resistance and working with the impulses that are constructed between partners. We work with blending our movements, giving and taking weight, and falling with gravity. This intersubjective focus allows us to effortlessly lift partners much heavier than ourselves because we work with momentum generated through our interactions. Dancing with one partner (or more) our attention is focused on what

is occurring between us from moment to moment. These moments aren't fixed places that we move from and to. The dance is not an exchange from one person to another, or from one pose or posture to another. If we had to wait for our partner to arrive at the destination of each movement, the momentum for the dance would be gone. If we take a slow motion look at this, we see that the dance isn't a series of static postures strung together, but is a constantly unfolding, emerging activity. The dancer never gets to or departs from any specific place. . . . The dance can't rely on the skill of one partner or of the other; if the intersubjective realm is not attended to, no amount of expertise will save the dance from being static. (1993, pp. 2-3)

The view that development is a transformation of participation of people engaged in shared endeavors avoids the idea that the social world is external to the individual and that development consists of *acquiring* knowledge and skills. Rather, a person develops through participation in an activity, *changing* to be involved in the situation at hand in ways that contribute both to the ongoing event and to the person's preparation for involvement in similar events. Instead of studying a person's possession or acquisition of a capacity or a bit of knowledge, the focus is on people's active changes of understanding and involvement in dynamic activities in which they participate (Arievitch & van der Veer, 1995; Gibson, 1979; Leont'ev, 1981; Pepper, 1942; Rogoff, 1990; Rogoff et al., 1994). Communication and coordination during participation in shared endeavors involve adjustments between participants (with varying, complementary, or even incompatible roles) to stretch their common understanding to fit with new perspectives in the shared endeavor. Such stretching to accomplish something together is development. As Wertsch and Stone (1979, p. 21) put it, "the process is the product." The central questions raised in the transformation of participation view deal with how people's roles and understanding change as an activity develops, how different activities relate to each other, and how people prepare now for what they expect later on the basis of their prior participation (Rogoff, in press).

Changing Participation versus Competence in Reaching a Developmental Goal

The effort to chart internal competence often appears in social influence views, conceived as acquisition of mental objects underlying actual but impure performance. The distinction between competence and performance is not

relevant to studying the structure of people's developing involvement in sociocultural activities. From a transformation of participation perspective, we examine how children actually participate in sociocultural activities to characterize how they contribute to those activities. The emphasis changes from trying to infer what children *can* think to interpreting what and how they *do* think (see also Packer & Scott, 1992; Rogoff et al., 1994).³

If we do not search for the acquisition of mental objects or competence, this move also recasts the question of the onset of new competences (Rogoff, 1996). The question of when a person *begins* to have plans, perspective-taking skills, or language treats transitions as if they were contained in the child, who either does or does not have the knowledge or skill. The onset question in developmental psychology generally searches for the earliest time one can find evidence of the skill or knowledge in question, yielding continual efforts to demonstrate that the child "has it" at an earlier age than asserted by Piaget or some other scholar, by changing the nature of the task situation (see Bruner, 1978; Elbers, 1991). From the transformation of participation perspective, developmental transitions are to be studied in people's roles in sociocultural activities rather than through assuming that developmental change involves the acquisition of a competence solely within the individual.

In addition, the definition of development changes from one in which people ascend levels toward a given (often uniform) developmental endpoint, to a sociocultural definition in which transformations are qualitative developmental changes in particular directions. The direction of development varies locally in accord with cultural values, interpersonal needs, and specific circumstances, but it does not require specification of universal or ideal endpoints of development. Further, the applicability of sociocultural ideas about learning and development is not restricted to directions that are considered desirable by

experts or other segments of the community. They apply also to explaining how people develop through participation in community activities that many would criticize. What is key is transformation in the process of participation in community activities, not acquisition of competences defined independently of the sociocultural activities in which people participate.

Relating Participation across Activities versus Transferring Knowledge across Situations

In a transformation of participation view, the relation between processes in different activities is a central matter for investigation. Processes are not automatically assumed to be general, nor are they assumed to be so particular that we cannot extend from any particular observation to others. Rather, researchers can observe how processes observed in one situation relate to those in others.

The question of relating activities to each other differs from questions of transfer or generalization using a storage metaphor. The focus is on determining how activities relate to each other and how people's participation in one activity relates to their participation in another, rather than on how mental objects are transferred (as if they existed in isolation in the head) or how physical similarities in the materials elicit transfer (as if the materials carry meaning outside of their use). Rather, the idea is that individuals change and handle later situations in ways prepared by their own participation and changing responsibility in previous activities (Rogoff, 1994, 1995, in press).

In the social influence perspective, since individual competence is traditionally seen as separate from environmental circumstances, researchers examine relations across situations by means of statistical interactions between person and situation (Rogoff, 1982). Social influence approaches conceptualize the complex whole as an enormous collection of variables that are defined independently of each other. The search for interactions between separately defined person and situation factors yields infinite interactions, leading to "a hall of mirrors that extends to infinity" (Cronbach, 1975, p. 119).

Those who become concerned that the study of contextual issues leads towards chaos are likely to be considering those infinite interactions from a social influence perspective rather than seeking the regularities and simplifications of patterns available when individuals are conceived as participants in—rather than separate from—sociocultural activity. Greater parsimony is to be found, I have argued

³This contrast does not imply a recommendation to attend only to behavior. Determining what and how people think is still inferential and is not simply a matter of recording simple aspects of behavior or of peoples' responses to questions or cognitive tasks. Neither the view of observers nor of people themselves is a "true" window on cognitive processes. Researchers should take advantage of whatever evidence is available from their own observations as well as from the reports of other observers and the people involved to create a plausible account that advances understanding (see Edwards, 1993; Kvale, 1977).

(Rogoff, 1996), in recognizing and studying regularities and coherence in the existing richness of structure of human activities.

The question from a participation view is to understand the transformations that occur in children's participation in particular kinds of activities, which themselves transform—how do children change from this kind of participation to that kind of participation, and how do the activities in which they participate change with the children's and others' involvement? For example, to examine children's progress in learning to read, researchers would examine transformations in how children make sense of letters in particular kinds of texts with specific kinds of social and cultural organization of the reading activity, such as the kind of social support provided for the child's participation in reading and the purpose of the reading effort. These are inherently part of the process of reading, not potential confounds or features that need to be controlled in order to identify the child's "level" of reading competence. The activity in which children's reading is observed would be part of the evaluation of the children's progress, since no setting provides a context-free window on hard-to-see competence that the individual "has" (Rogoff, in press).

In sum, the basic contrast is that in sociocultural views, individual development is seen as contributing to as well as constituted by the sociocultural activities in which people participate, whereas social influence approaches maintain a focus on the individual as the basic unit of analysis and examine the influence of "outside" social forces.

The next section considers ramifications for the central research questions and methods regarding the study of individuals' development that stem from the conceptual differences between sociocultural and social influence perspectives. The sociocultural approach does not just add new variables (e.g., whether or not people have a partner), but is developing a worldview that differs in some fundamental ways from the assumptions on which much developmental research has been based.

RESEARCH QUESTIONS AND ASSOCIATED WAYS OF OBSERVING DEVELOPMENT

Sociocultural and social influence approaches both address classical cognitive developmental questions such as how people learn to plan, remember, solve problems, classify information, perceive, communicate and understand each other, read and write, understand mathematical and

linguistic systems, and extend their understanding to new situations. However, in sociocultural approaches, such cognitive processes are regarded as an aspect of how people act intelligently within specific types of sociocultural activity, whereas they are seen as residing within individuals in the social influence approach (with domain specificity of skills used to account for differences in how people think in different activities).

This section outlines some of the key differences in research questions and methodological approaches for observing individuals' development from sociocultural and social influence perspectives. Sociocultural researchers are still in the process of developing research methods consistent with the assumption system of the sociocultural perspective. As Vygotsky (1978) argued, "any fundamentally new approach to a scientific problem inevitably leads to new methods of investigation and analysis. The invention of new methods that are adequate to the new ways in which problems are posed requires far more than a simple modification of previously accepted methods" (p. 58).

It is challenging for researchers to attend both to the learning of the children whose development is of interest and to the contributions of their partners and communities. The challenges to researchers working with the sociocultural perspective are to develop methods to examine individual contributions in relation to the course of their participation in sociocultural activity (not to treat the individual's contribution as existing separately from the dynamic interpersonal and sociocultural aspects of the activity). Researchers working from the social influence perspective attempt to standardize or separately define the social influences "impacting" the individual and isolate the individual for the sake of examining their learning.

These differences between the two approaches involve both conceptual and methodological issues, with quite different units of analysis: the individual (as an independent entity) versus the activity (with contributions by varying people whose roles are mutually defining). The different units of analysis are reflected in the central research questions regarding cognition as a collaborative process in the two approaches. With the social influence approach, researchers ask what external influences affect the individual's development and how individuals generalize what they have acquired to new tasks; with the sociocultural approach, researchers ask how individuals' understanding and roles transform in their participation in sociocultural activities and how people relate participation in one activity to another.

Examining Development in Social Influence Approaches

In social influence approaches, the assumption is that in order to evaluate learning, the individual must be isolated from other influences and a standard procedure applied to "measure" competence as pieces of knowledge that have been obtained. Methodological manipulations are used to clear away situational artifacts that "get in the way" of evaluating children's possessions of skills or concepts. This often involves using standardized tests or pretest-treatment-posttest designs to isolate the individual's competence. However, this approach is plagued by difficulties in applying equivalent procedures as well as in truly isolating the individual (Rogoff, in press).

Standardization of Procedures as an Attempt to Hold Constant the Situation

Standardization requires that situations have the same meaning for different individuals or groups; it is not necessarily achieved by applying the same procedures. The same procedures often carry very different meanings to differing people.

For example, U.S. middle-class children with different schooling backgrounds differed in treating an experimenter as a tester or a collaborator, making the children's "independent" performance noncomparable even though the experimenter acted the same way with both groups (Matusov, Bell, & Rogoff, unpublished data). Children whose schooling emphasized collaboration with adults (see Figure 14.1) treated the experimenter as a collaborator, attempting to converse with him about the problems and trying to involve him in the activities, though he sat reading a book to indicate that he was not supposed to be interacting. Children from a school that employed little collaboration seldom tried to involve the experimenter; they were more used to having adults withdraw as they worked or displayed their knowledge. For the experimenter to refuse to be involved with the children from the collaborative school was a violation of their expectations of the social situation, though it was consistent with the expectations of the children from the less collaborative school. Thus, it was not possible to compare the "independent" performance of the two groups of children, because the experimenter was treated by the children as playing different roles.

The expected relationships between child and examiner in a test or experiment are familiar to some research participants, but not to others of differing cultural or social

backgrounds. Relations with a tester entail a particular form of display of knowledge and of social interaction that is valued in many schools and experiments (Rogoff, 1982; Rogoff, Radziszewska, & Masiello, 1995; Schubauer-Leoni, Bell, Grossen, & Perret-Clermont, 1989). For example, in many communities, the role of children may be to observe and to carry out directives, but not to initiate conversation or talk back to a person of higher status (Blount, 1972; Harkness & Super, 1977; Ward, 1971). In tests, reliance on a companion for help may be considered cheating, whereas in everyday situations in many communities, not to employ a companion's assistance may be regarded as folly or egoism.

Schooled people are familiar with an interview or a testing situation in which a person who already knows the answer asks the question anyway (Mehan, 1979). In some cultural settings, however, the appropriate behavior may be to show respect to the questioner or avoid being made a fool of by giving the obvious answer to what must be a trick question (otherwise why would a knowledgeable person be asking it?). Irvine (1978) suggested that Wolof subjects' interpretation of an experimenter's purpose in a conservation procedure may conflict with their giving straightforward answers to questions. She reported that it is uncommon, except in schoolroom interrogation, for Wolof people to ask one another questions to which they already know the answers: "Where this kind of questioning does occur it suggests an aggressive challenge, or a riddle with a trick answer" (p. 549).

The particular forms of cognitive activity that are considered central to intellectual life in research are closely tied to the definitions of thinking employed in academic settings. Schubauer-Leoni et al. argued that schooled children often assume that relations with a researcher follow the "didactic contract" that they are familiar with from their relations with their teachers, entering a research setting with the tendency to function as a pupil with the associated "systems of rights, obligations, rules, and tacit agreements embedded within the institutional framework" (1989, p. 681).

Like other societal institutions, schooling provides practice in the use of specific tools and technologies for solving particular problems (Scribner & Cole, 1981). Such tools include mnemonic devices; language genres such as essayist prose and story problems; and formats for calculation and record keeping, such as arithmetic and writing. Societal institutions and tools of thought carry with them values that define important goals to reach, significant problems to

solve, and sophisticated approaches to use in addressing the problems and reaching the goals. The values differ in their emphasis on independent versus interdependent performance, social responsibility versus technological advance, analysis of freestanding puzzles versus synthesis of patterns in practical contexts, speed of action versus considered deliberateness, and many other contrasts (Goodnow, 1976; Lutz & LeVine, 1982; Rogoff, 1981; Rogoff & Chavajay, 1995; Scribner, 1976; Serpell, 1982).

Skills for mastering specific forms of assessment—such as the “objective” tests in schools and national standardized assessments—themselves become a central part of many institutions designed to foster learning, with instruction focusing on success in these specific activities (Fredriksen & Collins, 1989). Such differences in values and practices make it unlikely that standardized procedures will have the same meaning to different people, especially as their backgrounds differ (Cole & Means, 1981; Fredriksen & Collins, 1989).

Attempting to Isolate the “Individual” from Social Situations

Most information on children’s cognitive development has been obtained in situations in which children are treated as if they were revealing their thinking in a situation free of social and cultural constraints. According to Brown (1994), in the 1960s, children were often tested in “cages” (the Wisconsin General Test Apparatus, designed by Harlow for use with monkeys that bite) in order to minimize interaction of the experimenter and the child. The procedure kept the child from seeing the experimenter’s facial expressions behind a one-way mirror, in order to “control” for social influences.

A common method for attempting to isolate the individual from social influence in order to assess learning is the treatment-posttest design, in which researchers arrange for exposure to external knowledge or skill, and then examine evidence of acquisition as the person retrieves the acquired knowledge or skill “independently.” However, there *is* no pure observation of what the individual does independent of their prior and concurrent participation in sociocultural activity (Schubauer-Leoni et al., 1989; Wertsch et al., 1993). For example, posttests do not reveal purely individual performance. The subject in a posttest is working within the constraints and supports provided by the experimenter and the research tradition and scholarly institutions that encompass the procedures and interpretation of posttests. The posttest proceeds

according to a communicative contract that delineates the appropriate form of communication and resources available in responding to the problems posed by the experimenter (Crook, 1994; Forman & McPhail, 1993; Perret-Clermont, 1993; Perret-Clermont, Perret, & Bell, 1991; Rogoff et al., 1995).

Experimenters or testers are collaborators in children’s production of test performance (Newman, Griffin, & Cole, 1984; Scribner, 1976). Young children attempt to use researchers as collaborators, making use of the examiner’s nonverbal cues, such as direction of gaze and hesitations to answer standardized questions (Mehan, 1976). Tudge (1992) suggested that, in a situation in which the experimenter provided no feedback on children’s solutions to balance beam problems, the experimenter’s silence is nonetheless social information. “Silence on the part of an adult typically implies consent—or surely an incorrect answer would be challenged” (p. 1377). Tudge suggested that the stability of incorrect and correct responses in his study might have been due to an inadvertent strengthening by the adult of the views expressed by the children.

Even when experimenters and subjects are not directly engaged, they are indirectly engaged together. For example, researchers attempt to tailor the problems on which children work to their age level or abilities (Tudge & Winterhoff, 1993b), and the materials, instructions, and experimental script are used to communicate to children what they are to do, and to support their playing their role in the study. Cognitive researchers easily note that preschool children have difficulty following the experimenter’s plans or focusing on the experimental goals unless their role is carefully supported by the researcher and the experimental procedures.

Researchers seldom analyze how they themselves are involved in the cognitive activities of their subjects when the contact is indirect, such as through instructions in advance of a task, provision of materials or of constraints on available methods, or written or electronic communication with research participants. An example of how individuals relied on indirect collaboration with researchers occurred in a study noting that white upper-middle-class U.S. fourth-graders who worked solo on a computer-based tutorial accessed a computer helpscreen summarizing the meaning of symbols to be learned (a form of contact with the experimenters) more often than did students working in groups (Hooper, Temiyakarn, & Williams, 1993).

For researchers to examine our own assumptions and personal and institutional engagements in cognitive tests is a challenging endeavor, because people are notably

unaware of the institutions in which they themselves act. Berger and Luckmann (1966) speculated that habitual relations between people become institutionalized as expected and accepted rules and approaches that humans come to regard as external to their functioning. Shotter (1978) explained:

For the structure of human exchanges, there are precise foundations to be discovered in the *institutions* we establish between ourselves and others; institutions which implicate us in one another's activity in such a way that, what we have done together in the past, *commits us* to going on in a certain way in the future. . . . The members of an institution need not necessarily have been its originators; they may be second, third, fourth, [and so forth] generation members, having "inherited" the institution from their forebears. And this is a most important point, for although there may be an intentional structure to institutional activities, practitioners of institutional forms need have no awareness at all of the reason for its structure—for them, it is just "the-way-things-are-done." The reasons for the institution having one form rather than another are buried in its *history*. (p. 70)

Efforts by scholars to understand the cultural-historical nature of academic institutions and activities are aided by the discourse across disciplines, nations, and historical time periods that are inherent to the sociocultural approach, and by the aims of this line of work to understand the mutually constituting nature of individual functioning and interpersonal and community/institutional processes (Rogoff, 1995; Rogoff & Chavajay, 1995). In sociocultural approaches, the idea of separating the individual from social influences is seen as an analytic device that has been used by researchers using a particular assumption system that fits with prevalent academic institutions.

Observing Development as Transformation of Participation

From the perspective that development occurs as individuals transform their participation in sociocultural activities, the point is not to try to dissect individuals apart from sociocultural activity, but to try to understand their roles in, contributions to, and changes through the sociocultural activities in which they participate. Moving from the individual to the activity as the unit of analysis has been informed by methodological approaches prevalent in disciplines other than psychology, notably ethnographic analyses and graphical analyses.

Sociocultural approaches do not limit analyses to particular methods, but rather inspire broadening of methodological tools through using methods of examining evidence used in other disciplines. Depending on the question, researchers from a sociocultural approach choose among or combine methodological tools that have previously been regarded as belonging within the domain of particular disciplines. Sociocultural research emphasizes both qualitative approaches to understanding the meaning of events from a perspective that fits the practices of the community being studied, and quantitative approaches that can be useful in understanding patterns that appear across cases or settings. It is beyond the scope of this chapter to go into detail on methodological innovations; I refer the reader to Chapter 3 of Rogoff, Mistry, Göncü, and Mosier (1993) for discussion and examples of integrating qualitative and quantitative approaches that can support sociocultural analyses.

An important aspect of the sociocultural approach to understanding scholarly inquiry itself is an examination of the methods that are used in analyzing phenomena (see Kindermann & Valsiner, 1989; Valsiner, 1986). This involves putting the question first, and then looking for ways to study it, rather than limiting what is studied to the phenomena that can be analyzed exclusively with the methodological tools of a particular discipline. I suspect that the default assumptions employed in the social influence approach are maintained with tenacity due in part to the firm placement of ANOVA (and related statistical tools) as a rite of passage for researchers becoming psychologists.

From the perspective that development is a process of transformation of participation, evaluation of development focuses on how individuals participate in and contribute to ongoing activity rather than on "outcome" and individuals' possessions of concepts and skills. Evaluation of development examines the ways people transform their participation, analyzing how they coordinate with others in shared endeavors, with attention to the purposes and dynamic nature of the activity itself and its meaning in the community. The investigation of people's actual involvement and changing goals in activities becomes the basis of understanding development rather than simply the surface to try to get past. (See also Packer & Scott, 1992.)

The central question becomes: How do people participate in sociocultural activity and how does their participation change from being relatively peripheral participants (cf. Lave & Wenger, 1991), observing and carrying out secondary roles, to assuming various responsible roles in the management or transformation of such activities? Rogoff

(in press) suggested that these features of an individual's participation in shared endeavors can be used to evaluate their learning:

- The roles people play (including leadership and support of others), with what fidelity and responsibility;
- Their changing purposes for being involved, commitment to the endeavor, and trust of unknown aspects of it (including its future);
- Their flexibility and attitude toward change in involvement (interest in learning rather than rejection of new roles or protection of the status quo);
- Their understanding of the interrelations of different contributions to the endeavor and readiness to switch to complementary roles (e.g., to fill in for others);
- The relation of the participants' roles in this activity to those in other activities, with individuals extending to other activities or switching to different modes of involvement as appropriate (such as skillfully generalizing or switching approaches to participation in certain roles at school and at home, or to involvement in different ethnic communities); and
- Their flexibility and vision in contributing to revision of ongoing community practices.

For example, graduate students' progress in learning how to do research is commonly evaluated according to these features of their involvement with their advisor's research team.

A participation perspective is routinely used in the classroom evaluation of children's learning in an innovative public elementary school in which tests are rarely given, but teachers have rich information on children's development and learning (Rogoff, Matusov, & White, in preparation; see also Clay & Cazden, 1990). Evaluation derives from collaboration with the children and observation of the roles that the children begin to carry out in the learning activities. Teachers evaluate learning to write, for example, in terms of whether children are at the point of needing assistance in becoming involved at all in writing, or write with interest of their own. Do they write only in response to requests to do so or to initiate communication through writing? Is their writing embedded in a very limited range of activities or is it broadly used? As they write, do they consider whether a reader will understand their written communication, or are they tied to writing for themselves alone? Do they take responsibility for editing for meaning

and legibility or is this a role that needs close support from another person? Do they assist others with writing activities? Do they effectively adjust their writing to differing circumstances, such as writing collaboratively when this is called for and writing solo when required? Does their writing achieve its purpose?

These kinds of observations provide teachers with detailed understanding of the children's development as writers, and simultaneously with information about how the teachers could support further development. The evaluation necessarily includes examination of the teachers' own involvement, the writing situation and supports, as well as the child's role in the writing activity. It is a formative evaluation that assesses learning within ongoing activity and simultaneously informs practice. It resembles Frederiksen and Collins' (1989) recommendation that test makers, teachers, and assessors make clear guidelines regarding the central skills and understanding of a particular kind of learning (e.g., developing geometric proofs or technical and creative skill in ice skating) and focus assessment as well as instruction on directly and explicitly involving students in these activities.

Experimental situations can similarly be analyzed in terms of how people (including the researchers) arrange their relative contributions, such as in children's learning how to plan maze routes with the involvement of their mothers and the experimenter in both practice and posttest events (Rogoff et al., 1995). Evaluation would include examination of how the children, mothers, and experimenter collaborated and avoided collaborating in the practice and posttest sessions (according to the rules of the experiment, which would also be an object of study), and how each person's role in planning the maze routes transformed and was transformed by those of others. The maze planning itself would be viewed as a function of the contributions of the participants in the sociocultural activity, and the similarities across the training and posttest events would reveal the nature of responsibility taken by the different contributors.

The theoretical systems involved in social influence and sociocultural perspectives fit with very different questions and ways of observing the learning and development of individuals. The sections of this chapter that focus on research findings are inclusive of differing conceptions and methods of studying cognition as a collaborative process. I provide some overview of limitations of the body of research to date, but I do not focus on the assumptions or the methods used in each study. Rather, I include studies employing a wide range of approaches and attempt to convey

the extent to which the findings are convincing or simply suggestive.

A great proportion of the work appears to be based primarily on social influence assumptions, perhaps because these assumptions require only the addition of social factors to the traditional psychological focus on the individual as the basic unit of analysis. However, a great deal of the research reveals efforts to break out of that assumption system toward the sociocultural perspective. The research corpus reflects the field's efforts to move beyond the individual as unit of analysis. The inconsistencies in assumption systems across (and often within) studies may reflect a developmental transition in the field.

THE STATUS OF RESEARCH TO DATE

The next sections summarize research on cognition as a collaborative process, with the aim of examining regularities that are appearing in our empirical understanding. Some of the work is based on the cultural/historical theory of Vygotsky and Leont'ev or on sociocultural theory, some is based on Piagetian theory, and a great deal fits largely within the social influence model. In beginning to extend the study of cognition beyond the isolated individual to include another person, research often still analyzes the contributions of the individual and a partner separately, rather than as collaborating participants in an integrated activity (see Rogoff, 1986, for my own shift between these two stances).

Although my preference for sociocultural theory necessarily guides my interpretation and organization of this account of research questions and findings, much (but not all) of the work done from other perspectives can be interpreted from a sociocultural perspective. The diversity of approaches to the study of cognition is a resource, not a shortcoming to be avoided—diverse questions, goals, and methods provide us with a more flexible and insightful complex of understanding of our subject matter.

The research literature on cognition as a collaborative process has grown dramatically in the last two decades. Some efforts have examined *whether* interaction with others fosters cognitive development, with varying correlations between adult "input" and children's skills. Because it seems clear that the role of social interaction in cognitive development varies with the circumstances rather than yielding a yes-or-no answer to the question of whether social interaction makes a difference, it is of

greater interest to determine *how* individuals engage with others and how such participation relates to their later involvement in related activities. For this reason, the focus of this review is on the processes of individuals' participation in shared endeavors with others, and the relation of their engagement in one activity with their later engagement in related activities.

The available research on cognition as a collaborative process has several systematic shortcomings, which are not surprising given the field's focus on use of the individual as the unit of analysis and the relative paucity of information about development in situations other than the laboratory and in cultural groups other than those of the researchers. There is still insufficient study and analysis of the following aspects of collaboration:

- There has been little study of the social and cultural aspects of how people determine the problems, goals, and means of their collaborative efforts, perhaps because research has focused largely on activities devised by researchers. Even outside of laboratory settings, researchers are often a part of the activities without examining their own roles (e.g., when they ask mothers to play with their children naturally); the researchers' roles in phenomena are seldom studied.
- We know little about collaboration when children and adults are in each other's presence without interaction as their agenda; when interaction is initiated and controlled by children seeking assistance, entertainment, or companionship; or when groups of children are not in the presence of adults.
- The dynamics of groups larger than a dyad have received little attention. Even when larger groups have been studied, they are often treated simply as collections of more individuals, interacting with each other as successive dyads rather than as integrated groups.
- There is insufficient information regarding populations other than middle-class European American groups, or in situations other than those devised or managed by middle-class European American researchers. Existing research examines the types of interactional settings (dyadic, often face-to-face) and institutions (e.g., schooling) that are of importance in that setting. Some studies cautiously limit generalization to the populations, institutions, and situations observed, but still, many slip to inferences that the research generalizes to "the child" or "the mother" or "the teacher."

- Insufficient research attention has been paid to the role of cultural tools, such as language for categorization and analysis of events, taxonomies for organizing lists of information to be remembered, and conventions such as genres of communication and maps for planning efficient routes in advance of navigation. There has also been little attention to the functioning of the institutions in which children's collaborations are observed—the ways that thinking and collaborating are aspects of cultural practices in laboratories, schools, and families.

The most interesting research on cognition as a collaborative process has moved beyond these limitations. However, even the research within these limitations provides useful information. Rather than repeating my concerns with these limitations with each research topic, I ask readers to interpret the findings of research that focuses exclusively on dyads (usually from European American middle-class populations) as representing a particular sociocultural setting organized by researchers within the cultural traditions of research (and often, of schooling). Although the sociocultural aspects of these particular activities may not have been analyzed by the researchers, results should not be automatically generalized beyond the populations and situations observed.

The major sections that follow review conceptual and empirical work on how adults as experts support novices' learning and how peers assist each other in learning. In the concluding section, I give greater emphasis to how collaboration includes cultural and institutional processes among people in different eras and locations, with collaboration involving asymmetries and disagreements as well as equal or harmonious agreement.

ADULTS AS EXPERTS SUPPORTING NOVICES' LEARNING

Research from various traditions has addressed the question of how experts structure novices' engagement in activities. Much of the work has focused exclusively on the means of support and stimulation that experts provide to novices, using methods such as scaffolding, Socratic dialogue, and tutoring. The earliest work in this tradition was very important in expanding the field's perspective on cognitive development beyond the solo individual. It yielded important findings regarding the importance of contingency between a tutor's assistance and a novice's

performance in the task, which might be regarded as a rudimentary form of mutuality, although it treats the tutor's and novice's acts separately.

Nonetheless, from a sociocultural perspective, much of the early and current work is incomplete because it often pays relatively little attention to the ongoing mutual process of understanding (focusing often on the expert's treatment of the novice, with the novice contributing correct or incorrect behavior). More importantly, this literature often overlooks the institutional and cultural aspects of the joint problem-solving activities that are observed. In many cases, the unit of analysis is separate individuals influencing each other, rather than sociocultural activity in which mutually engaged individuals collaborate in reaching goals.

Most of the research that I report focuses on adult-child interaction, but I also include some work done with college-age novices that helps to document the specific processes employed in such interactions. I do not focus on the question of age differences in forms of support for children's learning. This is due in part to insufficient information thus far to systematically examine this question. However, my impression is that a more fruitful question is more socioculturally cast: How does experts' support of novices' learning vary with the novices' extent of experience and interest in the activity in question and the experts' and the community's goals for the novices to move beyond the particular interaction to become participants in broader frames of activities? Answers to this question would include attention to the maturity of children as it relates to their involvement with immediate and broader sociocultural activities.

In the section that follows, I examine the distinction between sociocultural approaches to studying experts' support of novices' learning and approaches that focus on particular techniques of providing support, such as scaffolding. Then I review research and conceptual work that focuses on the techniques through which experts support novices' learning (much of it fitting the concept of scaffolding, but also tutoring and Socratic dialogue). I then turn to consideration of ways in which experts change their supports for novices becoming more skilled in the activities in which they participate, mutuality in communication between adults and children, and the role of expertise itself.

Sociocultural and Scaffolding Approaches to Experts' Support of Novices' Learning

The notion of scaffolding is often mentioned in the same breath as working in the zone of proximal development.

However, the two concepts are distinct in several ways. One of them, which I do not detail here, is that interactions in the zone of proximal development occur in pretend play among peers in addition to interactions between children and more expert partners (Vygotsky, 1967), whereas scaffolding is not regarded as inherent to pretend play among peers. (The collaborative aspects of play are discussed in a later section. Here I focus on interactions between people who vary in expertise, treating expert and novice as relative terms pertaining to the activity in question, not absolute designations—though we all vary in expertise, we all also have more to learn.)

Scaffolding is a specific technique focusing on what experts provide for novices, with individuals as the basic units of analysis and attention to particular instructional moves that can be operationally defined as epitomizing scaffolding (Greenfield, 1984). The originators of the concept of scaffolding, Wood, Bruner, and Ross (1976), described the functions of the tutor in scaffolding a child's performance as involving the following functions:

- Recruiting the child's interest in the task as it is defined by the tutor.
- Reducing the number of steps required to solve a problem by simplifying the task, so that the learner can manage components of the process and recognize when a fit with task requirements is achieved.
- Maintaining the pursuit of the goal, through motivation of the child and direction of the activity.
- Marking critical features of discrepancies between what a child has produced and the ideal solution.
- Controlling frustration and risk in problem solving.
- Demonstrating an idealized version of the act to be performed.

As a metaphor, scaffolding has been criticized as being too mechanical (Griffin & Cole, 1984; Valsiner & van der Veer, 1993). For example, Packer (1993) pointed out that in construction work, scaffolding is meant to hold up a passive structure (the building = the child?) until external efforts to construct it are completed, but children, as well as adults, are active and can manage the interaction.

Scaffolding focuses on the tutor's efforts as they relate contingently to the novice's successes and failures. It makes a very important advance over efforts that considered adult instruction in a way that was not linked with children's roles at all. Such unlinked ways of studying instruction examined

only what the expert did (e.g., by counting frequency of questions, directives, or praise) without examining the instructional context involving the novice's current state of understanding or reaction to the expert's instruction. The scaffolding notion explicitly includes the novice's progress in the concept, recognizing that a tutor's moves mean quite different things if they follow upon an error or successful attempt by a novice.

Equating scaffolding and working in the zone of proximal development is a frequent occurrence in the literature, which seems to be an assimilation of Vygotsky's complex ideas to a more familiar approach. The concepts of scaffolding and working in the zone of proximal development serve quite different functions and involve different units of analysis (Griffin & Cole, 1984). Nicolopoulou and Cole (1993) criticized the "interactional reductionism" implicit in much Vygotskian-inspired research, which too seldom goes beyond studying specific interactions to place them in the context of a cultural and institutional framework.

The concept of the zone of proximal development is not a characterization of what the more expert partner does to the other. It is a way of describing an activity in which someone with greater expertise assists someone else (or participants in play stretch) to participate in sociocultural activities in a way that exceeds what they could do otherwise. Sociocultural approaches to the study of experts assisting novices focus on examining how participants mutually contribute to learning, with attention to institutional, historical aspects of how the activity functions in the communities in question.

Research on the zone of proximal development involves a more broadly dialogic analysis of the novices' contributions to the shared endeavor than does research on the original concept of scaffolding (Stone, 1993). Investigation of the zone of proximal development focuses on the process of communication that builds "a continually evolving mutual perspective on how to conceive the situation at hand (Stone, 1993, p. 180)" rather than limiting analysis of novices' roles simply to their success or their errors in the task. For example, observations of some adults' assistance to young children's narrative productions examine the collaborative process by which the adults and children together provide the structure for the children's accounts, together creating support for children's development in their community's narrative script (Eisenberg, 1985; McNamee, 1980; Reese, Haden, & Fivush, 1993).

Analysis of interactions in the zone of proximal development also involves attention to how participants and institutions determine the goals, means, and situation

definition of the activities observed (Forman & McPhail, 1993). Wertsch and Hickmann (1987) suggested that "the child becomes 'aware' of the *functional significance* of the behaviors he has been performing under the guidance of an adult, in the sense of grasping how these behaviors constitute appropriate means to reach a particular goal" (p. 262).

The concept of scaffolding does not refer to the institutional and cultural context in which it occurs, whereas the concept of zone of proximal development requires attention to processes of communication and the relation of the interaction at hand to institutional, cultural, and historical processes. The shared endeavors of novices and experts are regarded as aspects of cultural activities with intellectual tools elaborated by society, which participants contribute to developing as they interact (Forman & McPhail, 1993; Moll & Whitmore, 1993; Rogoff, 1990; Wertsch et al., 1993). For example, strategic assistance of children's problem solving varies depending on the instructional goals and institutional practices of teachers and parents—especially whether the goal is error-free performance or exploration with errors, and whether the adults consider the task as school-related or home-related (Rogoff, Ellis, & Gardner, 1984; Wertsch, Minick, & Arns, 1984).

However, the Vygotskian concept of the zone of proximal development has tended to focus on face-to-face dyadic and didactic instruction, due to Vygotsky's emphasis on schooled interactions supporting the learning of academic concepts. It has missed the routine and tacit engagements and arrangements involving children and their caregivers and companions in varying cultural communities.

Cultural research has found important variations in adult ways of interacting with children—such as in face-to-face dyadic interactions or in multiparty engagements, and in treating children as conversational peers or not—that connect with children's roles in their community, ideal social relations toward which they are developing, and opportunities to observe mature members of the community (Heath, 1983; Martini & Kirkpatrick, 1981; Ochs, 1988; Rogoff et al., 1993; Schieffelin, 1991; Ward, 1971). For example, middle-class teachers' and mothers' collaborative assistance of students' narrative accounts focus on literate scripts for discourse (Reese et al., 1993), which differ from conventions of skilled discourse in some other communities (Michaels & Cazden, 1986; Mistry, 1993). Collaboration in language socialization has been observed to relate to the preparation of preschool-age children to the literate discourse of schooling for middle-class white and black children, but not for working-class white and black children (Heath, 1983).

In order to call attention to learners' roles and to the tacit as well as explicit arrangements involved in children's learning through their everyday engagement with others in their community, I introduced the concept of guided participation (see Rogoff, 1990). The concept of guided participation has sometimes been assimilated to the more familiar didactic instructional concepts prevalent in middle-class researchers' concepts of what teaching and learning involve (see Rogoff, 1994). It has been interpreted as embodying a particular form of instructional communication, however, it is not intended to portray a particular model (as I think the concept of scaffolding is). Rather than being a particular technique, guided participation is a perspective for examining people's opportunities to learn through diverse processes of participation in the valued activities of their various communities.

In later sections of this chapter, I focus on cultural and institutional aspects of collaboration, collaboration among people in different eras and locations, and asymmetries and disagreements as well as equal or harmonious agreement in collaboration, which are essential aspects of cognition as a collaborative process. These are aspects of collaboration that are not captured simply by attention to scaffolding of novices' roles by experts in sensitive face-to-face contexts, but they are essential aspects of collaboration from a socio-cultural perspective.

Techniques through Which Experts Structure Novices' Problem Solving: Scaffolding, Tutoring, and Socratic Dialogue

A variety of techniques for supporting or stimulating novices' learning in tutorial situations have been studied, led by work on scaffolding that examines the contingency between experts' assistance and novices' performance. Some techniques, unlike scaffolding, appear to focus exclusively on the expert's efforts in social interaction, unrelated to the children's contributions to the ongoing social interaction. For example, providing challenging questions that encourage children to distance themselves from the immediate task has been proposed to stimulate skill in representation (Sigel, 1982; Sigel & Cocking, 1977).

In an influential series of studies with preschool children constructing complex block pyramids, Wood and his colleagues found that middle-class adults tailored their support of children's efforts according to the children's skill and that such contingency may have helped children to advance their skills (Wood, Bruner, & Ross, 1976). When mothers helped their 3- to 4-year-olds, most of them

tailored their instruction to their children's needs, guiding at a level that was near the limits of the children's performance, taking into account the children's responses to the most recent instruction, and adjusting the specificity of instruction according to whether the child had been successful on that step (Wood & Middleton, 1975). Children performed best on a posttest of independent construction if their mothers had intervened in their region of sensitivity to instruction and had adjusted to their success; the *number* of interventions did not relate to the children's performance. Wood and Middleton suggested that the region of sensitivity to instruction ideally involves one extra operation or decision beyond the level at which the child is currently performing.

When a tutor followed the mothers' patterns in systematically accommodating her instruction to children's needs, the 3- to 4-year-old children's performance with the puzzle improved (Wood, Wood, & Middleton, 1978). Children who were taught contingently—with the tutor moving to less intervention after success and to more intervention after failure—were more capable of carrying out the task in the posttest than were children who were taught according to scripts that focused on either modeling the whole task, describing the task, or arbitrarily switching between these levels of intervention.

Other studies have also noted the role of contingency of scaffolding, finding that the middle-class European American mothers studied adjusted their help to the children's success or errors in the task, and that sometimes this related to children's later performance in the task. Mothers' attempts to teach 7-month-olds to reach around a barrier to grasp an object were tailored to the infants' motivation, attention, and success—they assisted when the infants looked back at the toy after having just looked away or when infants had been close to success but were becoming fretful, but not when the infants were reaching for the toy (Kaye, 1977). Mothers working with preschoolers in a counting task adjusted the level of their assistance to children's correctness, giving children more responsibility for managing the task when they made accurate counts and giving more specific directives when children counted inaccurately (Saxe, Gearhart, & Guberman, 1984). Mothers who assisted 4-year-olds in solving mazes often provided strategic assistance when children got stuck and refrained from directing or taking over when children were not having difficulty; such contingency correlated with the extent of advance planning later used by the children solving mazes without their mothers' assistance (Rogoff et al., 1995). Toddlers whose parents more frequently asked for

context information in the toddlers' narratives more often provided a listener with when-and-where information in their stand-alone narratives 18 months later (Peterson & McCabe, 1994).

Some studies of tutoring or cognitive apprenticeship (Brown, Collins, & Duguid, 1989; Hennessy, 1993) employ a more sophisticated analysis of what is effective for the tutee than simply providing contingent assistance at one step beyond the level at which the tutee is currently performing. A tutor may consider what kinds of errors are instructive (and therefore worth focusing on) and what kind need simply to be corrected to maintain focus on key ideas.

In a study of college-age computer novices learning basic programming concepts, Merrill, Reiser, Merrill, and Landes (1995) found that two U.S. university student tutors corrected almost all errors that had to do with arbitrary details, but if an error concerned a conceptual aspect of programming or problems with keeping track of the goals, the tutors pointed out the general location of the error to the student (and if relevant, reminded them of the current goal). They allowed the student to participate in recovery from the error—recognizing what was incorrect, inferring the nature of the error, setting a goal to repair it, and implementing a repair—with support from the tutor to keep the student from floundering. Merrill et al. suggested that the tutors' responses to errors involved comparing the relative benefits of the learning opportunity with its costs. When learners' involvement provided the possibility of important learning, the tutors allowed them to do as much of the error recovery as possible, but if involving the student in the repair would yield little learning, tutors simply told the student how to repair the error, thereby keeping the student on track of the larger issues and protecting the student from floundering in arbitrary details. Similar tailoring occurred in tutors' interventions in remedial algebra tutoring by U.S. high school teachers (McArthur, Stasz, & Zmuidzinas, 1990).

Socratic dialogue also involves complex prioritizing of instructional moves based on students' growing understanding. Socratic dialogue techniques include encouraging students to specify their working hypotheses and to evaluate them, suggesting systematically varying cases to develop a hypothesis and counterexamples to test students' conclusions, and trapping students in incorrect statements to reveal faulty reasoning (Collins & Stevens, 1982). When adult experimenters engaged children in challenging and exploratory discussion regarding the causes of a physical event, Spanish 5- to 8-year-olds showed greater reflectiveness regarding the causes of a

physical event than did children interacting with an experimenter who merely asked for description or explanations of what had happened (Lacasa & Villuendas, 1990).

Brown and Palincsar (1989) characterized Socratic dialogues as involving discussions guided by teachers' instructional priorities:

They tend to take up errors before omissions, easy misconceptions before fundamentally wrong thinking, prior steps in theory before later steps, important factors before less important ones, and so on. . . . There is also order in the teachers' method for selecting teaching examples and analogies—ones that exemplify important factors and cases are stressed and grouped together so that significant generalizations can be reached. Finally the teacher fields questions based on his or her model of the students' knowledge, skipping topics assumed to be known (too simple) or beyond their existing competence (too advanced), and concentrating on what students can assimilate now. Given the continual growth in knowledge, such models of student understanding must be constantly adjusted. (p. 412)

A number of approaches focus explicitly on the changing nature of experts' assistance as novices develop in their understanding of the activity at hand—the topic of the next section.

Adult Experts Adjusting Support of Novices' Development

As children gain skill in handling a process, they and their more expert partners in informal family interactions and in deliberate instruction can encourage or even demand them to take greater responsibility (Greenfield, 1984; Rogoff & Gardner, 1984). For example, middle-class U.S. mothers helping their children plan imaginary routes or sorting miniature objects differed in the nature of their assistance depending on the children's ages (Freund, 1990; Gauvain, 1992); Mayan mothers' assistance in weaving was much greater for girls who were relatively inexperienced in weaving than for those who had already completed several pieces of cloth (Greenfield, 1984); middle-class European American parents gave more explicit prompts for clarification of statements regarding the location of objects to 3-year-olds than to 4-year-old children (Plumert & Nichols-Whitehead, 1996); and one-on-one tutoring by New Zealand teachers in the Reading Recovery program involves beginning with familiar work, gradually introducing unfamiliar aspects of reading strategies, and passing increasing control of the

activity to the child (Clay & Cazden, 1990). (As mentioned later, novices can also resist a shift in responsibility.)

Researchers in prelinguistic development have noted that middle-class European American adults carry on conversations with infants in which the adult's role as conversational partner is adjusted to the baby's repertoire, with adults stepping up their expectations as the baby's skills increase:

Mothers work to maintain a conversation despite the inadequacies of their conversational partners. At first they accept burps, yawns, and coughs as well as laughs and coos—but not arm-waving or head movements—as the baby's turn. They fill in for the babies by asking and answering their own questions, and by phrasing questions so that a minimal response can be treated as a reply. Then by seven months the babies become considerably more active partners, and the mothers no longer accept all the baby's vocalizations, only vocalic or consonantal babbles. As the mother raises the ante, the child's development proceeds. (Cazden, 1979, p. 11)

In communicating with young children, middle-class caregivers often support verbal messages with enough redundant verbal and nonverbal information to ensure understanding. As their infants become able to comprehend verbal messages, these adults decrease the redundant information and explicitness of statements (Bellinger, 1979; Bernstein, 1981; Greenfield, 1984; Messer, 1980; Ochs, 1979; Schneiderman, 1983; Snow, 1977; Zukow, Reilly, & Greenfield, 1982).

Some caregivers also seem to adjust their labeling of objects to children's growing conceptual understanding. For example, mothers observed by Adams and Bullock (1986) labeled penguins "penguins" rather than "birds" until children had established the bird prototype, at which time they began remarking that "penguins are birds." At 38 months of age, children provided most of the basic level names (e.g., bird), and their labels conformed to adult usage, but naming of atypical exemplars (e.g., penguin) showed roughly equal contributions of adult and child.

In early picture-book reading, European American middle-class mothers have been observed to adjust their demands according to their child's development, and reported that their adjustments were deliberate (DeLoache, 1984). Mothers of 12-month-olds carried the whole conversation, primarily labeling the pictures. With 15-month-olds, they named the objects and asked children simply to confirm the label ("Is that an elephant?") or they answered their own "What's this?" questions. When children began labeling

objects, mothers skipped pictures with which they thought their children were unfamiliar. With older children, mothers began requesting information that was not directly visible in the picture ("What do bees make?")—if children did not reply, some mothers gave clues, apparently avoiding responding to their own question (though mothers of younger children routinely answered their own questions) but aiding children in getting the right answer.

European American middle-class mothers' assistance in a memory task also often involved support to prevent noticeable errors, such as redundant verbal and nonverbal information to ensure correct performance (Rogoff & Gardner, 1984). For example, a mother developing an idea for associating category labels with their locations increasingly involved her child in its development. The mother devised a story incorporating the first three out of six category boxes, explaining, "We'll remember those things go there . . . we'll make a little story," as she invented mnemonics involving a daily routine. The child contributed slightly to the story for the fourth category, and invented part of the story for the last two category boxes. The mother attempted to involve the child in developing the story by pausing and looking at the child at junctures and pointing to the next box without filling in that part of the story. The partners seemed to seek a level of responsibility in which the children could extend their role without making errors of a magnitude that would require notice.

The same sort of subtle evaluation of learner's readiness, with attendant support from an expert for taking the next step, was evidenced in tutoring university-level science and math students (Fox, 1988, 1993). Tutors made use of the timing of the students' participation in discourse to infer understanding of the points, providing pauses to allow students to take the responsibility for an idea by anticipating or completing the tutor's idea. Tutors made use of information regarding the number and length of each response opportunity that students passed up, taking into account whether the information being discussed was new, the effectiveness of the tutor's invitation to the student to respond, and what the student was doing during the passed-up opportunity (e.g., looking blank versus calculating). If students passed up two or three opportunities, tutors were likely to continue with an explanation, and if no evidence of understanding occurred during the explanation, the tutor was likely to repeat or reformulate it. Both partners showed a preference for having the student handle the problem before the tutor intervened, and for the tutor's intervention to

involve a collaborative redirection of the student's efforts. Tutors used collaborative completion of statements as a way to find out what the student understood, with a rising intonation to cue the student to complete the statement. If the student provided an inappropriate completion, the tutor could provide the correct answer simply by completing her own sentence without appearing to correct the student. A common form of tutorial assistance that avoided direct correction was to ask a "hint" question whose answer helps the student get unstuck if the student can determine how the answer is a resource.

Although classroom situations involving many students seldom allow this sensitivity of exchange, teachers may nonetheless attempt to discern students' level of understanding by the looks on their faces and their uptake of questions. Pettito (1983) observed a fourth-grade teacher structuring a long-division lesson into stages involving decreasing explicitness of formal steps, with adjustment according to the skills of individual students. Brown and Campione (1984) observed that in initial sessions of reading instruction, a teacher primarily modeled strategies for comprehension, but gradually the teacher's demands for student involvement increased as students began to perform parts of the task until finally the students independently produced strategic behavior that resembled that modeled by the teacher. The students improved in both reading comprehension and guidance skills as they took on the roles practiced with the teacher; they gradually served as experts to each other (Brown & Reeve, 1987). Reviewing studies successful in training reading comprehension, Pearson and Gallagher (1983) stressed the importance of careful release of responsibility for applying the skills from teacher to students.

The flexibility of support and shared understanding characteristic of tutoring has proven difficult to model with technological attempts to create teaching tools (Crook, 1994; McArthur et al., 1990). Fox argued that computer systems lack the necessary cognitive flexibility and multiple interpretations of ongoing interaction in context used by human tutors, which involve interpretation of the ongoing interaction in the context of the history of the preceding discourse (1988). Merrill et al. (1995) found that tutors instructing computer programming did not follow a path through a curriculum script or simply correct students and review curriculum material; instead, they carefully tracked student reasoning and modulated the timing and nature of their assistance depending on the type of difficulty encountered and the current problem-solving context.

Similarly, Schallert and Kleiman (1979) suggested that elementary students understand teachers better than they understand textbooks because teachers tailor their presentations to children's level of understanding and monitor students' comprehension to adjust messages. Schallert and Kleiman quoted Socrates from the dialogue *Phaedrus*: "Written words seem to talk to you as though they were intelligent, but if you ask them anything about what they say . . . they go on telling you the same thing forever."

In summary, the subtle and tacit skills of determining a learner's current understanding and designing a supportive situation for advancement have been observed in parent-infant interaction, both verbal and nonverbal, and in interaction in tutoring situations by adults working with children or other adults. In all these situations, mutual interactional cues—the timing of turns, nonverbal cues, and what each partner says or does not say—are central to the partners' achievement of a challenging and supportive structure for learning that adjusts to the partners' changes in understanding. Research on techniques of supporting novices' learning have moved far beyond examining the aid provided by expert partners independent of the contributions of learners, or simple contingencies between adult aid and learners' success in the task (with each partner's moves defined independently of the other). The next section considers the mutual role of adults and children, emphasizing the leadership of both children and adults in shared thinking. Later sections address the roles of adult expertise and of peer guidance.

The Mutual Roles of Children and Adults in Structuring Adult-Child Interaction

The research reviewed in the preceding sections indicated the importance of considering the mutual roles of expert and novice. In this section, I review work that emphasizes the mutual roles of adults and children in collaboration, and the leadership of both adults and children in initiating and managing their shared endeavors. (I am not implying that adults and children are always eager and conscientious in their relations; as I discuss in a later section, collaboration involves both discord and harmonious relations.)

Mutual involvement in routine shared activities provides children and adults with many learning opportunities. For example, Ferrier (1978) and Newson and Newson (1975) argued that language development occurs in routine participation in shared experience and efforts to communicate as caregivers and infants carry out the thousands of

diaperings, feedings, baths, and other recurring activities of daily life.

Around the world, children and their caregivers engage with each other in shared activities (Rogoff et al., 1993). At the same time, the particular norms for adult and child responsibility for organizing learning vary. In some communities, children have great responsibility to learn, with extensive opportunities for observation and engagement in community activities along with the support of caregivers; in other communities, adults take major responsibility for structuring lessons and motivating children to learn (Lamphe, 1977; Ochs, 1988; Ochs & Schieffelin, 1994; Rogoff, 1990; Rogoff et al., 1993; Schieffelin, 1991). In some communities where children are usually segregated from observing and participating in community events, their learning takes place in specialized adult-run settings such as lessons created by adults for children to learn adult-promoted skills (Morelli, Rogoff, & Angelillo, submitted; Rogoff, 1990; Scribner & Cole, 1973).

In the specialized adult-child collaboration of schools, the responsibilities of children and adults vary with the structure of the school. In U.S. schools, the structure often involves an adult attempting to control the behavior and stimuli in the classroom, with students simply supposed to receive the information presented to them (Cuban, 1984). The teacher does most of the talking and students are allowed to talk only when called upon to respond to a question or directive from the teacher, often following a format where the teacher tests a student with a question, the student responds briefly, and the teacher evaluates the correctness of the response (Mehan, 1979). In other school structures of growing interest in U.S. schools, teachers arrange for students to work with each other in structured collaborative learning sessions directed by the teacher (more about this in a later section). The organization occasionally involves adult leadership of a community of learners in which children and adults engage in multi-way collaboration with each other on topics of mutual interest, with adults learning as well as facilitating the students' learning (see Figure 14.1; Brown et al., 1993; Rogoff, 1994; Tharp & Gallimore, 1988; Wells, Chang, & Maher, 1990).

Throughout these cultural and institutional variations in relative responsibility of adults and children, it is nonetheless the case that both adults and children collaborate in the arrangements of children's time, resources, and companionship. The following subsections focus in turn on how adults make arrangements for and with children and how children themselves manage their activities with adults.

Adults' Arrangements for and with Children

Adults around the world frequently select activities they consider appropriate for children of a particular developmental status or interest level (Laboratory of Comparative Human Cognition, 1983; Valsiner, 1984). Whiting (1980) cogently pointed out the importance of parents and other adults in arranging children's learning environments:

The power of parents and other agents of socialization is in their assignment of children to specific settings. Whether it is caring for an infant sibling, working around the house in the company of adult females, working on the farm with adults and siblings, playing outside with neighborhood children, hunting with adult males, or attending school with age mates, the daily assignment of a child to one or another of these settings has important consequences on the development of habits of interpersonal behavior, consequences that may not be recognized by the socializers who make the assignments. (p. 111)

Adults' choices also include arrangements of children's material environment that may or may not be deliberately planned for children's instruction. For example, adults provide specialized objects to assist children in achieving developmental milestones, such as the varying forms of baby walkers used around the world to help infants practice walking—ranging from wheeled vehicles to bamboo railings to siblings assigned to "walk" the baby. Their arrangement of objects in the home make certain activities available or unavailable to children.

From early in infants' first year of life, caregivers and infants participate in exchanges that involve infants in the practices and systems of meaning of their families and communities. A compelling example was provided in observations of a musically inclined family in which the adults assisted a child in musical engagement in her first two years by providing constant musical interaction and instruction.

[By 24 months, the toddler's] singing was characterized by accurate pitch and rhythm, distinct diction, basically correct lyrics, vocal technique, and musical expression. These songs primarily developed from the mother reading and singing nursery rhymes and stories at bedtime using a "scaffolding" procedure mentioned by Ninio and Bruner (1976), where the child filled in words. On morning waking and at play, the child would sing or pretend-read songs to herself. The mother corrected songs and sang along on difficult passages. At times the father accompanied the songs at the piano. Of interest here is the development of vocal technique. On one occasion the

child was having difficulty with an octave interval jump. Noticing this problem while riding in the car, the grandmother told her she could sing that note if she "breathed in a great big breath with lots of air, opened her throat as if she yawned a great big yawn, and then sang the note." The child followed these instructions and the note was easily sung. (Kelley & Sutton-Smith, 1987, pp. 38–39)

Mothers from some communities regulate joint attention during the first year, often by following infants' direction of gaze, by touching or shaking an indicated object, or introducing it between themselves and the infant (Bruner, 1983; Kaye, 1982; Lempers, 1979; Schaffer, 1984; Schaffer, Hepburn, & Collis, 1983). They often provide verbal and nonverbal interpretation for babies' actions, their own actions, and events in the environment (Harding, 1982; Kruper & Uzgiris, 1985; Packer, 1983; Shotter, 1978; Shotter & Newson, 1982; Snow, 1984). For example, for babies learning to eat from a spoon, middle-class U.S. adults frequently provided cues regarding the appropriate action for the child—opening their own mouths wide at the time the baby was to do the same (Valsiner, 1984).

Studies of early language development include emphasis on adults' roles with mutuality in communication. For example, some infants in the one-word period build discussions with others through successive turns that layer comments on topics of joint attention, as in "Shoe" . . . "Is that your shoe?" . . . "On" . . . "Oh, shall I put on your shoe?" (Greenfield & Smith, 1976; Ochs, Schieffelin, & Platt, 1979; Scollon, 1976; Zukow et al., 1982). By filling in slots in social routines managed by their elders, such as saying hello or naming family members and in social games such as Peek-a-boo and All Gone, infants may learn the structure of such events as well as memorized phrases to apply in conversation (Snow, 1984). The dinnertime conversations of European American families provide routine and extensive opportunities to collaboratively build and test theories to account for everyday events, as family members narrate and contest the meaning of events and their telling (Ochs, Taylor, Rudolph, & Smith, 1992).

Language development occurs within a system in which the primary goal is achieving understanding between child and companions (Camaioni, de Castro Campos, & de Lemos, 1984; John-Steiner & Tatter, 1983; Tomasello, in press, 1992). In introducing labels, mothers have been observed to focus on immediate communicative concerns rather than on technical accuracy such as whether whales are fish (Adams & Bullock, 1986; Mervis, 1984), a practice

that may assist children in some communities in understanding category hierarchies and learning labels (Adams, 1987; Callanan, 1985, 1991). In working with young children on puzzles, mothers often began by ensuring that their children perceived the overall puzzle in the same way the mothers did (as a truck), by asking the children to identify the overall array and its pieces (Wertsch, 1979b). This establishment of a common ground enabled the mothers' later references to pieces by terms that both partners understood (e.g., "wheels," "headlights").

According to Ochs and Schieffelin (1994), in all societies, members attempt to "get their intentions across to children" (p. 76) and modify their language to do so. (However, in diverse communities, prevalence and situations in which adults modify their speech vary—in particular, the age at which children begin to be treated as conversational partners varies widely.)

Consistent with the perspective that language development occurs in the context of mutual and functional communication, research shows a relationship between the responsiveness of adult-child interaction and children's language development, largely in middle-class European American samples (Adamson, Bakeman, & Smith, 1990; Hoff-Ginsberg & Shatz, 1982; Masur, 1982; Nelson, Denninger, Bonvillian, Kaplan, & Baker, 1984; Olson, Bates, & Bayles, 1984; Tomasello & Farrar, 1986). Several studies have demonstrated that labels for objects were learned better if young children's attention was already focused on the objects of reference (Dunham, Dunham, & Curwin, 1993; Tomasello & Farrar, 1986; Valdez-Menchaca, 1987).

Thus, a great deal of research has focused on adult leadership in children's learning, while underlining the mutual involvement of children in the process. Another research line supporting this view focuses on the role of children's narration with adults for their memory development (McNamee, 1980; Nelson, 1995). For example, joint discussions between mothers and young children in a museum led to greater memory of the information discussed, no matter which member of the pair initially focused attention on that detail (Tessler, cited by Fivush, 1988); details that the children pointed out but did not become a focus of joint discussion were not remembered as well by the children. In the next subsection, the focus shifts to children's leadership in learning with the mutual involvement of adults in the process.

Children's Management of Activities with Adults

In many circumstances, children initiate their involvement with adults, who may support children's learning by fitting

their assistance into children's already occurring interests and efforts (Wood, 1986). Carew (1980) reported that 82% of middle-class European American toddlers' interactions in their natural activities at home were initiated by the toddlers.

Children are very active in choosing their own activities and companions, directing adults toward desirable and away from undesirable activities. Rheingold (1969) argued that even the youngest babies direct adults to fulfill their goals, socializing their caregivers, teaching them what the infants need to have them do through the power of the cry and the rewards of smiles and vocalization. "From his behavior they learn what he wants and what he will accept, what produces in him a state of well-being and good nature, and what will keep him from whining" (p. 786).

During the first year, infants have been observed to deliberately seek information and direct activities (Trevarthen & Hubley, 1978). During the first half of the first year, European American middle-class babies have been observed to maintain eye contact, smile, and cooperate with adults trying to get them to play as long as the adults meshed their agenda with the baby's interests and were sensitive to the baby's cues, and by the last half of the first year, they use adults instrumentally to reach their own goals (Bretherton, McNew, & Beeghly-Smith, 1981; Kaye, 1977; Mosier & Rogoff, 1994; Rogoff, Malkin, & Gilbride, 1984; Rogoff et al., 1992; Sugarman-Bell, 1978).

Infants in a number of communities look to the interpretation of companions to determine how to proceed in ambiguous circumstances (Feinman, 1982; Gunnar & Stone, 1984; Rogoff et al., 1993; Sorce, Emde, Campos, & Klinnert, 1985). Such social referencing is facilitated by infants' efforts during the first year to obtain information from the direction in which caregivers point and gaze (Bruner, 1983, 1987; Butterworth, 1987; Butterworth & Cochran, 1980; Churcher & Scaife, 1982; Scaife & Bruner, 1975; Tomasello, 1995). Young infants also seem to interpret intonation contours, timing, and emotional tone of adult commentary to understand the gist of messages (Fernald, 1988; Papousek, Papousek, & Bornstein, 1985).

A key debate regarding infants' responsibility for managing learning has involved the question of the origins of intersubjectivity (Rogoff, 1990; Schaffer, 1977). Some have suggested that adults act *as if* infants achieve communication (e.g., Kaye, 1982), arguing that adults lend meaning to infants' facial expressions, hand movements, and gaze patterns and insert social meaning into the autonomous patterning of infant behavior, assisting babies in adding meaning to their initially random or nonsocial

actions. Other scholars have argued that infants engage their social partners with mutual contingency and contribute to the structure formed by both partners, even in the first months of life (Beebe, Jaffe, Feldstein, Mays, & Alson, 1985; Brazelton, 1983; Luria, 1987; Murray & Trevarthen, 1985; Newson, 1977; Trevarthen, Hubley, & Sheeran, 1975; Tronick, 1982).

From a sociocultural perspective, the question is not when intersubjectivity is acquired, but rather how it transforms as children and their social partners change (see Rogoff, 1996). The form of intersubjectivity between infants and their caregivers differs from the kind of communication possible in early linguistic communication a few years later. Consistent with this view, Vygotsky (1987) argued that from the beginning of life, children are involved in social exchanges that guide cognitive development, but with an enormous transition occurring "when speech becomes intellectual and thinking verbal" (p. 111).

Facility with verbal and gestural means of communication allows for greater clarification of purpose by both children and adults, as can be seen in an interaction between an adult and a 14½-month-old European American middle-class baby as the adult tried to determine which toy the baby (restrained in a high chair) wanted to handle.

The adult began looking for a toy in the toy box. When he touched the tower of rings, the baby exclaimed, "Aa!" The adult asked, "Aa?," picking up the tower. The baby continued looking at the toy box, ignoring the tower, so the adult showed the baby the tower and again asked, "Aa?" The baby pointed at something in the toy box, grunting, "Aa . . . aa . . ." The adult reached toward the toy box again, and the baby exclaimed, "Tue!" The adult exclaimed "Aa!" as he picked up the peekaboo cloth and showed it to the baby. But the baby ignored the cloth and pointed again at something in the toy box, then impatiently waved his arm. The adult exclaimed, "Aa!" and picked up the box of blocks. Offering it to the baby, the adult asked, "Aa?" But the baby pointed down to the side of the toy box. The adult discarded the blocks in the indicated spot. Then they repeated the cycle with another toy. . . . When the adult picked up the jack-in-the-box, asking "This?" the baby opened his hand toward the toy, and they began to play. (Rogoff, Malkin, & Gilbride, 1984, pp. 42-43)

Shatz (1987) argued that young children are equipped with procedures for structuring and making use of language input—eliciting talk in relevant situations, and maintaining discourse and using overheard linguistic information even with only partial understanding. Of course, this process could not occur without social interaction, and

may be assisted by other people's efforts to simplify language and support children's growing understanding (Waxman & Gelman, 1986).

Young children often attend to adults' activities and how adults use objects. Rheingold (1982) found that toddlers spontaneously and energetically helped their parents or a stranger in the majority of the household chores that the adults performed in a laboratory or home setting (although many of these middle-class parents reported that they commonly circumvented their child's efforts to participate at home by trying to do chores while the child was napping). Several studies indicate that infant attentiveness, skill, and learning new uses for objects was enhanced by adult object demonstration, focusing of attention, and collaborative engagement with objects, with markedly similar actions performed on the objects by the children (Bornstein, 1988; Eckerman, Whatley, & McGhee, 1979; Hay, Murray, Cecire, & Nash, 1985; Henderson, 1984; Hodapp, Goldfield, & Boyatzis, 1984; Parrinello & Ruff, 1988; Rogoff, Malkin, & Gilbride, 1984).

Children are also active in recruiting adults' help as early as the second half of the second year (Heckhausen, 1984). In explicit teaching situations, older children may direct adults' assistance through seeking help (Nelson-Le Gall, 1985, 1992). At times, they lead in structuring a learning situation (Rogoff, 1990; Toma, 1992). In a classification task carried out by middle-class European American 9-year-olds and their mothers (Ellis & Rogoff, 1986; Rogoff & Gardner, 1984), a few children took over management of instruction, despite their mothers' assigned responsibility to prepare them for an upcoming test and the fact that only the mothers had access to a cue sheet indicating the correct placement of items. One 9-year-old took control when his mother indicated that she was totally confused and the items were in disarray. The child told her, politely but insistently, to look at the cue sheet, and led her through the process of checking the correct placement of items, picking up one item at a time and asking, "Is this one right? . . . Look at the sheet." The child elicited the information about correct placement from his mother to independently infer the category organization (Rogoff & Gardner, 1984).

Children, as well as adults, manage their shared endeavors in ways that involve them in shared thinking. Even very young children are expert beyond any of their companions in some aspects of their lives. Children and adults can be simultaneously regarded as providing leadership in some areas while continuing to learn (though often about different things). The next section examines the role of expertise

as an aspect of adult structuring of children's learning; subsequent sections focus on the roles of children in collaboration with each other.

The Role of Adult Expertise

Observations in infancy suggest that interactions with mothers are more sensitive and contingent than are interactions with other children.⁴ Working-class Mexican American toddlers were less likely to respond to and expand on each others' comments than their mothers' comments, and their mothers in turn were more responsive partners than were peers (Martinez, 1987). Similarly, middle-class European American mothers were more likely to support infants' conversational skills through responding contingently and constructing exchanges around the infants' actions than were preschool siblings, who were less contingent and less likely to involve the infants' interests (Vandell & Wilson, 1987).

The importance of the roles of expertise and status of partners have been addressed in several studies by comparing the processes of interaction and the later performance of children who work on a task with adults versus with peers. The adults have been used to represent skilled partners and the peers as less skilled partners, in tasks such as remembering and planning in laboratory situations. In these situations, which are also designed and managed by adults (the researchers), adult partners seem to provide children with advantages in learning, compared with peer partners. Thus, adults seem to have a special role in guiding children's learning in the constrained cognitive tasks of the laboratory.

⁴Less sensitive partners, however, offer other opportunities for learning. For example, with fathers who are less involved with their young children, the limited shared understanding may stimulate children to stretch to explain themselves and to understand their partner (Barton & Tomasello, 1994; Mandle & Tomasello, 1989). Familiar partners may give children the experience of complex sharing of ideas with people who do not require much background in order to proceed with a new thought, and seem to be more likely to engage in productive discussions of differences of perspective that foster learning (Azmitia, 1996; Azmitia & Hesser, 1993; Azmitia & Montgomery, 1993). However, less familiar or less sensitive partners may provide the challenge to develop new ways of expressing notions that could otherwise be taken for granted in interactions with a very familiar and skilled partner.

In learning a classification system to organize sets of common objects, 6-year-old European American middle-class children performed better after having the assistance of their mothers than of 8-year-old acquaintances (Ellis & Rogoff, 1982, 1986). The mothers almost always explained the tasks before beginning to place items, referred to the need to categorize, and provided category rationales for the groups of items; less than half of the child teachers did so. Most of the mothers prepared their learners for the memory test through rehearsal and mnemonics for the classification system, whereas very few of the child teachers provided explicit preparation for the test beyond admonishing their partners to study. The children whose mothers provided guidance and who participated in working out the organization of items and in preparing for the test remembered the items and the conceptual organization better in a posttest (Rogoff & Gauvain, 1986).

The child teachers often appeared not to consider their partners' need to learn in this task; they appeared to focus on the immediate task of sorting items (Ellis & Rogoff, 1986). The peer dyads did not evidence the shared decision making observed with the mother-child dyads—more than half of them did not include the learners in the task, placing the items themselves without explanation and often without even looking to see if the learners were watching; others required the learners to perform the task with minimal guidance, having them guess the location of items without explanation. (On occasion, it appeared that this was the child teachers' idea of the role of a teacher, as they used school-teacher intonations to praise the learners' correct guesses.) Similar contrasts between the teaching interactions of adults and children teaching younger children have been found by McLane (1987), Foot, Shute, Morgan, and Barron (1990), and Koester and Bueche (1980). The child teachers seemed to focus on accomplishing the concrete task rather than ensuring that their partners understood the rationale, and they usually did too much (taking over the performance of the task) or too little (insisting that their young partners "figure it out" without giving them guidance in doing so).

In two studies of 10-year-old children's planning of imaginary errands, similar contrasts were observed between children's collaboration with adults and with peers, even when peers were trained in the task. Compared with adult-child dyads, peer dyads planned less efficient routes, with destinations scattered around and decisions involving one item at a time rather than coordinating several destinations into one efficient route (Radziszewska & Rogoff,

1988, 1991). In addition, peers were less likely to explain their strategies or talk-aloud their decisions than were adults, and they were less likely to share in joint decision making in skilled planning. During collaboration with adults, children usually participated in managing the sophisticated strategies organized by the adults.

There has been little research examining the roles of peers in activities in which children may be equally or more expert than adults. However, there are a few indications that such situations warrant study. For example, U.S. suburban third and sixth graders were more accurate than adults (most of whom were experienced teachers) in interpreting filmed children's understanding and nonunderstanding of a lesson on the basis of slight nonverbal cues (Allen & Feldman, 1976). In collaborative learning of computer games in which all participants were novices (but 9-year-olds were more comfortable than adults), peer and adult-child dyads did not differ substantially in collaborative processes (Tudge, Fordham, Lawrence, & Rogoff, 1995).

Even in the tasks in which interaction with adults appeared to foster children's learning more than interaction with peers, peer involvement may nonetheless have also been helpful to the children. (The studies did not provide comparisons of children working without a partner at all.) In other activities, peers play many roles that adults do not, and adult and peer partners appear to complement each others' roles in shared endeavors—which often involve both adult and peer partners, not one to the exclusion of the other. The next section considers the roles of peers assisting each other in learning; it and subsequent sections also consider the integrated involvement of adult and child collaborators in varying roles.

PEERS ASSISTING EACH OTHER IN LEARNING

Children's engagement with their peers and with adults can be regarded as involving complementary, multifaceted roles in shared sociocultural activity, rather than considering peers and adults as contrasting influences. Research on how peers may assist each other in learning focuses on how children contribute to each other's learning in peer play and in child caregiving activities, the role of peers' similar status in collaborative argumentation, and how peers facilitate each other's learning in classrooms.

I use the term *peer* broadly to refer to companions of roughly equal status, to include sibling and neighbor groups

of generally similar age and status, not just the unrelated same-age classmates that have been a primary focus of peer research. The roles of unrelated and related similar-age children vary extensively around the world, requiring greater research than is presently available to systematically distinguish the contributions of siblings and unrelated peers to children's cognitive development.

Children Learning with Each Other in Peer Play and Child Caregiving

In some communities, play is considered as children's domain (Rogoff et al., 1993), but even in middle-class communities where adults often act as playmates with young children, adults are likely to take differing roles than child companions in play. Dunn and Dale (1984) found that the play of 2-year-olds with their older siblings commonly involved close meshing of the partners' actions in complementary pretend roles, whereas mothers generally observed and supported the play without entering it by performing pretend roles or actions.

Vygotsky suggested that play "creates its own zone of proximal development of the child. In play a child is always above his average age, above his daily behavior; in play it is as though he were a head taller than himself." (1967, p. 552; see also Göncü, 1987; Nicolopoulou, 1993). Vygotsky regarded play as the "leading activity" (the central goal) of development during early childhood. In play, children experiment with the meanings and rules of serious life, but place these meanings and rules in the center of attention—for example, two sisters focus on the rules of sisterhood as they "play sisters." In such play, children free themselves from the situational constraints of everyday time and space and the ordinary meaning of objects or actions, to develop greater control of actions and rules and understanding.

Role play and dramatic play among peers may be arenas for children to work out the "scripts" of everyday life—adult skills and roles, values and beliefs (see Figure 14.3; Hartup, 1977; Hollos, 1980). In addition, the freedom to play with the rules of activities and to creatively recast goals from moment to moment may be unique and valuable in peer interaction (John-Steiner, 1985; Sylva, Bruner, & Genova, 1976). In addition to learning about the given structure of social life, middle-class European American children in their play adapt and restructure the social order (Packer, 1994). Forbes, Katz, and Paul (1986) stated that "through active manipulation of representations in the



Figure 14.3 These Mayan children engage in pretend play, preparing and serving a meal of leaf tortillas and dirt meat. The older children, at other times, help their mothers with actual meal production (note the skilled slapping of 'tortillas' by the girl on the right). Child caregiving that is occurring simultaneously in the play provides younger children with the opportunity to observe and to participate in the enactment (with modifications) of a mature activity of their community. (© Barbara Rogoff)

course of original fantasy creation, the child comes to know the nature of the socially accepted world in a much fuller way than might be possible if play were to consist of simply recreations or recapitulations of observed social phenomena" (p. 262).

Play appears to be important in the development of novel, adaptive behavior as well as in the socialization and practice of established skills (Lancy, 1980; Vandenberg, 1980). For example, a study with third-graders of a variety of ethnic backgrounds noted that children benefitted most from collaborative writing who balanced their planning and revising activities with playful approaches to language, academic concepts, reality, and each other (Daiute & Dalton, 1993).

Children's collaborative play also often requires efforts to take the perspectives of others and to clarify communication as play partners negotiate scripts and rules of play (Bretherton, 1984; Corsaro & Rizzo, 1988; Göncü, 1987). Children may force each other to work to be understood and to understand (Barton & Tomasello, 1994; Cicirelli, 1976; French, 1987; Garvey, 1986; Rogoff, 1990). Coordination between young children in pretend play involves collaboration and clarification of meaning in ways that build beyond each person's contribution (Verba, 1993). An example of the coordination of ideas in very young children's play was given by Verba (1994), who observed two French

toddlers aged 1 year 4 months and 1 year 2 months as they developed a common play idea:

As the children sat next to each other on the floor, Child A tapped two beads against each other and repeated the action several times. Child B manipulated a rubber band while glancing at A's action. A took two cubes and tapped several times. B looked at A and stopped manipulating the rubber band, then took a bead, explored, and glanced at A. A looked at B, and took an identical bead and gave it to B. B took the bead and tapped the two beads twice.

Peers' efforts to achieve shared understanding and action involve cognitive stretches that contribute to their development, as Gearhart (1979) observed with 3-year-olds who were planning episodes of playing store and learned that their partner had a separate plan for playing and that coordination of plans is necessary for play to run smoothly. The children developed more explicit and sophisticated plans over the course of repeated play episodes, addressing directly the shortcomings in their plan and its communication that had impeded joint action in earlier episodes. Similarly, Baker-Sennett, Matusov, and Rogoff (1992) noted that a group of middle-class European American children's planning of a classroom play required flexibility in coordinating their often discrepant ideas, which resulted in ideas that were more than the sum of the individual contributions.

In many communities children play a more central role with each other than in the European American middle class, serving from the age of 4 or 5 as caregivers of younger siblings and working and playing in mixed age groups responsible for their own functioning (see Figure 14.3; Rogoff, Sellers, Pirrotta, Fox, & White, 1975; Watson-Gegeo & Gegeo, 1989; Weisner & Gallimore, 1977; Whiting & Edwards, 1988; Whiting & Whiting, 1975). Under such circumstances, children have opportunities to develop skills in guiding other children which are less available to children with little responsibility for other children and more limited contact with children of ages different from their own. For example, Heath (1983) noted that the play-songs invented by working-class Black girls are tailored to language teaching for young children, with nonsense wordplay, number counting, and naming body parts—topics handled in middle-class adult-child interaction through nursery rhymes and routines.

In West Africa, peer and sibling caregiving usually involves multi-age teams of children ranging from about 20 months to 6 or 7 years of age, under the guidance and mentorship of one or two older siblings aged 8 to 10 years

(Nsamenang, 1992). In these teams, children learn collective roles, responsibility, and peer mentoring, and how to handle conflicts and compromises. Previously, such teams were used as a training ground for leadership roles and (when members became old) as part of the government and law enforcement system.

Once Marquesan (Polynesian) babies can walk, they enter the care of 3- to 4-year-old siblings (Martini & Kirkpatrick, 1992). According to mothers, toddlers want to be with and be like their older siblings, so they learn to run, feed and dress themselves, and help with household chores by imitating preschool children. The preschoolers (who enjoy the company of the toddlers and the mature status among peers that comes from being a caregiver) teach the toddlers that they can stay with the children's group only if they keep themselves safe and stay out of the way of the group activity. The toddlers learn to be self-reliant and nondisruptive, and play on the edge of the group and watch the group intently until they can keep up with the play. Martini (1994) observed 13 members of a stable play group of 2- to 5-year-olds daily for 4 months as they played several hours a day without supervision while older siblings attended school. The children organized activities, settled disputes, avoided dangers such as strong surf and dangerous objects that were often left around, and dealt with injuries without adult intervention. Tasks are also often assigned to the children as a unit, leaving them to decide who does what, with all held responsible for task completion.

Thus peers may fill important roles seldom taken by adults. Peer interaction may foster exploration without immediate goals, which in the long run may lead to insightful solutions to unforeseen problems. Peers may also provide each other with engagement in building their own social structure and opportunities to learn to take others' perspectives. For children with extensive opportunities to fill responsible roles with other children, there seem to be rich opportunities to learn how to take the perspective of others and to collaborate in groups, skills that have become of widespread interest in schooling and in research on peers' collaborative argumentation.

Peers' Similar Status in Collaborative Argumentation

Peer interaction has been suggested as offering children the opportunity to explore ideas in a more equal relationship than is possible with adults. Piaget (1926, 1977) argued that similarity of status is essential for social interaction that

supports a change of perspective. He also stated that interaction with an adult is essentially unequal due to the adult's power, which disrupts the condition of reciprocity for achieving equilibrium in thinking through discussion and cooperation. According to Piaget (1977/1928), the effect of lessons from adults is for young children to abandon their own ideas for those presented, since their ideas are poorly formulated and exist only as an "orientation of the spirit" that cannot compete with the views of adults, so children agree without examining the idea.

In this section, I examine the importance of shared thinking in problem solving among peers, as well as suggestions that differences in expertise or perspective are important for learning among peers. I conclude the section with a discussion of whether adults are necessarily in positions of authority and peers are necessarily in positions of equal status, and argue that the roles of peers and adults (or equal and different status and expertise) can be seen as complementary resources in cognitive development through collaboration.

The importance of intersubjective reasoning and problem solving has been increasingly noted by scholars studying peer interaction (Berkowitz & Gibbs, 1985; Forman & Cazden, 1985; Mercer, 1995; Mugny, Perret-Clermont & Doise, 1981; Rubtsov & Guzman, 1984-1985). Miller (1987) claimed that a collective process in children's argumentation with adults and peers functions as a basic developmental mechanism where the coordination of arguments leads participants toward a set of collectively valid statements. He gave the example of one 5-year-old centering on weight as the principle for explaining what will balance on a scale, and another focusing on distance from the fulcrum. When contradictions are detected, the participants seek a change in their understanding to resolve the contradiction:

Even if these children do not yet have any idea of what these changes will eventually look like, i.e., even if the structurally higher level knowledge remains undefined (transcendent) relative to their already attained knowledge, they nevertheless know where it has to be found. It must be a structural solution of the contradiction between their mutually exclusive points of view—a contradiction they have created themselves and which now begins to determine their ascension to a higher level of knowledge. (p. 237)

Several studies report that decision making that occurs jointly with a balanced exploration of differences of perspective among peers is most likely to contribute to children's progress in understanding (Glachan & Light, 1982; Kobayashi, 1994; Kruger, 1993; Light, Foot, Colbourn, &

McClelland, 1987). Peers who engaged with each other's ideas were more likely to gain in skill and understanding of a logical game and math and science tasks than peers who did not discuss the ideas or whose discussions focused on their roles or behavior (Damon & Phelps, 1987; Light & Glachan, 1985). Middle-class European American preschool children who worked together on an imaginary errand planning task performed better in subsequent solo planning than children who worked alone only if they shared in decision making (Gauvain & Rogoff, 1989). British 11-year-olds who worked in pairs on a computer errand planning game with discussion of planning, co-construction of knowledge, and negotiation performed better on the task by themselves later than did children who less often engaged in such discussion (Light, Littleton, Messer, & Joiner, 1994).

Collective accomplishment of 11- to 13-year-olds judging whether pictures were by the same artist was usually substantially higher than the best individual performance of either partner, with solutions not originally proposed by either of the partners (Bos, 1937).

Both came to a new way of thinking, arrived at fresh viewpoints, so that in this case it would be impossible to establish the individual share of each partner. The same things happen in cases where, in lively exchange of thoughts, adults discuss a problem. Through the interpretation of the other, which is rejected by us, we arrive at ideas, which in their turn are taken over, eventually are further elaborated, and thereby lead to a result. Whom shall we give credit for the solution? It was fortunate, that our young candidates did not bother about the authorship and after intensive collaboration, simply declared, that they had worked out the problems *together*. (pp. 363-364)

The children who managed such cooperative activity (half of the dyads) achieved 76% of the maximum score possible. The others who took one another's opinions into account only in rejecting them, without discussion or justification, achieved 56% of the maximum, and those who worked individually in alternating participation in the execution of the task, *being* together but not *working* together, reached only 42%.

Piaget's idea that children may be freer to examine the logic of arguments when interacting with peers than with adults is supported by several studies of moral reasoning. Middle-class children of 7 and 11 years expressed logical arguments more with their peers than with their mothers (Kruger & Tomasello, 1986). Although mothers requested idea clarification more than did peers, children produced

more self-generated clarifications of logic and were more likely to make comments operating on their partner's logic when interacting with peers. Kruger (1992) found that 8-year-olds who had discussed moral dilemmas with peers progressed more in their moral reasoning than did children who had discussed the dilemmas with their mothers. The more interactive logical discussion of partners' ideas that characterized peer discussions were positively correlated with progress in moral reasoning.

However, several studies investigating Piagetian physical and mathematical concepts have not found the same pattern. With conservation tasks, lower-to-middle-class European American children made more progress working with adults than with nonconserving peers (and working with conserving peers yielded intermediate results); interactions with adults involved a slightly greater extent of partners discussing each others' ideas (Radziszewska, 1993). Heber (1981) found improvement in seriation skills in a condition in which an adult engaged each child in dialogue about the child's seriation decisions, especially when the dialogue encouraged the child to specify the rationale for decisions (to an "ignorant" puppet) or guided the child in discussing relations of "more" and "less." In contrast, there was no improvement for children who received a didactic explanation of the rationale, worked with peers of equal skill, or worked independently, compared with children who received no opportunity to work on the problem. It appears that both expertise and shared thinking may be important for learning from social interaction.

In Piagetian theory, differences in children's views of appropriate ways to solve a problem is presumed to induce "cognitive conflict" among the partners which impels them to seek equilibrium at a higher level (Bearison, 1991; Sigel & Cocking, 1977). Cognitive conflict in conservation tasks is often operationalized by pairing children with a partner with greater or different expertise; progress in conservation seems often to relate to the partner's expertise (Azmitia & Perlmutter, 1989; Ellis, Klahr, & Siegler, 1993; Lacasa & Villuendas, 1990). Several authors suggest that children are most likely to advance in their thinking when faced with a perspective that fits reality better than their own, especially if it involves problem solving at a level *just* beyond that of the child (see Azmitia, 1988; Kuhn, 1972; Mugny & Doise, 1978; Tudge, 1992; Tudge & Rogoff, 1989).

In a meta-analysis involving studies with children of varying racial and economic status, Johnson and Johnson (1987) reported that peer cooperation tended to promote transitions to higher levels of reasoning in about half of the

studies, to show no difference in half, and not to favor individual arrangements in any studies. Nonconservers often learned how to conserve when engaged cooperatively with conservers, and when group members expressed differences of opinion, thinking was enhanced—findings consistent with the idea that cognitive conflict involves differences of expertise as well as with the idea that shared engagement with ideas matters.

There are substantial inconsistencies in the results of research pairing children with partners similar or different in conservation. Although working with a partner who is slightly more skilled may be most effective, working with a partner equal in skill, or even one less advanced, has sometimes yielded progress (Forman & Kraker, 1985; Glachan & Light, 1982; Howe, Tolmie, & Rodgers, 1990; Light & Glachan, 1985; Light et al., 1994; Rubtsov, 1981; Rubtsov & Guzman, 1984–85). Occasionally, however, there is no such progress, as when partners are equal in understanding of seriation problems (Heber, 1981), or there may even be “regression,” as when children interact with less advanced partners on balance beam problems (Tudge, 1992) or simply trade strategies in classifying objects (Fonzi & Smorti, 1994). In scientific reasoning on a problem that often evokes misconceptions among adults, transactive discussions among middle-class Israeli youth led some to progress in their thinking, but others to regress in a way that could be considered compatible with adult views in their community; similar transactions on a Piagetian task not subject to misconceptions among adults yielded progress in the participants’ understanding (Levin & Druyan, 1993). Thus, the role of cognitive conflict and transactive discussion may well fit together with the role of expertise, with understanding moving toward group or community consensus rather than necessarily toward an outside definition of correctness.

The literature on peer argumentation is not yet coherent enough to allow conclusions about what aspects of peer engagement are most important. However, the occurrence of actual engagement of partners with each other’s thinking seems to be crucial, and this may at least sometimes be facilitated by differences of perspective or expertise.

Some of the differences that have been observed in peer learning under varying circumstances may be explained by Damon’s (1984) conjecture that interaction with more expert partners (e.g., in peer tutoring) may be especially helpful when children are learning information or skills that do not require conceptual change, whereas the free exchange of ideas and feedback among equals may be ideal for wrestling with difficult new principles to stretch the

boundaries of understanding. Damon’s suggestion is especially useful in its focus on differences and similarities of status among children. To finish this section, I suggest that adults are not necessarily in positions of authority and peers not necessarily in positions of equality, and I argue for the importance of considering the patterns of interaction that involve peers and adults as joint contributors to children’s learning.

Questioning the Notions That Adult = Authority and Peer = Equal Status

In many accounts, it is assumed that adults are more likely to play an authority role with children, and peers are more likely to play an equal status role that allows true collaboration. Although Piaget argued that children’s interaction with adults does not promote their cognitive development, his focus was on the use of adult authority. He allowed for the possibility that adults may be able to interact with children in a cooperative fashion that permits the sort of reciprocity required for children to advance to a new level of equilibrium: “It is despite adult authority, and not because of it, that the child learns. And also it is to the extent that the intelligent teacher has known to efface him or herself, to become an equal and not a superior, to discuss and to examine, rather than to agree and constrain morally, that the traditional school has been able to render service” (Piaget, 1977/1928, p. 231).

Adult-child interaction does not necessarily involve invoking authority (Radziszewska, 1993). Changes in the use of adult authority have occurred across the decades of the twentieth century in many nations, including Piaget’s Switzerland. Toma (1992) provided an example of historically changing adult-child roles in examining a case in which a Japanese boy challenged his father’s perspective on a problem and advised his father on how he could have handled the problem better; such discourse would have been improbable in pre-World War II Japan, but was not surprising in Japan of the early 1990s. Further study of cultural changes and differences in conceptions of adult-child relations (in families and schools) would enhance understanding of the roles of expertise and status as adults direct or assist children in learning.

There are also important issues of what being peers involves—a question that is often focused on age similarity, but even this definition is problematic. One study noted advantages from working with an agemate but not from working with a slightly older child, indicating that being close in age does not necessarily lead to balanced involvement in problem solving. In planning routes, middle-class

U.S. 5-year-olds were more involved in decision-making and strategy formulation with 5-year-old expert partners than with 7-year-old expert partners; over time, their involvement increased with the same-age partners, but decreased with the slightly older partners (Duran & Gauvain, 1993). Later solo performance was better for the children who had worked with a same-age expert than for children who had had no partner but not for those who had worked with slightly older experts.

Even with people who are of the same age, equality of status may be rare, due to other differences such as their varying social status in the group, differing expertise, or differing interest in controlling the activity (Verba & Winnykamen, 1992). Observations of U.S. elementary school students' collaboration at computers noted wide spontaneous variations in how the pairs worked—in some, one member tutored a less-skilled partner; in others the partners explicitly divided jobs such as the “thinkist” and the “typist” (Hawkins, 1987, p. 11); others worked simultaneously together at a detailed level of action; a few employed more extended joint work with partners proposing and critiquing each other's ideas. With college student peers, Gillam, Callaway, and Wikoff (1994) noted struggles with issues of authority among peers when one was designated as a writing tutor—with tutors pondering whether their relationship was one of equals or of authority based on expertise and on institutional role-designation. The quandary was especially complicated when the writing tutor was younger than the student to receive their assistance.

Research on peer relations thus indicates the importance of considering not only the age of the partners but their roles in the social group, their personal relationships, and their relative expertise. The previous section also pointed to cultural differences in children's opportunities to learn how to collaborate with siblings and other peers through their involvement with each other in responsible family and play roles. A later section focuses on how children learn how to collaborate and the roles of adults and of the structure of institutions (such as schooling) in which children habitually interact, in children's patterns of collaboration with each other.

Adults and Peers: Joint Contributors to Children's Learning in the Activities of Their Community

There are other possibilities of relationship in addition to adults-as-authority figures and children-as-equal-partners. A variety of educational prescriptions urge teachers to depart from their traditional authority roles to engage more in

dialogue with students (Sutter & Grensjo, 1988; Tharp & Gallimore, 1988). In classrooms in which teachers exert control through commands and questions, children respond tersely, whereas when teachers substitute noncontrolling talk (such as commentary on their own ideas and demonstration of their own uncertainty) and increase the amount of time allowed for children to respond, children are more active and equal participants (Subbotskii, 1987; Wood, 1986).

The literature on adult-child relations (in both parenting and classroom teaching) often casts two models in opposition, one with adults as authorities transmitting information to children and controlling children's behavior (“adult-run”) and the other with children “free” from adult authority (“children-run”; Rogoff, 1994). These are often regarded as opposite extremes of a pendulum swing in discussions among researchers focusing on freedom and control in classrooms and families as well as on issues of restructuring schools and evaluating child-centered versus didactic approaches (see Eccles et al., 1991; Giaconia & Hedges, 1982; Greene, 1986; Stipek, in press). However, both adult-run and children-run models are alike in relegating control and activity to one side of adult versus child relations. The controversy over whether learning is best structured with adults (or experts) in charge or with the learner or equal peers in charge simply switches which side of an assumed dichotomy is active and in control.

A distinct model is that adults and children are not necessarily on different sides; they can collaborate with varying roles and responsibilities of different members of the group (Dewey, 1938; Engeström, 1993; Kohn, 1993; Rogoff, 1994). This view is reflected in discussions of community of learners models of classroom and family relations, based on theoretical notions of learning as a process of transformation of participation in which people engage with each other in shared activities, in varying leadership and responsibility roles (Bartlett, Goodman Turkakis, & Rogoff, in press; Brown & Campione, 1990; Newman, Griffin, & Cole, 1989; Rogoff, 1994; Tharp & Gallimore, 1988; Wells, Chang, & Maher, 1990). It is also reflected in the Japanese Hypothesis-Experiment-Instruction method of science education, which is based on the idea that conceptual change occurs through discussion of ideas among peers, with “scaffolding” of the peers' discussion by a teacher who defines the target issue, reviews possible alternatives, encourages participants to use informal knowledge, and proposes ways to get further information (Kobayashi, 1994).

In a community of learners model, adults and children make varying contributions to each others' learning, with all active and involved (see Figure 14.4). This often fits with the model of apprenticeship learning in trades, where learning involves a system of relations of an apprentice and other apprentices as well as a master, rather than the tutorial expert-novice dyadic relation to which the apprenticeship metaphor seems often to be assimilated. It is also consistent with the kind of social interaction that has been observed to foster discoveries in microbiology laboratories, in which differences of perspective and expertise among professors, postdoctoral fellows, and graduate students provide productive grounds for reconceptualizing problems and promoting conceptual change by all members of the research team (Dunbar, 1995).

The community of learners model of instruction fits well with the theoretical perspective that learning is a process of transformation of participation in community activities, where individual learning is seen as a function of individuals' active, ongoing involvement in sociocultural activities rather than the passive result of transmission from others or the active but solo (or at most peer-based) result of acquisition of outside information (Rogoff, 1994; Rogoff, Matusov, & White, 1996). In both the community of learners instructional model and the transformation of participation theory, the dichotomy that is often drawn between adult and peer contributions to children's learning is superseded. Both the instructional model and the theory

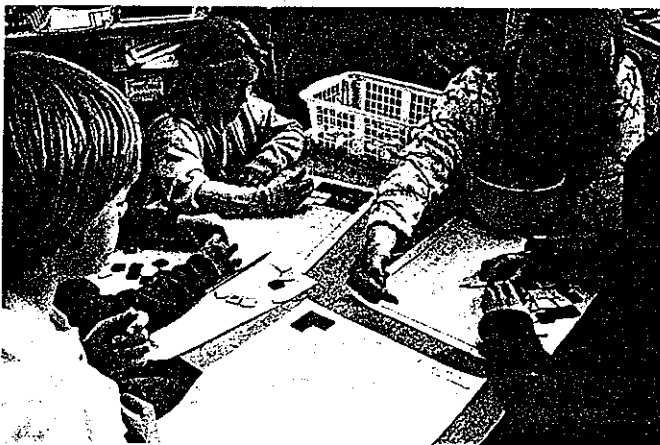


Figure 14.4 This activity illustrates the involvement of children in both symmetrical and asymmetrical collaboration, as they engage with each other and with an adult in a multiplication lesson laying out tiles to represent the numerical concept. (© Barbara Rogoff)

emphasize that children's participation in sociocultural activities is complexly and multidimensionally structured, with important contributions from individuals, their social partners of varying status and expertise, and the structure of the cultural/historical activities in which they participate and which they contribute to shaping further.

Peers Facilitating Each Other's Learning in the Classroom

Although much of U.S. schooling occurs according to a model that places the responsibility for teaching exclusively on adult teachers, increasing efforts make use of peers as tutors or as collaborators in each others' learning in the classroom (see Figures 14.1 and 14.4). Both peer tutoring and peer collaboration appear to be effective learning formats for the students who are regarded as needing the greatest help as well as for those who serve as tutors or are very well prepared academically (Allen, 1976; Allen & Feldman, 1973; Bruffee, 1993; Daiute & Dalton, 1993; Palincsar, Brown, & Martin, 1987; Phelps & Damon, 1989).

This section first examines the role of cooperative learning in the development of children's academic skills, a topic that has received a great deal of investigation. Then it turns to issues of how children learn to collaborate, as collaboration itself involves complex problem solving. Finally, this section addresses the role of adult collaboration in children's cooperative learning, a topic that has often been overlooked when the role of peers is examined. This section also emphasizes the role of the institution of schooling in children's opportunities to collaborate and the form of their collaboration.

The Value of Cooperative Learning for the Development of Academic Skills

Numerous studies support the idea that cooperative learning enhances individual academic achievement (Brandt, 1991; Slavin, 1990). For example, cooperative organization of classrooms was associated with greater learning in Israeli and German classrooms, compared with traditional classroom instruction where an adult addresses the class as a whole and children do not work together (Huber & Eppler, 1990; Lazarowitz & Karsenty, 1990; Sharan & Shaulov, 1990). U.S. college students and third graders of a variety of ethnic backgrounds wrote and studied essays and stories more effectively when working in pairs than alone, and this cooperative advantage carried over to individual

writing and comprehension tasks (Daiute & Dalton, 1993; O'Donnell & Dansereau, 1992; O'Donnell et al., 1985).

A meta-analysis carried out by Johnson and Johnson (1987) on 378 studies compared the achievement of people working individually versus in cooperative groups or in competitive arrangements. More than half of the studies favored cooperation; less than 10% favored individualistic efforts. These results were similar regardless of the age of participants (ranging from elementary school through college), the duration of the study (from 1 to more than 30 sessions), whether the studies employed research laboratories or field settings, or involved published or unpublished studies.

Participating in cooperative groups often facilitates (and does not hurt) the achievement of individuals who are already proficient, and clearly benefits the achievement of individuals who are achieving at medium or low levels before the study (Johnson & Johnson, 1989). Other studies comparing cooperative and individual arrangements for "high ability" elementary age European American middle-class students have found that cooperative arrangements promoted greater learning and high-level reasoning (Hooper et al., 1993; Johnson, Johnson, & Taylor, 1993).

Almost all the studies analyzed by Johnson and Johnson (1989) were conducted in North America; no differences were found according to the socioeconomic class or ethnic background of participants. Sharan (1990) reviewed studies employing different ethnic and socioeconomic groups and similarly found cooperative learning arrangements to be beneficial to all groups. Some authors suggest that cooperative learning structures are especially appropriate for Latino, African American, Native American, and Native Hawaiian students, and for other groups whose community values are more in line with cooperative than individualistic arrangements (Duran, 1994; Haynes & Gebreyseus, 1992; Little Soldier, 1989; Manning & Lucking, 1993; Tharp & Gallimore, 1988).

In addition to the goals of academic and cognitive development, cooperative learning in the classroom often has other goals that are extremely important, but beyond the scope of this chapter: promoting children's learning how to get along with others, intergroup relations among varying ethnic groups or children with differing skills, and respect and responsibility in social relations.

A limitation of much of this research is how it usually evaluates learning, which (with important exceptions) seems to involve no change from traditional school practices treating knowledge as an individual possession (Packer, 1993). Collaboration between peers is generally handled as

a "treatment" intended to produce an "outcome" that is conceived as individual "in-the-head" learning. Some inspiring but rare exceptions consider alternatives to the traditional definition of learning, sometimes approaching learning as a change in peoples' ways of participating in sociocultural activities (including literate and numerate activities that are basic to schooling).

There have been some efforts to delineate what aspects of cooperative learning are involved in successful arrangements for children to learn from each other in groups in the classroom. In the next subsections, I examine motivating structures of group activities, the importance of intersubjectivity, and the group's engagement with "big" ideas. Then later sections address the related questions of how children learn how to collaborate and assist each other in learning and the roles of adults and institutions in children's collaboration.

Motivational Processes in Cooperative Learning.

Motivation to engage in learning activities is one of the key aspects proposed to account for the enhancement of achievement through cooperative classroom arrangements (Knight & Bohlmeier, 1990). Johnson and Johnson's (1989) meta-analysis supports the idea that motivation to learn is enhanced by cooperative learning arrangements—in 51% of the studies, cooperation promoted greater task involvement than did individualistic efforts; only 4% of the studies favored individualistic efforts. Sharan and Shaulov (1990) found that cooperative learning increased fifth- and sixth-grade Israeli students' likelihood of choosing to forego the chance to go out to play in favor of continuing their schoolwork; such motivation was a very strong predictor of the children's achievement. Sharan and Shaulov suggested that the explanation for their finding was positive peer social relations and enhanced involvement of students in decision making regarding their own work in the cooperative learning situation. Similarly, European American middle-class high school students made greater gains and expressed greater intrinsic motivation to learn the concepts of algebra in a peer cooperative than in an individualistic arrangement (Nichols & Miller, 1994).

The motivating and supporting context that students can provide each other also includes reciprocal assistance and encouragement to take intellectual risks (Knight & Bohlmeier, 1990). An example is provided in a study that compared middle-class multi-ethnic U.S. children aged 8 to 11 working either alone or in pairs on an unsolvable spatial logic problem (Gauvain, 1994). The pairs generated

more attempts to solve the problem, less often erroneously believed that they had solved it, and more frequently attributed their lack of success to the unsolvability of the problem than to the problem being too hard for them. The pairs that collaborated (rather than taking turns) made suggestions regarding each others' ideas and remembered and kept track of prior moves and attempts to a greater extent, monitoring and editing plans together, thereby supporting each other in developing novel solutions.

Researchers disagree on the role of extrinsic rewards in cooperative learning. Some have argued that group rewards along with individual accountability are essential (e.g., Slavin, 1990). Others have argued that it is more effective for group work to build on student-student interdependence in projects and on interest in working together on projects of inherent interest, or to focus on the relation of the activity to what is to be learned from it (Johnson & Johnson, 1987; Kohn, 1992; Meloth & Deering, 1994; Sharan & Sharan, 1992; see also Forman & McPhail, 1993). Phelps and Damon (1989) suggested that different notions of the aims of education underlie this debate, and argued that the conceptual changes that education should promote are jeopardized by extrinsic motivation. They argued for collaboration based on intrinsic incentives such as the children's natural search for knowledge, competence, and stimulating communication.

Intersubjectivity in Cooperative Learning. Discussions of the process by which classroom cooperative learning aids cognitive development are consistent with the earlier discussion of intersubjectivity based on other literatures. Johnson and Johnson (1989) argued on the basis of their meta-analysis that positive interdependence among students' goals is important for individuals to learn from their engagement in a group—students' parallel work had no advantage over individual work for their transfer to later individual work. Roschelle (1992) and Pontecorvo and Girardet (1993) emphasized the importance of the development of a common understanding ("convergence") between partners. Ellis, Klahr, and Siegler (1994) noted that fifth graders from a multiethnic middle-income population were more likely to move to a correct strategy for solving decimal problems if partners clearly explained their ideas and considered each others' proposals: correct strategies that were proposed but were not met with interest were likely to be abandoned.

An important aspect of cognition as a collaborative process seems to be the learning that derives from explaining ideas and resolving controversies through

attempts to understand and persuade (Webb, 1982). College students learned more from a history passage if they taught it to someone else than if they just prepared to teach it or if they read it without the aim of teaching it (Annis, 1983). Johnson and Johnson (1989) summarized a number of studies indicating that understanding and reasoning were enhanced by the combination of explaining one's knowledge and summarizing another person's perspective. They argued that people learn something more deeply if they learn it in order to teach someone else: "A person actively teaching someone else may reorganize or clarify material on the spot, both of which allow the teacher to see the issue from new perspectives, enabling him or her to see previously unthought of new relationships" (p. 67).

Brown and Palincsar (1989) noted that although conflict has been repeatedly pointed to as an impetus for cognitive change, it may not be the conflict but the processes of co-elaboration which support cognitive progress, as several points of view are examined and modified to produce a new idea that takes into account the differing standpoints:

Change is not the automatic outcome of group problem solving. . . . It is the result of certain social settings that force the elaboration and justification of various positions. Groups, peers, and adults can cause change, if they set into motion the appropriate processes. By extension, experienced learners can cause change on their own by adopting these process roles in thought experiments, or by "internalizing" role models from their experiences of group discussion in later intrapersonal dialogues. (p. 408)

Conceptual Change through Cooperative Learning. In general, researchers suggest that cooperative learning is most useful for learning that involves conceptual change (Kobayashi, 1994). Johnson and Johnson (1987) stated that cooperative learning is effective for any instructional task but note that "the more conceptual and complex the task, the greater the superiority of cooperative learning over competitive or individualistic learning" (p. 44).

Based on their meta-analysis, Johnson and Johnson (1989) argued that cooperative arrangements promote the use of higher quality cognitive reasoning strategies and metacognitive approaches than in individual arrangements. They reported that when cooperative situations were structured appropriately, groups of children working together induced new ideas or general principles that none of the group members could induce alone. Their 1989 meta-analysis found no difference among studies according to academic subject area, but reported that on lower-level

learning tasks, individuals' achievement is the same whether they have worked cooperatively or by themselves, while on higher-level learning tasks having worked with a group benefits individuals' later solo achievements. Phelps and Damon (1989) noted that peer collaboration promoted deep conceptual development (such as understanding the notion of proportionality) but was not the best medium for fostering rote learning (such as multiplication tables and copying skills). Kruger (1994) found more shared thinking in spontaneous collaboration on discovery tasks than on skill tasks.

The conceptual advances that are possible in groups are not an automatic outcome of putting peers together. As the research of the previous sections revealed, cognitive development in peer collaboration is likely to require engagement between members of the group, with collective and individual understanding developing from such engagement. For such understanding to fit with adult definitions of cognitive development may require some members or facilitators of the group (whether children or adults) to induce the group to consider alternative concepts and information that fits with what is regarded as more sophisticated concepts or approaches. For example, with preliminary instruction by a teacher, ethnically mixed U.S. community college students who discussed chemistry concepts in cooperative group tasks structured to elicit misconceptions showed far fewer misconceptions as well as greater understanding of concepts such as the conservation of matter and energy than did students who received the preliminary instruction but not the cooperative tasks (Basili & Sanford, 1991).

An impressive example of peer collaboration with expert help is reciprocal teaching, in which peers aid each other with facilitation by an expert who helps the group in the subject matter as well as in group thinking processes (Brown & Palincsar, 1989). The group is responsible together for understanding and evaluating the meaning of a text; each member serves (in different turns, following a teacher's model) as a learning leader responsible for orchestrating the dialogue and as a listener or critic in the joint construction of meaning. Studies of reciprocal teaching indicate that in this system, U.S. students from first through eighth grades learned how to look for and comprehend the meaning of information presented, and performed better on tests. Brown and Palincsar argued that working in groups provides learners of varying levels of understanding with the opportunity to engage with deeply meaningful concepts for fundamental restructuring of knowledge, supported by the understanding and diversity of skills in the

group. "Change is more likely when one is required to explain, elaborate, or defend one's position to others, as well as to oneself; striving for an explanation often makes a learner integrate and elaborate knowledge in new ways" (p. 395).

Brown and Palincsar emphasized that reciprocal teaching is a system that simultaneously involves cooperative learning among peers and direct instruction by an adult who models strategies and provides temporary scaffolding to bolster the group's process (a combination that they pointed out resembles apprenticeship). Students witness others' enactment of differentiated spontaneous roles such as the executive who designs plans, the skeptic who questions premises and plans, the instructor who explains and summarizes for the less involved members of the group, the recordkeeper, and the conciliator who strives to minimize interpersonal stress. This provides learners with support for their own development of corresponding thinking strategies that they are learning to manage for themselves, such as defining the problem, isolating important features of it, referring to information and general principles, and evaluating progress. The next section considers how children learn to participate skillfully in shared thinking.

Children Learning How to Collaborate and Assist Each Other in Learning

Developmental research suggests that children's shared decision making is not easy for many European American children (Patterson & Roberts, 1982; Peterson, Wilkinson, Spinelli, & Swing, 1982). There is evidence that they develop greater skills in collaboration as they develop, such as increasing use of attention-focusing statements, responsiveness to a partner, and explicitness of reference to objects from age 3 to 5 years (Cooper, 1980).

However, collaboration among European American middle-class elementary and secondary school students is often still a challenge (Socha & Socha, 1994). For example, pairs of 9-year-old European American "teachers" who were asked to teach 7-year-olds to play a game often offered two parallel, unrelated lines of instruction, whereas pairs of Navajo 9-year-olds were more likely to build on each other's comments in teaching a 7-year-old (Ellis & Gauvain, 1992). The Navajo children provided a higher proportion of useful task information and remained engaged in the task, observing their partners even when they were not controlling the game moves; European American children were distracted when they were not controlling the game, sometimes to the point of leaving the task.

Extent of experience collaborating may play a role in children's learning to coordinate ideas. Rodrigo and Batista (1995) found that three 11-year-old middle-class Spanish children who had worked together on reasoning tasks for 9 sessions advanced in their collaboration skills, and these skills seemed to carry over to a later errand-planning task; three other girls who had done the reasoning tasks solo for 9 sessions evidenced less skill in managing the coordination of ideas on the shared errand-planning task. Through experience with solving the problems of collaboration, and perhaps also with development of relationships among people engaging in shared thinking, children may develop skill in coordinating their ideas with each other.

An example of progress in children's collaboration with experience is available in Socha and Socha's (1994) study in which two groups of U.S. 6-year-olds progressed in their problem-solving discussions over 5 sessions. The difficulties of coordinating ideas in the first session are evident in the interactions of a group of nine children, upon being asked to decide how they would spend the day together if given an imaginary day off from school (with specific questions such as what they would all eat):

The children began their discussion by whispering to the person seated next to them. The teacher had to re-explain the concept of "group" decision making to them. The children subsequently talked louder and also talked with the child across from them, but still did not talk to the entire group. Small coalitions formed as a result of this, characterized by such statements as, "Me and R. are going to J's house" [in response to the question of whose house the whole group would go to]. Once these subgroups decided their response to a question, they proceeded to the next question without the rest of the group. . . . They reached agreement by shouting their responses in unison. It seemed that whoever yelled the loudest, first, "won." For example, one child yelled "Cheese pizza" (in response to what to eat), and the others yelled, "Yeah, cheese pizza." The group also had difficulty handling disagreements. One girl pouted and cried when she did not get things her way. The teacher had to intervene and teach the group about ways to compromise (e.g., "Next time we could do things your way"). The other decision-making strategy they chose was [using the counting-out rhyme] "e-nee, me-nee, mi-nee, mo." (p. 237)

These children's (and teacher's) reliance on ways of dividing up the task fits with their difficulties in coordinating their efforts to think together. By the fifth discussion (on another topic), this group engaged in a more orderly

discussion, having been supported over the five sessions by the teacher's occasional suggestions and rules.

The pervasiveness of the lack of cooperative opportunities and of support in learning how to cooperate in traditionally organized schools makes it easy for researchers as well as students to assume that European and European American children's usual lack of skill in collaborating is simply "natural" (Forman & McPhail, 1993; Sharan & Sharan, 1992). Johnson and Johnson (1987) pointed out that students who are used to working in competitively structured individualistic classrooms assume that this is the natural structure unless assisted in learning about the nature of interdependence in goal structures and the skills necessary to work in groups. In British primary schools, Bennett and Dunne (1991) pointed out, students often work *in* groups (as a collection of children who sit together) but seldom work *as* groups. In German classrooms, cooperative learning organization was observed to be rare; without support in learning to cooperate (such as by prioritizing group reflection on the process of working together), students often simply divided the task, preventing their enlarging their individual resources by learning in collaboration (Huber & Eppler, 1990). A sociocultural approach urges attention to the role of institutional arrangements in children's development.

A growing literature supports the idea that peers solve problems cooperatively and tutor collaboratively when the social structure of the classroom supports such interactive patterns (Aronson, Blaney, Stephan, Sikes, & Snapp, 1978; Cazden, Cox, Dickinson, Steinberg, & Stone, 1979; Cooper, Marquis, & Edward, 1986; Damon, 1984). Pairs of middle-class European American children from a school structured collaboratively were more likely to work together with consensus, building on each other's ideas collaboratively, and to assist each other collaboratively in out-of-class math and categorization tasks than were children from a neighboring traditional school that had less emphasis on collaboration (Matusov, Bell, & Rogoff, submitted).

Middle-class U.S. third-graders learned more if their studying was done in cooperative groups that included discussion of how well their group was functioning and how they could improve its effectiveness than if they were in cooperative groups without group processing (Yager, Johnson, Johnson, & Snider, 1986). (However, students in cooperative groups without group processing nonetheless learned more than students in an individualistic condition.) A follow-up study with African American high school

seniors and college freshmen (Johnson, Johnson, Stanne, & Garibaldi, 1989) replicated these findings with the added result that a combination of teacher and student processing was even more effective:

The results of hundreds of studies on group dynamics indicate that communication, leadership, trust, decision-making, and conflict management skills are required for effective cooperative action. Individuals must be taught the interpersonal and small group skills needed for high quality cooperation, and be motivated to use them. . . . It is a truism in group dynamics that to be productive groups have to "process" how well they are working and take action to resolve any difficulties members have in collaborating together productively. (Johnson & Johnson, 1989, pp. 74-75)

The emphasis on learning to think and develop ideas together goes beyond individuals developing skill in interpersonal understanding. Crook (1994) warned against looking for successful collaboration solely in terms of individual characteristics such as age, stage, or "skill" in comprehending the intentions of another or in communicating. Crook contrasted an emphasis on individual social-cognitive skills with development of an "intersubjective attitude" that transcends the characteristics of individuals, as collaborators work toward constructing joint understanding. "If intersubjectivity does become a resource to support collaboration, it is because the conventions, rituals, institutions and goals of organized social life arrange that it should do so. This is the phenomenon we need to understand. Teachers and others need to understand how best to mobilize an intersubjective attitude towards the particular purposes of joint problem-solving" (p. 145).

In some communities, assisting children in learning to coordinate with others is central to the social structure of classroom and/or family life (Martini & Kirkpatrick, 1992; Rogoff et al., 1993; Toma, 1991a). Hatano (1994) contrasted the Western ideal of individualized instruction with Japanese educators' unanimous recommendation that instruction be organized to maximize multiway interaction and group norms emphasizing understanding. In Japanese elementary school classrooms, it is very common for teachers to explicitly teach children discourse forms for building on each other's ideas (Toma, 1991b). A Japanese teacher explained:

As a first step before addressing the teacher, children discuss among themselves. For example, "I think such and such but what do you think, B-kun?" Then in return, "I think in such

and such a way but what do you think?" Just like that. Children question and respond among themselves and by doing this, they deepen their understanding of the content (which they are supposed to be learning in the class session). The teacher comes into the picture at the very end when it is time to make sure that the main points are learned. As a first step before all of this, we need to teach speech forms, otherwise the discussion goes in chaotic ways. (p. 5)

This instruction often uses lists on classroom walls suggesting phrasings to begin a statement, including the following phrasings quoted by Toma (1991b, pp. 3-4): for agreeing with someone else ("I agree with [name]'s opinion. This is because . . ."), for disagreeing ("I disagree with [name]'s opinion. This is because . . ."), for requesting clarification ("I would like to ask [name]. Did you mean to say. . .?"), and for extending an argument ("Does anyone have another idea [opinion]?" or "I would like to add . . . to [name's] idea").

In a Mayan community in Guatemala, children of 3 to 5 years collaborate with and support their younger siblings, voluntarily allowing the younger one leeway in access to resources with allowance for a toddler's lack of social understanding (Mosier & Rogoff, submitted). The 3- to 5-year-olds may act in a socially responsible way with regard to the toddlers in part because that is the way they themselves have been treated. They are no longer the one that is given the leeway but are already part of the system in which responsibility to other people is an inherent part of human relations. Learning to collaborate may be easiest if one has been treated in a collaborative fashion by adults and others in positions of responsibility. The next section focuses further on the roles of adults and of cultural institutions in collaboration with and among children.

Adult and Institutional Roles in Children's Collaborative Learning

Previous sections have touched on the important roles that adults play in children's collaborations with each other, for example, in the work of Brown and Palincsar (1989), Kobayashi (1994), and studies of communities of learners. Groups of Spanish 13- to 14-year-old students planned writing assignments in a more sophisticated fashion when working on a common group outline than on individual outlines; the difference was even stronger if the teacher assisted the children in developing a common outline (Lacasa, Herranz-Ybarra, Martín-del-Campo, & Pardo-de-León, 1994).

There is a great need for more focused attention on how children's collaboration with each other is integrated with adult roles. In most work on peer collaboration, adults are practically hidden collaborators, as teachers or researchers who structure or even script the tasks and attempt to facilitate the ongoing process and the participants' reflections on it. The adults' roles are usually referred to only in the background of the situation. In collaborative learning research, often the comparison serving as the "individual" condition is actually children's learning in whole-class instruction where the teacher addresses the children as a class. This is a form of interaction between the children and the adult; it is individual only in the sense that collaboration among peers is discouraged.

It is also common for researchers to treat experimenters as a neutral background feature of the experiment rather than to consider their role as collaboration. In one example, the researchers treated the learning through problem solving with a peer partner as "social interaction" and noted that receiving feedback regarding correctness of answers either while working "alone" or with a peer was also effective for the children's learning. The children receiving the adult researchers' feedback were regarded as working "alone," although the adults communicated correctness (with an arrow under a sticker indicating the correct answer) and presumably gave the children instructions and interacted with them during the experimental session.

Beyond the roles of adults, the institutional or cultural processes involved in experiments or in cooperative learning sessions are rarely examined directly. For example, usually it is assumed that cooperative activities occur as separate sessions within otherwise "traditional" academic settings in which most of the day involves teachers instructing the whole class at once (or individuals) and students are not allowed to help each other and are judged in comparison with each other. Exceptions are research in schools or communities where the everyday structure of communication is collaborative and the cooperative learning events are studied in relation to everyday classroom or family communication (e.g., Graves, 1992; Haynes & Gebreyesus, 1992; Johnson & Johnson, 1987; Kohn, 1992; Little Soldier, 1989; Matusov, Bell, & Rogoff, submitted).

Attempts to understand or to promote cooperative learning in the classroom require consideration of the roles of adults in children's cooperative learning and the overall structure of the classroom, and the roles of adults outside the classroom in supporting adults' collaboration with children within the classroom (Tharp & Gallimore, 1988).

Nicolopoulou and Cole's (1993) research on creating collaborative learning after-school activities noted the essential role played by the "common culture" (collaborative or not) of the institutions in which their activities were initiated.

Literature on school restructuring suggests that for children to learn through collaboration (or to sustain it once encouraged and helped to do it) requires rethinking adults' roles in children's learning and in relation to each other. Teachers have difficulty learning to guide rather than to control children's behavior when attempting to change from traditional teacher-controlled whole-class activities to cooperative learning activities (Solomon, Watson, Schaps, Battistich, & Solomon, 1990). For teachers to learn to use cooperative learning approaches, it appears that they themselves need to have participated in such learning activities rather than to have been lectured regarding the importance of cooperative learning (Johnson & Johnson, 1987; Sharan & Sharan, 1992; Sharan & Shaulov, 1990). Solomon et al. (1990) and Sharan and Sharan (1992) have described programs helping teachers learn how to help children learn how to support each other's work in the classroom through collaboration.

The same processes of learning through collaboration through shared purposes are important for adults as for children's learning of the school curriculum (Bruffee, 1993; Clokey, Cryns, & Johnston, in press; Lubomudrov, in press; Rogoff, Matusov, & White, 1996). Thus the structure of the school as a whole appears to relate to the success of efforts for children and teachers to learn to collaborate—principals' and district administrators' collaboration with teachers supports teachers' collaboration with each other as they learn to collaborate with the children, rather than each "level" of responsibility seeing itself as the repository of knowledge or authority for those "lower" (Shedd & Weaver, 1995; Tharp, 1993; Tharp & Gallimore, 1988). Cooperative learning in elementary and secondary school classrooms also requires university researchers and educators to learn to collaborate with educators of younger students, in order to promote the cognitive development we all seek for the children. Thus, the cooperative learning of children involves the collaboration of adults who carry out institutional roles ranging from the setting in which the children sit to distant universities.

My point in this section on the role of peer interaction in children's cognitive development has been to underline the roles of shared thinking between the peers and to expand

the field of vision beyond the specific interactions of the children themselves to include the roles of others who are involved in the interaction or arrangements for its structure, as well as the roles of institutional and cultural traditions in the structure of children's collaborative thinking with each other and with adults.

This is a sociocultural view of cognitive development through collaboration that extends far beyond the simple examination of the "social influence" of putting another person together with the individual child being studied. Although research has begun to effectively include more than one person in studies of cognitive development, our scope has been largely limited to observations of interacting individuals (especially those who are deliberately engaged in teaching and learning situations). Most of the work to date thus fits the social influence perspective more than the sociocultural perspective.

To conclude this chapter, I suggest that we need to devote greater attention to the processes of collaboration in other sociocultural activities beyond social interaction with experts or with peers in situations that are largely intended as instructional. A broader view of collaboration as a sociocultural process includes other forms of collaboration between people than those that are usually the focus of research on social impacts on cognitive development. In particular, a sociocultural view emphasizes examining how the relations between partners and the contributions of individuals may vary as they participate in different activities of their community, and how individual and interpersonal aspects of activities are constituted by and themselves constitute cultural practices and institutions.

INTERPERSONAL AND COMMUNITY ASPECTS OF COLLABORATION IN SOCIOCULTURAL ACTIVITIES

The work on how adults as experts support novices' learning and how peers assist each other in learning has extended our purview of cognitive development beyond the role of the individual to include the involvement of other people, largely in instructional situations. The work includes some research that moves beyond dyadic and didactic settings, such as research on play among peers, integration of adult roles in peer interactions, and cultural variation in the structure of adult-child or peer interaction. The need to conceptualize the roles of individuals in sociocultural activities is clear in an observation by Schrage (1990):

An ethnographer studying a group of machine technicians came to a blunt rethinking of what expertise means in the context of the workplace. His analysis was that expert knowledge among technicians is less a matter of what each individual knows than of their joint ability to produce the right information when and where it's needed. . . . In other words, expertise is a social affair. (p. 49)

This concluding section extends the effort to understand how the thinking and interactions of individuals and their social partners fit with group, institutional, and cultural processes.

Moving beyond the notion that cognition is the property of isolated individuals opens important research questions regarding how individuals' participation in sociocultural activities proceeds and how it prepares those individuals for participation in other activities. It focuses cognitive developmental researchers' attention to a greater extent on the proximal and distal relations of individuals with other individuals, the roles of individuals in groups, and the structural arrangements of people's roles in institutions that extend beyond the lifespan and lifespaces of individuals.

The shortcomings in the available research that I mentioned prior to reviewing the research on adult and peer roles in cognition as a collaborative process are important directions for future research. We need greater attention to the social and cultural aspects of how people determine the problems, goals, and means of their collaborative efforts, and to researchers' roles in phenomena under study. We also need to study collaboration in circumstances in which partners are mutually engaged but without interaction or instruction as their goal. We need to attend to the role of cultural tools—such as tools of language, genres of communication, and material technologies involved in problem solving—as well as to the functioning of the institutions in which collaboration occurs—the ways that thinking and collaborating are aspects of cultural practices in laboratories, schools, and families.

We need far greater understanding of collaboration and cognition in populations other than middle-class European American groups, or in situations other than those devised or managed by middle-class European American researchers. The available research is very limited as to the cultural communities represented. I have attempted to avoid overgeneralizing findings beyond the populations studied in three ways:

1. Frequently mentioning the communities in which the research has taken place,

2. Discussing cultural similarities and differences where research provides sufficient evidence, and
3. Referring to findings as observations that have occurred with particular participants in research ("these children did such-and-such") rather than in a general form ("children do such-and-such").

Related to some of the suggestions of cultural variation in collaboration is the need to study the dynamics of groups larger than dyads, without reducing them to collections of individuals or dyads. Evidence suggests that the dynamics are often quite different in larger groups than in dyads (examine the relations in Figures 14.1 to 14.4). For example, the presence of a second child can change mother-child conversations (Feinman & Lewis, 1983; Snow, 1982; Tomasello, Mannle, & Kruger, 1986; Wells, 1975).

Dyads may be the prototypical social relationship in some but not all communities. In Martini's (1994) observations of 3- to 5-year-olds, U.S. children played alone in 36% of observations and with just one partner in 35% of observations, whereas Marquesan (Polynesian) children almost never played alone (0%) or with just one other child (7%)—they played in groups of 3 to 6 children in 75% and in groups of 7 to 10 children in another 18% of the observations. Toddlers in a Mayan community in Guatemala and in a tribal community in India interacted in multiway engagement in groups about half of the time, whereas middle-class Turkish and European American toddlers engaged as members of a group during only about a tenth of the occasions—they more commonly acted alone or in successive dyadic relations with one person at a time, even though a group was always present during the observations (Rogoff et al., 1993). Even in large groups such as classrooms, middle-class European American interaction is usually structured dyadically—the students are to speak only to the teacher, who takes a speaking turn between each child turn (Lerner, 1993; Mehan, 1979). This contrasts with the structure in Japanese elementary school classrooms in which children build on each other's ideas as a group in exploring a problem (Toma, 1991b) and researchers argue that the involvement of more than two people is important for cognitive development (Hatano & Inagaki, 1991).

Although research on collaboration has focused on symmetrical conversations between two partners as a prototype for investigation, collaboration involves varied arrangements that warrant much more study. In the remaining sections, I focus on cognitive development through collaboration that involves specialized as well as symmetrical roles of participants, the role of conflictual as

well as harmonious relations in collaboration, and the roles of distant collaborators, such as those who are not physically or temporally present.

Specialized as Well as Symmetrical Roles in Collaboration

The literature often applies the term collaboration to instances in which partners engage with equal or symmetrical contributions. However, interactions involving symmetrical exchanges—in which each partner accords the other equal latitude and in which exchanges resemble smooth and fair turn taking between partners of equal status engaged on the same topic—are simply one form of collaboration.

Collaboration also includes interactions in which participants' roles are complementary or with some leading and others following, supporting, or actively observing (see Figures 14.1 to 14.5). Under varying circumstances, different partners may be more responsible for initiating and managing shared endeavors. For example, middle-class European American toddlers' attention to their mothers' activity increased during times that the mothers had not been asked to interact with their toddlers compared with times that the mothers had been directed to either encourage the toddlers to play with them or to play separately (Goldsmith & Rogoff, unpublished data).

As long as an endeavor and its thought process occurs at least partially in common, I regard the activity as involving collaboration. A person who is actively observing and following the thinking or decisions made by another is



Figure 14.5 Two young Mayan girls observe the skilled practice of backstrap weaving by the older girls and women in their family. (© Barbara Rogoff)

participating whether or not he or she contributes directly to decisions as they are made. A lecture can involve collaboration if either the lecturer or the audience (or both) manage to engage in thinking together. Collaboration can even occur without people being in each other's presence (discussed in a later section). The particular balance of responsibility is extremely interesting to examine (Rogoff et al., 1993).

Observation is an important collaborative process in child development, one that is often mistakenly regarded as passive. Children's active monitoring of events happening around them provides them with important information, even when the events are not staged for the children's benefit or adjusted to their viewing (see Figure 14.5). Children often pick up information from observing the actions of other people (Bandura, 1986; Hay et al., 1985; Lewis & Feiring, 1981; Verba, 1994; Zimmerman & Rosenthal, 1974). For example, toddlers have been observed to evaluate the character of a stranger by observing the reactions of others (Feiring, Lewis, & Starr, 1983). Likewise, 5-year-old children whose performance in Lego construction improved spent three times longer observing their expert partners, and their partners spent five times longer monitoring and observing them, than members of dyads in which novices' performance did not improve (Azmitia, 1988). In a group setting, some Japanese students, even when they did not speak, evaluated and incorporated other students' ideas to achieve deeper and more accurate understanding (Hatano, 1994).

In informal learning in many communities, children learn through participation with adults in community activities, and in some apprenticeships novices learn through the opportunity to observe and work with others varying in skills and roles in learning a craft as they contribute to the work of the shop (Goody, 1989; Lave & Wenger, 1991; Rogoff, 1990; Rogoff et al., 1993). Learners may play very central roles in managing their own learning and involvement, with adults or experts potentially (but not necessarily) facilitating their observation and growing participation.

Lave and Wenger (1991) pointed out that learners are often involved in *legitimate peripheral participation*, in which they have access to observe and begin to participate in the activities of a community of practice. The novices carry great responsibility for their involvement, and more competent practitioners may support their learning by structuring the activities in which they are allowed to engage directly. The "curriculum" of apprenticeship for Vai (Liberian) tailors involves novices observing masters and advanced apprentices, and participating in successive steps

for approaching the overall body of tailoring skill and knowledge. The structuring of tasks in the relationship between master and apprentices provides the opportunity for an alert apprentice to observe the next step while participating in production of steps already under control, involved in a way that allows understanding of the overall process while contributing to a small section of it.

As legitimate peripheral participants, children often observe in contexts in which they are preparing to or already participate on other occasions. Their observations build upon their current understanding based on participation in social activities with caregivers and peers in previous situations and on their projected roles in managing cultural activities using cultural tools of understanding and action.

Although observation has been noted as an important means for children to come to an understanding with others in their community, there has been little research on how children go about observing, how participants in a situation in which children are observing communicate and foster or structure children's attention, or how children's observation of incidental activities may differ from their observation of purposefully modeled activities. A study focused on this issue indicated that in a Mayan community emphasizing learning by observation, toddlers and their caregivers frequently focused simultaneously on several competing ongoing events, without attention to one event disrupting attention to others (Rogoff et al., 1993). Such attentional management may facilitate being alert to important surrounding events. In contrast, in a middle-class European American community with less emphasis on learning by observation, toddlers and their caregivers more frequently attended to one event at a time, switching between competing events or appearing to ignore important surrounding events.

I have referred to "shared" thinking in this section as a key aspect of collaboration. Since many people seem to regard any form of "sharing" as the sort of rosy engagement desired between children in many preschools, I should clarify that I regard both harmonious and discordant interactions as involving shared thinking, as long as there are some premises in common. Collaboration and shared thinking does not require agreement on all points—just some common topic or starting point. The important role of disagreement is worth expanding, in the following section.

Discord as Well as Harmony in Collaboration

Collaboration does not imply smooth relationships or that everyone is happily supporting each other all the time.

Collaboration may involve disagreements about who is responsible for what aspect of the endeavor, or about the direction of the effort itself. Collaborative engagement in shared endeavors includes contested roles and disagreements, as well as moments of smoothly coordinated ongoing activity (Baker-Sennett, Matusov, & Rogoff, 1992; Gutierrez, Kreuter, & Larson, 1995; Matusov, 1995).

The notion that collaboration includes conflict appears to be a difficult idea, as the terms cooperation and collaboration to some people imply a lack of disagreement. In the United States, children and adults often use the term "cooperation" to mean "behaving" or avoiding conflict with an authority, as when parents and teachers tell children they "need their cooperation" or children report that they cooperate with others by withdrawing or avoiding disagreement (Holloway, 1992).

During collaboration, disagreements are an important tool for learning. Indeed, much research based on Piaget's theory and on collaboration in classrooms posits a central role for conflict in sparking advances in understanding (see Bruffee, 1993; Kruger, 1993; Nelson & Aboud, 1985). For example, discussions in which fifth-grade friends (from mostly Caucasian, low-to-middle income families) engaged in exploring their disagreements were associated with advances in scientific reasoning (Azmitia & Montgomery, 1993).

Several scholars have underlined the productive role of discord in learning through collaboration (Kohn, 1992). Hawkins (1987) noted that episodes of U.S. elementary students' collaboration at computer work that involved reorienting a problem-solving episode generally involved dissent between partners. Francis Crick, who discovered the double helix with James Watson, observed a similar phenomenon:

"Our . . . advantage was that we had evolved unstated but fruitful methods of collaboration. . . . If either of us suggested a new idea, the other, while taking it seriously, would attempt to demolish it in a candid but nonhostile manner." (In fact, Crick once told a BBC interviewer at the time he got the Nobel that "Politeness is the poison of all good collaboration in science." Candor—if not rudeness—is at the heart of most successful collaborative relationships.) (Schrage, 1990, p. 42)

In accord with this notion is Zinchenko's (1995) moving account of the productive tension between the theoretical strands of cultural-historical psychology and the psychological theory of activity of Vygotsky and Leont'ev and their colleagues and students in the former USSR: "There

are *vital* (i.e., *life-giving*) *contradictions* between cultural-historical psychology and the psychological theory of activity and . . . these are a point of growth for both directions" (p. 51).

Beyond the role of disagreement in friendly collaborations, even participants in an unfriendly argument can be considered collaborators. Participants in an argument share some rules about the proceedings and are contesting for some common goal; through their argument they may assist in sharpening their own and the other combatants' ideas (even if this is contrary to their intent). Schoenfeld pointed to the importance of collaboration with unsympathetic partners in his description of his approach to math instruction at U.C. Berkeley:

The general tenor of these discussions followed the line of argumentation outlined in Mason, Burton, and Stacey's (1982) *Thinking mathematically*: First, convince yourself. Then, convince a friend. Finally, convince an enemy. (That is, first make a plausible case, and then buttress it against all possible counter-arguments.) In short, we focused on what it means to truly understand, justify, and communicate mathematical ideas. (1993, p. 14)

Of course, the consequences of conflict (and of social interaction) are not necessarily beneficial, or intended to foster learning.

Even children's closest relationships often involve disagreement or efforts by partners or by children themselves to avoid some kinds of learning opportunities. Children often resist attempts to direct their learning (Litowitz, 1993). And as Goodnow (1987) pointed out, there are many topics that adults protect or divert children from learning (e.g., sexuality, family income), and adults are not always eager to participate in instructional situations. Parents are often busy with their own activities and sometimes stressed: they are not constantly focused on preparing each of their children for their future occupations or ensuring that their child is learning at each moment of the day (Goldsmith & Rogoff, 1995, 1997). Middle-class mothers interacting with their children when they think they are not being observed are much less involved and less instructive than when they are aware of being observed (Graves & Glick, 1978). Often parents' goal of the moment is to get a job done, not to instruct. When lower- to middle-income U.S. mothers worked with their 4-year-olds in planning routes through a model grocery store, they shared more responsibility with their children if they had been told that the children would later carry out the task on their own;

otherwise they somewhat more frequently carried out key aspects of the task without involving the child (Gauvain, 1995).

Adults often constrain children's opportunities to explore, as for example in refusing to let a one-year-old near a fire (Valsiner, 1984, 1987). Carew's (1980) observations of toddlers at home revealed that their activities were restricted during 8% of the observations, compared with being facilitated during 12% and engaged in mutually with another person during 21% of the observations. Such constraints are a part of the arrangements for children's learning that I believe are essential for understanding the collaborative nature of cognitive development—they are key to understanding both children's opportunities for learning and community or more local values and practices that inherently contribute to children's development in shared endeavors of their community.

Collaboration does not imply harmonious relations, but rather some degree of shared thinking and effort, which can be the sort that is necessary for an argument to proceed, or for a child to observe their family's and other companions' values and solutions to everyday problems. Indeed, shared thinking and effort can occur without people being in each other's presence or even without each knowing about the other.

Collaboration among People of Different Eras and Locations

Although collaboration and intersubjectivity are prototypically treated as processes occurring among people who are in each other's presence, they also characterize the shared thinking of people involved in shared endeavors at a distance or in different time periods. This point is central to sociocultural approaches to development.

Individual cognitive development occurs in collaboration with a community of thinkers in which more than one person is working on a particular problem, with historical and material aspects of other people's solutions available to each thinker in their extended conversation (Bruffee, 1993; Hutchins, 1995; John-Steiner, 1985, 1992; Schrage, 1990). Patricia MacLachlan described how she relied on both an anticipated reader and an absent editor to solve problems in writing:

I try to anticipate the experience of the reader. I myself, of course, am the first reader, and I try to envision a small, objective, heartless Patty MacLachlan looking over my shoulder

saying, "Aw, come on!" when I am clumsy or self-indulgent. But the small Patty MacLachlan somehow turns into a Charlotte Zolotow [MacLachlan's editor]. Her voice has become ingrained in my consciousness; I can hear her.

I've passed this on. My daughter Emily is becoming a wonderful, imaginative writer herself, and we spend a good deal of time discussing her work. "When I write a theme in class," she told me the other day, "I hear your voice in my ear." (1989, pp. 740–741)

In Schoenfeld's (1989) tracing of the development of the ideas of a research project, he noted the importance of the discussions among group members as well as of conversations with other colleagues, on other topics, in apparently extraneous events. These conversations at the time did not seem significant to the research problem, but analysis in retrospect revealed their centrality to the research endeavor, across time and contexts. Schoenfeld noted that "ideas in the air" in the local research culture (at U.C. Berkeley's School of Education) led to synergistic ideas that could not have derived from the work of any one individual working alone, or in another local research culture.

Such communities of thinkers may not be particularly organized, they may be competitive or supportive, and they may not coexist in time. Striking examples of collaboration across time are provided by Michaelangelo's study of ancient sculpture and by the creative grounding of cello virtuosity of Pablo Casals in his daily morning exercise of playing from Bach (John-Steiner, 1985). Exceptionally creative writers, painters, and physicists discover their own teachers from the past, engaging with "an intense and personal kinship that results when the work of another evokes a special resonance in them. . . . In this way, they stretch, deepen, and refresh their craft and nourish their intelligence" (p. 54). Collaborators may also be individuals in the future, such as a writer must consider in order to write in a way that will make sense to a future generation.

Collaboration and intersubjectivity between people participating in shared activity at a distance are often mediated by technologies for indirect involvement, such as computers, fax machines, telephones, television, and literacy (see Figure 14.6; Bruffee, 1993; Crook, 1994; Pea & Gomez, 1992; Schrage, 1990). For example, in classrooms, some forms of guidance can be provided by either a computer or a human partner (Zellermayer, Salomon, Globerson, & Givon, 1991); either option involves collaboration with human partners acting either indirectly through a device or directly in face-to-face interaction. Or a published



Figure 14.6 A boy, apparently alone on the lakeshore, is engaged socially with the ideas of a distant author of a book and with a nearby researcher taking a photograph. (© Barbara Rogoff)

artifact may be used for extending a topic beyond the prior contributions of an absent author, as with the use of a phase-transition diagram to re-represent ideas in ongoing discussion in a physics research group (Ochs, Jacoby, & Gonzales, 1994).

Tools for thinking provide a form of collaboration that may be easily overlooked. Kobayashi (1994) pointed out that in the Japanese science education method of Hypothesis-Experiment-Instruction, in which students are presented with a question along with three or four possible answers to choose among and to discuss, the problem setup itself serves as guidance in the learning process. The question and the alternatives guide how students verify their predictions, simply in the way the questions are asked and the alternatives worded. The alternatives provide a range of possibilities that encompass the common misconceptions in the domain of the question. This aids students in discerning both which opinions are plausible and which predictions are accurate when feedback is sought, providing students with clues as to how to restructure their naive understanding into scientific concepts. Without considering the collaborative role of those who devise such cognitive tools and the structure of the tools themselves, the students' learning process would be incompletely understood.

It is fascinating that one tool, the computer, is coming to be regarded by many as an "interactive" partner itself. Hawkins (1987) suggested that computers as partners have special value in being able to quickly and efficiently

display the results of substeps in problem solving and thus invite reconsideration and revision. Schrage (1990) argued that use of computers as a collaborative tool in scientific and business work can enhance creative problem solving by externalizing the discussion in print or graphic symbols. Of course, thinking with the aid of a computer also involves remote collaboration with the people who designed the hardware, the software, and the computer setting in use (see Figure 14.7). Pea (1993) provided an apt illustration of reconceptualizing intelligence and its development to include computer use, in describing a presentation by Papert at a 1987 National Science Foundation meeting:

Papert described what marvelous [LEGO-Logo] machines the students had built, with very little "interference" from teachers. . . . On reflection, I felt this argument missed the key point about the "invisible" human intervention in this example—what the designers of LEGO and Logo crafted in creating just the interlockable component parts of LEGO machines or just the Logo primitive commands for controlling these machines. For there are only so many ways in which these components can be combined. Considerable intelligence has been *built into* these interpart relations as a means of constraining what actions are possible with the parts in combination. What I realized was that, although Papert could "see"

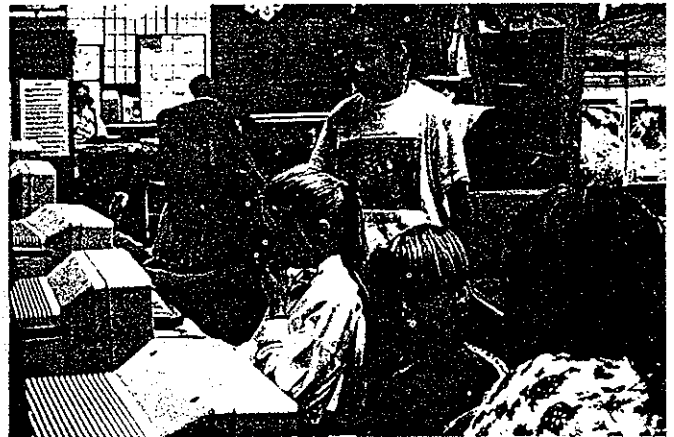


Figure 14.7 These U.S. students working at computers are at least as engaged with distant people's ideas through the use of the programs and the information on the screen as they are with the people next to them. Notice also the asymmetrical collaboration of the standing girl observing the problem-solving of a classmate and of the adult in the foreground who is observing and available to help. At least one of the children is also clearly engaged with the researcher documenting the activity. (© Barbara Rogoff)

teachers' interventions (a kind of social distribution of intelligence contributing to the child's achievement of activity), the designers' interventions (a kind of artifact-based intelligence contributing to the child's achievement of activity) were not seen. . . . [The child] could be scaffolded in the achievement of activity either explicitly by the intelligence of the teacher, or *implicitly* by that of the designers, now embedded in the constraints of the artifacts with which the child was playing. (pp. 64–65)

Material artifacts such as books, orthographies, computers, buildings, and hammers are essentially social, historical objects, transforming with the ideas of both their designers and their later users, forming and being formed by the practices of their use and by related practices, in historical and projected communities (Brown & Duguid, 1994; Gauvain, 1993; Rogoff et al., 1994). Artifacts serve to amplify as well as to constrain the possibilities of human activity as the artifacts participate in the practices in which they are employed (Cole & Griffin, 1980; Wertsch, 1991). They are representatives of earlier solutions to similar problems by other people, which later generations modify and apply to new problems, extending and transforming their use.

Consider the example of the development of current practices in drafting a written composition, which in recent years have been transformed by the advent of word processing on computers, replacing drafts on tablets of lined paper and supporting revision of text in new ways. Before the Middle Ages in Europe, all elaboration of the ideas and expression of text occurred before the material was set to written form (Alcorta, 1994). The person who composed the text was not the one who wrote it—the text's author merely dictated it to a scribe who wrote it exactly on the parchment. In the Middle Ages, it became possible to work with an intermediate draft—with the innovation of using a wax tablet—and some authors began to fill all three roles: the composer of the text, the writer on the wax tablet, and the transcriber to parchment for the final, neat document. It was not until the 1880s in France that schoolchildren were expected to express themselves in writing, rather than simply write to put lectures to paper. Literate people may now take for granted the tool for thinking that written composition provides, but this cognitive practice has evolved through the centuries from earlier roots in oral traditions, along with material inventions, in a collaboration of people extending over great periods of time.

Children's cognitive development is inherently related to their community's historical traditions, such as whether

formal schooling or literacy are prevalent or observation of parents' work is easily accessible. Each new generation builds on and modifies the inventions and arrangements of prior generations, in a process of continuing involvement with people no longer present (who may or may not be of the same ancestry).

Thus collaboration is a process that can take many forms, whether intended or accidental, mutual or one-sided, face-to-face, shoulder-to-shoulder, or distant, congenial or contested; the key feature is that in collaboration, people are involved in others' thinking processes through shared endeavors. Many of these forms of collaboration have not yet received much research attention. It will be important to investigate the ways that individual, interpersonal, and community aspects of shared thinking function in the rich variety of sociocultural activities in which children participate.

CONCLUSION

Research on collaboration has derived largely from the perspective of the social influence approach, in which individuals serve as the unit of analysis and the impact of external influences is studied. Such research examines the roles of characteristics of the separate individuals who are interacting—such as age, expertise, or status of the developing learner or of the partner, or the kind of technique used by the partner in influencing the learner.

Much of this research can be interpreted from a sociocultural perspective (though sometimes requiring great effort in avoiding overgeneralization to other populations or situations). The largest shortcomings of the literature at present are that most of the research leaves unanalyzed the cultural/historical aspects that are important in all the situations observed (whether in laboratories, schools, homes, Girl Scout troops, or other organized settings in any community) and devotes insufficient attention to what is meant by learning or development (relying on unquestioned habits of thinking of learning/development as acquisition of mental objects).

In this chapter, I have provided an overview of the research as well as commentary suggesting that sociocultural approaches can lead us further in understanding cognition as a collaborative process. Sociocultural approaches broaden the focus to include cultural/historical aspects of the phenomena and, at least from the perspective that I take in thinking of learning as transformation of participation, to rethink what is meant by learning and development.

Theoretical, research, and methodological issues in the sociocultural study of cognition as a collaborative process center on the following themes: A sociocultural approach goes beyond regarding the individual as a separate entity that is the base unit of analysis to examine sociocultural activity as the unit of analysis, with examination of the contributions of individual, interpersonal, and community processes. Thus, analysis goes beyond the individual and the dyad to examine the structured relations among people in groups and in communities, across time.

With sociocultural activities as the units, analysis emphasizes the purposes and dynamically changing nature of events. Analysis examines the changing and meaningful constellations of aspects of events, not variables that attempt to be independent of the purpose of the activity. Central to analysis of cognition as a collaborative process is a focus on the shared meaning in endeavors in which people engage in common. Cognition is not conceptualized as separate from social, motivational, emotional, and identity processes—people's thinking and development is conceived as involved in social relations, with purpose and feeling central to their involvement in activities, and transformation of their roles as a function of participation.

Developmental transitions are of great interest; they are conceived as properties of people's participation in sociocultural activities, not as properties of people independent of their involvements. Development and learning are evaluated in terms of the transformation of people's participation in sociocultural activities. The extent to which individuals' changing roles and understandings are used in other activities is a matter for empirical investigation; generality is not assumed and is not attributed to either the individual's or to the situation's characteristics, but to the processes of participation of the individual and others (present and historical) in the activity. Generalization focuses on processes rather than personal or situational attributes. Analysis of cognition as a collaborative process includes consideration of how the researcher and the research tradition itself plays a role in the activities under consideration. Cognition is a widely collaborative process.

I hope that my comments in this chapter help support development of the field in these areas, and that when the next volume of the *Handbook* appears in a dozen years or so, some of the issues reported here can be seen as transitional to a more adequate understanding of cognitive development as a collaborative process involving individuals engaged with others in sociocultural activities. Understanding how people develop, that is, how they change in their participation in sociocultural activities, requires

attention to the changing activities themselves, to people's changing responsibilities and roles, and to how their participation relates to their becoming a member of a community with specific but changing institutions, technologies, and definitions of intelligent involvement. The field has made considerable progress in moving beyond considering cognitive development as a property exclusively of solitary individuals; we have much left to do to incorporate the insights of sociocultural theory into our research and practices. The learning and development that we seek as a field is itself a collaborative process, like the phenomena we study.

ACKNOWLEDGMENTS

I am grateful to the Spencer Foundation for their support for my writing of this chapter, to Margarita Azmitia, Maureen Callanan, Michael Cole, Bill Damon, Deanna Kuhn, Eugene Matusov, Bob Siegler, and Chikako Toma for their suggestions on earlier drafts, and to Cindy White for her help in preparing the manuscript.

REFERENCES

- Adams, A. K. (1987, January). "A penguin belongs to the bird family": *Language games and the social transfer of categorical knowledge*. Paper presented at the third International Conference on Thinking, Honolulu.
- Adams, A. K., & Bullock, D. (1986). Apprenticeship in word use: Social convergence processes in learning categorically related nouns. In S. A. Kuczaj & M. D. Barrett (Eds.), *The development of word meaning: Progress in cognitive development research* (pp. 155–197). New York: Springer-Verlag.
- Adamson, L. B., Bakeman, R., & Smith, C. B. (1990). Gestures, words, and early object sharing. In V. Volterra & C. Erting (Eds.), *From gesture to language in hearing and deaf children* (pp. 31–41). New York: Springer-Verlag.
- Alcorta, M. (1994). Text writing from a Vygotskian perspective: A sign-mediated operation. *European Journal of Psychology of Education*, 9, 331–341.
- Allen, V. L. (Ed.). (1976). *Children as teachers: Theory and research on tutoring*. New York: Academic Press.
- Allen, V. L., & Feldman, R. S. (1973). Learning through tutoring: Low-achieving children as tutors. *Journal of Experimental Education*, 42, 1–5.
- Allen, V. L., & Feldman, R. S. (1976). Studies on the role of tutor. In V. Allen (Ed.), *Children as teachers: Theory and research on tutoring* (pp. 113–129). New York: Academic Press.

- Als, H. (1979). Social interaction: Dynamic matrix for developing behavioral organization. In I. C. Uzgiris (Ed.), *Social interaction and communication during infancy* (pp. 21-39). San Francisco: Jossey-Bass.
- Annis, L. F. (1983). The processes and effects of peer tutoring. *Human Learning*, 2, 39-47.
- Arievitch, I., & van der Veer, R. (1995). Furthering the internalization debate: Gal'perin's contribution. *Human Development*, 38, 113-126.
- Aronfreed, J. (1968). *Conduct and conscience: The socialization of internalized control over behavior*. New York: Academic Press.
- Aronson, E., Blaney, N., Stephan, C., Sikes, J., & Snapp, M. (1978). *The jigsaw classroom*. Beverly Hills: Sage.
- Azmitia, M. (1988). Peer interaction and problem solving: When are two heads better than one? *Child Development*, 59, 87-96.
- Azmitia, M. (1996). Peer interactive minds. In P. B. Baltes & U. M. Staudinger (Eds.), *Interactive minds*. Cambridge, England: Cambridge University Press.
- Azmitia, M., & Hesser, J. (1993). Why siblings are important agents of cognitive development: A comparison of siblings and peers. *Child Development*, 64, 430-444.
- Azmitia, M., & Montgomery, R. (1993). Friendship, transactive dialogues, and the development of scientific reasoning. *Social Development*, 2, 202-221.
- Azmitia, M., & Perlmutter, M. (1989). Social influences on children's cognition: State of the art and future directions. In H. Reese (Ed.), *Advances in child development and behavior* (Vol. 22, pp. 89-144). Orlando, FL: Academic Press.
- Baker-Sennett, J., Matusov, E., & Rogoff, B. (1992). Socio-cultural processes of creative planning in children's play-crafting. In P. Light & G. Buterworth (Eds.), *Context and cognition: Ways of learning and knowing* (pp. 93-114). New York: Harvester Wheatsheaf.
- Bakhtin, M. M. (1981). In M. Holquist (Ed.), *The dialogical imagination*. Austin: University of Texas Press.
- Bakhurst, D. (1988). Activity, consciousness and communication. *Newsletter of the Laboratory for Comparative Human Cognition*, 10, 31-39.
- Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory*. Englewood Cliffs, NJ: Prentice-Hall.
- Bartlett, L., Goodman Turkkanis, C., & Rogoff, B. (in press). *Learning as a community*. New York: Oxford University Press.
- Barton, M. E., & Tomasello, M. (1994). The rest of the family: The role of fathers and siblings in early language development. In C. Gallway & B. J. Richards (Eds.), *Input and interaction in language acquisition* (pp. 109-134). New York: Cambridge University Press.
- Basili, P. A., & Sanford, J. P. (1991). Conceptual change strategies and cooperative group work in chemistry. *Journal of Research in Science Teaching*, 28, 293-304.
- Bearison, D. J. (1991). Interactional contexts of cognitive development: Piagetian approaches to sociogenesis. In L. T. Landesman (Ed.), *Culture, schooling, and psychological development* (pp. 56-70). Norwood, NJ: ALEX.
- Beebe, B., Jaffe, J., Feldstein, S., Mays, K., & Alson, D. (1985). Interpersonal timing: The application of an adult dialogue model to mother-infant vocal and kinesic interactions. In T. M. Field & N. Fox (Eds.), *Social perception in infants* (pp. 217-247). Norwood, NJ: ALEX.
- Bellinger, D. (1979). Changes in the explicitness of mothers' directives as children age. *Journal of Child Language*, 6, 443-458.
- Bennett, N., & Dunne, E. (1991). The nature and quality of talk in co-operative classroom groups. *Learning and Instruction*, 11, 103-118.
- Berger, P. L., & Luckmann, T. (1966). *The social construction of reality*. New York: Doubleday.
- Berkowitz, M. W., & Gibbs, J. C. (1985). The process of moral conflict resolution and moral development. In M. W. Berkowitz (Ed.), *Peer conflict and psychological growth* (pp. 71-84). San Francisco: Jossey-Bass.
- Bernstein, L. E. (1981). Language as a product of dialogue. *Discourse Processes*, 4, 117-147.
- Blount, B. G. (1972). Parental speech and language acquisition: Some Luo and Samoan examples. *Anthropological Linguistics*, 14, 119-130.
- Bornstein, M. H. (1988). Mothers, infants, and the development of cognitive competence. In H. E. Fitzgerald, B. M. Lester, & M. W. Yogman (Eds.), *Theory and research in behavioral pediatrics* (Vol. 4, pp. 67-99). New York: Plenum Press.
- Bos, M. C. (1937). Experimental study of productive collaboration. *Acta Psychologica*, 3, 315-426.
- Brandt, R. S. (Ed.). (1991). *Cooperative learning and the collaborative school*. Alexandria, VA: Association for Supervision and Curriculum Development.
- Brazelton, T. B. (1983). Precursors for the development of emotions in early infancy. In R. Plutchik & H. Kellerman (Eds.), *Emotion: Theory, research, and experience* (Vol. 2, pp. 35-55). New York: Academic Press.
- Bretherton, I. (Ed.). (1984). *Symbolic play: The development of social understanding*. Orlando, FL: Academic Press.
- Bretherton, I., McNew, S., & Beeghly-Smith, M. (1981). Early person knowledge as expressed in gestural and verbal communication: When do infants acquire a "theory of mind"? In M. E. Lamb & L. R. Sherrod (Eds.), *Infant social cognition* (pp. 333-373). Hillsdale, NJ: Erlbaum.

- Brown, A. L. (1994). The advancement of learning. *Educational Researcher*, 23, 4-12.
- Brown, A. L., Ash, D., Rutherford, M., Nakagawa, K., Gordon, A., & Campione, J. C. (1993). Distributed expertise in the classroom. In G. Salomon (Ed.), *Distributed cognitions: Psychological and educational considerations* (pp. 188-228). New York: Cambridge University Press.
- Brown, A. L., & Campione, J. C. (1984). Three faces of transfer: Implications for early competence, individual differences, and instruction. In M. E. Lamb, A. L. Brown, & B. Rogoff (Eds.), *Advances in developmental psychology* (Vol. 3, pp. 143-192). Hillsdale, NJ: Erlbaum.
- Brown, A. L., & Campione, J. C. (1990). Communities of learning and thinking, or a context by any other name. In D. Kuhn (Ed.), *Developmental perspectives on teaching and learning thinking skills: Contributions in human development* (Vol. 21, pp. 108-126). Basel: Karger.
- Brown, A. L., & Palincsar, A. S. (1989). Guided, cooperative learning and individual knowledge acquisition. In L. B. Resnick (Ed.), *Knowing, learning, and instruction*. Hillsdale, NJ: Erlbaum.
- Brown, A. L., & Reeve, R. A. (1987). Bandwidths of competence: The role of supportive contexts in learning and development. In L. S. Liben (Ed.), *Development and learning: Conflict or congruence?* (pp. 173-223). Hillsdale, NJ: Erlbaum.
- Brown, J. S., Collins, A., & Duguid, P. (1989). Situated cognition and the culture of learning. *Educational Researcher*, 18, 32-42.
- Brown, J. S., & Duguid, P. (1994). Borderline issues: Social and material aspects of design. *Human-Computer Interaction*, 9, 3-36.
- Brownell, C. A., & Carriger, M. S. (1991). Collaborations among toddler peers. In L. B. Resnick, J. M. Levine, & S. D. Teasley (Eds.), *Perspectives on socially shared cognition* (pp. 365-383). Washington, DC: American Psychological Association.
- Bruffee, K. A. (1993). *Collaborative learning. Higher education, interdependence, and the authority of knowledge*. Baltimore, MD: Johns Hopkins University Press.
- Bruner, J. S. (1978). The child's conception of language. In A. Sinclair, R. J. Jarvella, & W. J. M. Levelt (Eds.), *The child's conception of language* (pp. 241-256). Berlin: Springer-Verlag.
- Bruner, J. S. (1983). *Child's talk: Learning to use language*. New York: Norton.
- Bruner, J. S. (1987). The transactional self. In J. Bruner & H. Haste (Eds.), *Making sense: The child's construction of the world* (pp. 81-96). London: Methuen.
- Butterworth, G. (1987). Some benefits of egocentrism. In J. Bruner & H. Haste (Eds.), *Making sense: The child's construction of the world* (pp. 62-80). London: Methuen.
- Butterworth, G., & Cochran, G. (1980). Towards a mechanism of joint visual attention in human infancy. *International Journal of Behavioral Development*, 3, 253-272.
- Callanan, M. A. (1985). How parents label objects for young children: The role of input in the acquisition of category hierarchies. *Child Development*, 56, 508-523.
- Callanan, M. A. (1991). Parent-child collaboration in young children's understanding of category hierarchies. In S. A. Gelman & J. P. Byrnes (Eds.), *Perspectives on language and thought: Interrelations in development* (pp. 440-484). Cambridge, England: Cambridge University Press.
- Camaioni, L., de Castro Campos, M. F. P., & deLemos, C. (1984). On the failure of the interactionist paradigm in language acquisition: A re-evaluation. In W. Doise & A. Palmonari (Eds.), *Social interaction in individual development* (pp. 93-106). Cambridge, England: Cambridge University Press.
- Carew, J. V. (1980). Experience and the development of intelligence in young children at home and in day care. *Monographs of the Society for Research in Child Development*, 45(6/7, Serial No. 187).
- Cazden, C. B. (1979). Peek-a-boo as an instructional model: Discourse development at home and at school. In *Papers and reports on child language development* (No. 17). Department of Linguistics, Stanford University, Stanford, CA.
- Cazden, C. B., Cox, M., Dickinson, D., Steinberg, Z., & Stone, C. (1979). You all gonna hafta listen: Peer teaching in a primary classroom. In W. Collins (Ed.), *Children's language and communication: The Minnesota Symposium on Child Psychology* (Vol. 12, pp. 183-231). Hillsdale, NJ: Erlbaum.
- Churcher, J., & Scaife, M. (1982). How infants see the point. In G. Butterworth & P. Light (Eds.), *Social cognition: Studies of the development of understanding* (pp. 110-136). Chicago: University of Chicago Press.
- Cicirelli, V. G. (1976). Siblings teaching siblings. In V. Allen (Ed.), *Children as teachers: Theory and research on tutoring* (pp. 99-111). New York: Academic Press.
- Clark, H. H., & Wilkes-Gibbs, D. (1986). Referring as a collaborative process. *Cognition*, 22, 1-39.
- Clay, M. M., & Cazden, C. B. (1990). A Vygotskian interpretation of Reading Recovery. In L. Moll (Ed.), *Vygotsky and education* (pp. 206-222). Cambridge, England: Cambridge University Press.
- Clokey, M., Cryns, T., & Johnston, M. (in press). Teachers learning together. In L. Bartlett, C. Goodman Turkkanis, & B. Rogoff (Eds.), *Learning as a community*. New York: Oxford University Press.
- Cole, M. (1985). The zone of proximal development: Where culture and cognition create each other. In J. V. Wertsch (Ed.), *Culture, communication, and cognition: Vygotskian perspectives*

- (pp. 146-161). Cambridge, England: Cambridge University Press.
- Cole, M. (1990). Cognitive development and formal schooling: The evidence from cross-cultural research. In L. C. Moll (Ed.), *Vygotsky and education* (pp. 89-110). Cambridge, England: Cambridge University Press.
- Cole, M., & Griffin, P. (1980). Cultural amplifiers reconsidered. In D. R. Olson (Ed.), *The social foundations of language and thought* (pp. 343-364). New York: Norton.
- Cole, M., & Means, B. (1981). *Comparative studies of how people think: An introduction*. Cambridge, MA: Harvard University Press.
- Collins, A., & Stevens, A. L. (1982). Goals and strategies of inquiry teachers. In R. Glaser (Ed.), *Advances in instructional psychology* (Vol. 2, pp. 65-119). Hillsdale, NJ: Erlbaum.
- Cooper, C. R. (1980). Development of collaborative problem solving among preschool children. *Developmental Psychology*, 16, 433-440.
- Cooper, C. R., Marquis, A., & Edward, D. (1986). Four perspectives on peer learning among elementary school children. In E. C. Mueller & C. R. Cooper (Eds.), *Process and outcome in peer relationships* (pp. 269-300). Orlando, FL: Academic Press.
- Corsaro, W. A., & Rizzo, T. A. (1988). *Discussion and friendship: Socialization processes in the peer culture of Italian nursery school children*. *American Sociological Review*, 53, 879-894.
- Cronbach, L. J. (1975). Beyond the two disciplines of scientific psychology. *American Psychologist*, 30, 116-127.
- Crook, C. (1994). *Computers and the collaborative experience of learning*. London: Routledge & Kegan Paul.
- Cuban, L. (1984). *How teachers taught: Constancy and change in American classrooms, 1890-1980*. New York: Longman.
- Daiute, C., & Dalton, B. (1993). Collaboration between children learning to write: Can novices be masters? *Cognition and Instruction*, 10, 281-333.
- Damon, W. (1984). Peer education: The untapped potential. *Journal of Applied Developmental Psychology*, 5, 331-343.
- Damon, W., & Phelps, E. (1987, June). *Peer collaboration as a context for cognitive growth*. Paper presented at Tel Aviv University School of Education, Tel Aviv.
- DeLoache, J. S. (1984). What's this? Maternal questions in joint picturebook reading with toddlers. *Quarterly Newsletter of the Laboratory for Comparative Human Cognition*, 6, 87-95.
- Dewey, J. (1916). *Democracy and education*. New York: Macmillan.
- Dewey, J. (1938). *Experience and education*. New York: Macmillan.
- Dewey, J., & Bentley, A. F. (1949). *Knowing and the known*. Boston: Beacon Press.
- Dunbar, K. (1995). How scientists really reason: Scientific reasoning in real-world laboratories. In R. J. Sternberg & J. E. Davidson (Eds.), *The nature of insight* (pp. 365-395). Cambridge, MA: MIT Press.
- Dunham, P. J., Dunham, F., & Curwin, A. (1993). Joint-attentional states and lexical acquisition at 18 months. *Developmental Psychology*, 29, 827-831.
- Dunn, J., & Dale, N. (1984). I a daddy: Two-year-olds' collaboration in joint pretend with sibling and with mother. In I. Bretherton (Ed.), *Symbolic play: The development of social understanding* (pp. 131-158). Orlando, FL: Academic.
- Duran, R. P. (1994). Cooperative learning for language minority students. In R. A. DeVillar, C. J. Faltis, & J. Cummins (Eds.), *Cultural diversity in schools: From rhetoric to practice* (pp. 145-159). Buffalo, NY: SUNY Press.
- Duran, R. T., & Gauvain, M. (1993). The role of age versus expertise in peer collaboration during joint planning. *Journal of Experimental Child Psychology*, 55, 227-242.
- Eccles, J. S., Buchanan, C. M., Flanagan, C., Futigni, A., Midgley, C., & Yee, D. (1991). Control versus autonomy during early adolescence. *Journal of Social Issues*, 47, 53-68.
- Eckerman, C. O., Whatley, J. L., & McGhee, L. J. (1979). Approaching and contacting the object another manipulates: A social skill of the 1-year-old. *Developmental Psychology*, 15, 585-593.
- Edwards, D. (1993). But what do children really think?: Discourse analysis and conceptual content in children's talk. *Cognition and Instruction*, 11, 207-225.
- Eisenberg, A. R. (1985). Learning to describe past experiences in conversation. *Discourse Processes*, 8, 177-204.
- Elbers, E. (1991). The development of competence and its social context. *Educational Psychology Review*, 3, 73-94.
- Ellis, S., & Gauvain, M. (1992). Social and cultural influences on children's collaborative interactions. In L. T. Winegar & J. Valsiner (Eds.), *Children's development within social context* (Vol. 2, pp. 155-180). Hillsdale, NJ: Erlbaum.
- Ellis, S., Klahr, D., & Siegler, R. S. (1993, March). *Effects of feedback and collaboration on changes in children's use of mathematical rules*. Paper presented at the meetings of the Society for Research in Child Development, New Orleans.
- Ellis, S., Klahr, D., & Siegler, R. S. (1994, April). *The birth, life, and sometimes death of good ideas in collaborative problem-solving*. Paper presented at the meetings of the American Educational Research Association, New Orleans.
- Ellis, S., & Rogoff, B. (1982). The strategies and efficacy of child versus adult teachers. *Child Development*, 53, 730-735.
- Ellis, S., & Rogoff, B. (1986). Problem solving in children's management of instruction. In E. Mueller & C. Cooper (Eds.), *Process and outcome in peer relationships* (pp. 301-325). Orlando, FL: Academic.

- Engeström, Y. (1993). Developmental studies of work as a test-bench of activity theory: The case of primary care medical practice. In S. Chaiklin & J. Lave (Eds.), *Understanding practice: Perspectives on activity and context* (pp. 64-103). Cambridge, England: Cambridge University Press.
- Feinman, S. (1982). Social referencing in infancy. *Merrill-Palmer Quarterly*, 28, 445-470.
- Feinman, S., & Lewis, M. (1983). Is there social life beyond the dyad? A social psychological view of social connections in infancy. In M. Lewis (Ed.), *Beyond the dyad* (pp. 13-41). New York: Plenum Press.
- Feiring, C., Lewis, M., & Starr, M. D. (1983, April). *Indirect effects and infants' reaction to strangers*. Paper presented at the meetings of the Society for Research in Child Development, Detroit.
- Fernald, A. (1988, November). *The universal language: Infants' responsiveness to emotion in the voice*. Paper presented at the Developmental Psychology Program, Stanford University, Stanford, CA.
- Ferrier, L. (1978). Word, context and imitation. In A. Lock (Ed.), *Action, gesture and symbol: The emergence of language* (pp. 471-483). New York: Academic.
- Fisher, R. (1969). An each one teach one approach to music notation. *Grade Teacher*, 86, 120.
- Fivush, R. (1988). *Form and function in early autobiographical memory*. Unpublished manuscript, Emory University, Atlanta.
- Fonzi, A., & Smorti, A. (1994). Narrative and logical strategies in socio-cognitive interaction between children. *International Journal of Behavioral Development*, 17, 383-395.
- Foot, H. C., Shute, R. H., Morgan, M. J., & Barron, A. -M. (1990). Theoretical issues in peer tutoring. In H. C. Foot, M. J. Morgan, & R. H. Shute (Eds.), *Children helping children*. New York: Wiley.
- Forbes, D., Katz, M. M., & Paul, B. (1986). "Frame talk": A dramatic analysis of children's fantasy play. In E. C. Mueller & C. R. Cooper (Eds.), *Process and outcome in peer relationships* (pp. 249-265). Orlando, FL: Academic Press.
- Forman, E. A. (1987). Learning through peer interaction: A Vygotskian perspective. *Genetic Epistemologist*, 15, 6-15.
- Forman, E. A., & Cazden, C. B. (1985). Exploring Vygotskian perspectives in education: The cognitive value of peer interaction. In J. V. Wertsch (Ed.), *Culture, communication, and cognition: Vygotskian perspectives* (pp. 323-347). Cambridge, England: Cambridge University Press.
- Forman, E. A., & Kraker, M. J. (1985). The social origins of logic: The contributions of Piaget and Vygotsky. In M. W. Berkowitz (Ed.), *Peer conflict and psychological growth* (pp. 23-39). San Francisco: Jossey-Bass.
- Forman, E. A., & McPhail, J. (1993). A Vygotskian perspective on children's collaborative problem-solving activities. In E. A. Forman, N. Minick, & C. A. Stone (Eds.), *Contexts for learning: Sociocultural dynamics in children's development* (pp. 213-229). New York: Oxford University Press.
- Fox, B. A. (1988). *Cognitive and interactional aspects of correction in tutoring* (Tech. Rep. No. 88-2). Institute of Cognitive Science, University of Colorado, Boulder.
- Fox, B. A. (1993). *The Human Tutorial Dialogue Project: Issues in the design of instructional systems*. Hillsdale, NJ: Erlbaum.
- Frederiksen, J. R., & Collins, A. (1989). A systems approach to educational testing. *Educational Researcher*, 18, 27-32.
- French, L. (1987). *Effects of partner and setting on young children's discourse: A case study*. Unpublished manuscript, University of Rochester, New York.
- Freund, L. S. (1990). Maternal regulation of children's problem-solving behavior and its impact on children's performance. *Child Development*, 61, 113-126.
- Garvey, C. (1986). Peer relations and the growth of communication. In E. C. Mueller & C. R. Cooper (Eds.), *Process and outcome in peer relationships* (pp. 329-345). Orlando, FL: Academic Press.
- Gauvain, M. (1992). Social influences on the development of planning in advance and during action. *International Journal of Behavioral Development*, 15, 377-398.
- Gauvain, M. (1993). Spatial thinking and its development in sociocultural context. *Annals of Child Development*, 9, 67-102.
- Gauvain, M. (1994, August). *Spatial planning, peer collaboration, and the problem of the Konigsberg bridges*. Paper presented at the meetings of the American Psychological Association, Los Angeles.
- Gauvain, M. (1995). Influence of the purpose of an interaction on adult-child planning. *Infancia y Aprendizaje*, 69-70, 141-155.
- Gauvain, M., & Rogoff, B. (1989). Collaborative problem solving and children's planning skills. *Developmental Psychology*, 25, 139-151.
- Gearhart, M. (1979, March). *Social planning: Role play in a novel situation*. Paper presented at the meetings of the Society for Research in Child Development, San Francisco.
- Gellatly, A. (1989). The myth of cognitive diagnostics. In A. Gellatly, D. Rogers, & J. A. Sloboda (Eds.), *Cognition and social worlds* (pp. 113-131). Oxford, England: Clarendon Press.
- Giaconia, R. M., & Hedges, L. V. (1982). Identifying features of effective open education. *Review of Educational Research*, 52, 579-602.
- Gibson, E. J. (1982). The concept of affordances in development: The renaissance of functionalism. In W. A. Collins (Ed.), *Minnesota Symposium of Child Psychology* (Vol. 1, pp. 55-81). Hillsdale, NJ: Erlbaum.
- Gibson, J. J. (1979). *The ecological approach to visual perception*. Boston: Houghton Mifflin.

- Gillam, A., Callaway, S., & Wikoff, K. H. (1994). The role of authority and the authority of roles in peer writing tutorials. *Journal of Teaching Writing*, 12, 161-198.
- Glachan, M., & Light, P. (1982). Peer interaction and learning: Can two wrongs make a right? In G. Butterworth & P. Light (Eds.), *Social cognition: Studies of the development of understanding* (pp. 238-262). Brighton, England: Harvester Press.
- Goldsmith, D., & Rogoff, B. (1995). Sensitivity and teaching by dysphoric and nondysphoric women in structured versus unstructured situations. *Developmental Psychology*, 31, 388-394.
- Goldsmith, D., & Rogoff, B. (1997). Mothers' and toddlers' coordinated joint focus of attention: Variations with maternal dysphoric symptoms. *Developmental Psychology*, 33, 113-119.
- Göncü, A. (1987). Toward an interactional model of developmental changes in social pretend play. In L. G. Katz & K. Steiner (Eds.), *Current topics in early childhood education* (Vol. 7, pp. 126-149). Norwood, NJ: ALEX.
- Göncü, A., & Rogoff, B. (submitted). *Children's categorization with varying adult support*. Manuscript submitted for publication.
- Goodnow, J. J. (1976). The nature of intelligent behavior: Questions raised by cross-cultural studies. In L. B. Resnick (Ed.), *The nature of intelligence*. (pp. 169-188). Hillsdale, NJ: Erlbaum.
- Goodnow, J. J. (1987, November). *The socialization of cognition: What's involved?* Paper presented at the conference on Culture and Human Development, Chicago.
- Goody, E. N. (1989). Learning, apprenticeship and the division of labor. In M. W. Coy (Ed.), *Apprenticeship: From theory to method and back again* (pp. 233-256). Albany: State University of New York Press.
- Graves, L. N. (1992). Cooperative learning communities: Context for a new vision of education and society. *Journal of Education*, 174, 57-79.
- Graves, Z. R., & Glick, J. (1978). The effect of context on mother-child interaction. *Quarterly Newsletter of the Institute for Comparative Human Development*, 2, 41-46.
- Greene, M. (1986). Philosophy and teaching. In M. C. Wittrock (Ed.), *Handbook of research on teaching* (3rd ed., pp. 479-501). New York: Macmillan.
- Greenfield, P. M. (1984). A theory of the teacher in the learning activities of everyday life. In B. Rogoff & J. Lave (Eds.), *Everyday cognition: Its development in social context* (pp. 117-138). Cambridge, MA: Harvard University Press.
- Greenfield, P. M., & Smith, J. (1976). *The structure of communication in early language development*. New York: Academic Press.
- Griffin, P., & Cole, M. (1984). Current activity for the future: The zo-ped. In B. Rogoff & J. V. Wertsch (Eds.), *Children's learning in the "zone of proximal development"* (pp. 45-64). San Francisco: Jossey-Bass.
- Gunnar, M. R., & Stone, C. (1984). The effects of positive maternal affect on infant responses to pleasant, ambiguous, and fear-provoking toys. *Child Development*, 55, 1231-1236.
- Gutierrez, K., Kreuter, B., & Larson, J. (1995). Script, counter-script and underlife in the classroom: James Brown vs. *Brown vs. the Board of Education*. *Harvard Education Review*, 65, 445-471.
- Harding, C. G. (1982). *Prelanguage vocalizations and words*. Paper presented at the International Conference on Infant Studies, Austin, TX.
- Harkness, S., & Super, C. M. (1977). Why African children are so hard to test. In L. L. Adler (Ed.), *Issues in cross-cultural research*. *Annals of the New York Academy of Sciences*, 285, 326-331.
- Hartup, W. W. (1977, Fall). Peers, play, and pathology: A new look at the social behavior of children. *Newsletter of the Society for Research in Child Development*.
- Hatano, G. (1994). Introduction: Conceptual change—Japanese perspectives. *Human Development*, 37, 189-197.
- Hatano, G., & Inagaki, K. (1991). Sharing cognition through collective comprehension activity. In L. B. Resnick, J. M. Levine, & S. D. Teasley (Eds.), *Perspectives on socially shared cognition* (pp. 331-348). Washington, DC: American Psychological Association.
- Hawkins, J. (1987, April). *Collaboration and dissent*. Paper presented at the meetings of the Society for Research in Child Development, Baltimore.
- Hay, D. F. (1980). Multiple functions of proximity seeking in infancy. *Child Development*, 51, 636-645.
- Hay, D. F., Murray, P., Cecire, S., & Nash, A. (1985). Social learning of social behavior in early life. *Child Development*, 56, 43-57.
- Haynes, N. M., & Gebreyesus, S. (1992). Cooperative learning: A case for African American students. *School Psychology Review*, 21, 577-585.
- Heath, S. B. (1983). *Ways with words: Language, life, and work in communities and classrooms*. Cambridge, England: Cambridge University Press.
- Heber, M. (1981). Instruction versus conversation as opportunities for learning. In W. P. Robinson (Ed.), *Communication in development* (pp. 183-202). London: Academic Press.
- Heckhausen, J. (1984). *Mother-infant dyads in joint object-centered action*. Unpublished doctoral dissertation, University of Strathclyde, Glasgow.
- Henderson, B. B. (1984). Parents and exploration: The effect of context on individual differences in exploratory behavior. *Child Development*, 55, 1237-1245.

- Hennessey, S. (1993). Situated cognition and cognitive apprenticeship: Implications for classroom learning. *Studies in Science and Education*, 22, 1-41.
- Hodapp, R. M., Goldfield, E. C., & Boyatzis, C. J. (1984). The use and effectiveness of maternal scaffolding in mother-infant games. *Child Development*, 55, 772-781.
- Hoff-Ginsberg, E., & Shatz, M. (1982). Linguistic input and the child's acquisition of language. *Psychological Bulletin*, 92, 3-26.
- Hollos, M. (1980). Collective education in Hungary: The development of competitive, cooperative and role-taking behaviors. *Ethos*, 8, 3-23.
- Holloway, S. (1992). A potential wolf in sheep's clothing: The ambiguity of "cooperation." *Journal of Education*, 174, 80-99.
- Hooper, S., Temiyakarn, C., & Williams, M. D. (1993). The effects of cooperative learning and learner control on high- and average-ability students. *Educational Technology Research and Development*, 41, 5-18.
- Howe, C., Tolmie, A., & Rodgers, C. (1990). Physics in the primary school: Peer interaction and the understanding of floating and sinking. *European Journal of Psychology of Education*, 5, 459-475.
- Huber, G. L., & Eppler, R. (1990). Team learning in German classrooms: Processes and outcomes. In S. Sharan (Ed.), *Cooperative learning: Theory and research* (pp. 151-171). New York: Praeger.
- Hutchins, E. (1995). *Cognition in the wild*. Cambridge, MA: MIT Press.
- Irvine, J. T. (1978). Wolof "magical thinking": Culture and conservation revisited. *Journal of Cross-Cultural Psychology*, 9, 300-310.
- Johnson, D. W., & Johnson, R. T. (1987). *Learning together and alone: Cooperative, competitive, and individualistic learning* (2nd ed.). Englewood Cliffs, NJ: Prentice-Hall.
- Johnson, D. W., & Johnson, R. T. (1989). *Cooperation and competition: Theory and research*. Edina, MN: Interaction.
- Johnson, D. W., & Johnson, R. T. (1990). Cooperative learning and achievement. In S. Sharan (Ed.), *Cooperative learning: Theory and research* (pp. 23-37). New York: Praeger.
- Johnson, D. W., Johnson, R. T., Stanne, M. B., & Garibaldi, A. (1989). Impact of goal and resource interdependence on problem-solving success. *Journal of Social Psychology*, 129, 621-629.
- Johnson, D. W., Johnson, R. T., & Taylor, B. (1993). Impact of cooperative and individualistic learning on high-ability students' achievement, self-esteem, and social acceptance. *Journal of Social Psychology*, 133, 839-844.
- John-Steiner, V. (1985). *Notebooks of the mind: Explorations of thinking*. Albuquerque: University of New Mexico Press.
- John-Steiner, V. (1992). Creative lives, creative tensions. *Creativity Research Journal*, 5, 99-108.
- John-Steiner, V., & Tatter, P. (1983). An interactionist model of language development. In B. Bain (Ed.), *The sociogenesis of language and human conduct* (pp. 79-97). New York: Plenum Press.
- Kaye, K. (1977). Infants' effects upon their mothers' teaching strategies. In J. D. Glidewell (Ed.), *The social context of learning and development* (pp. 173-206). New York: Gardner Press.
- Kaye, K. (1982). Organism, apprentice, and person. In E. Z. Tronick (Ed.), *Social interchange in infancy* (pp. 183-196). Baltimore: University Park Press.
- Kelley, L., & Sutton-Smith, B. (1987). A study of infant musical productivity. In J. C. Peery, I. W. Peery, & W. Thomas (Eds.), *Music and child development* (pp. 35-53). New York: Springer-Verlag.
- Kindermann, T., & Valsiner, J. (1989). Strategies for empirical research in context-inclusive developmental psychology. In J. Valsiner (Ed.), *Child development in cultural context* (pp. 13-50). Toronto: Hogrefe & Huber.
- Knight, G. P., & Bohlmeyer, E. M. (1990). Cooperative learning and achievement: Methods for assessing causal mechanisms. In S. Sharan (Ed.), *Cooperative learning*. New York: Praeger.
- Kobayashi, Y. (1994). Conceptual acquisition and change through social interaction. *Human Development*, 37, 233-241.
- Koester, L. S., & Bueche, N. A. (1980). Preschoolers as teachers: When children are seen but not heard. *Child Study Journal*, 10, 107-118.
- Kohn, A. (1992). Resistance to cooperative learning: Making sense of its deletion and dilution. *Journal of Education*, 174, 38-56.
- Kohn, A. (1993, September). Choices for children: Why and how to let students decide. *Phi Delta Kappan*, 8-20.
- Kozulin, A. (1990). *Vygotsky's psychology: A biography of ideas*. New York: Harvester Wheatsheaf.
- Kruger, A. C. (1992). The effect of peer and adult-child transactive discussions on moral reasoning. *Merrill-Palmer Quarterly*, 38, 191-211.
- Kruger, A. C. (1993). Peer collaboration: Conflict, collaboration, or both? *Social Development*, 2, 165-182.
- Kruger, A. C. (1994). Task influences on spontaneous peer learning in the classroom. In H. C. Foot, C. J. Howe, A. Anderson, A. K. Tolmie, & D. A. Warden (Eds.), *Group and interactive learning* (pp. 459-464). Southampton, England: Computational Mechanics.
- Kruger, A. C., & Tomasello, M. (1986). Transactive discussions with peers and adults. *Developmental Psychology*, 22, 681-685.

- Kruper, J. C., & Uzgiris, I. C. (1985, April). *Fathers' and mothers' speech to infants*. Paper presented at the meetings of the Society for Research in Child Development, Toronto.
- Kuhn, D. (1972). Mechanisms of change in the development of cognitive structures. *Child Development*, *43*, 833-842.
- Kuhn, D. (1995). Microgenetic study of change: What has it told us? *Psychological Science*, *6*, 133-139.
- Kvale, S. (1977). Dialectics and research on remembering. In N. Datan & H. W. Reese (Eds.), *Life-span developmental psychology: Dialectical perspectives on experimental research* (pp. 165-189). New York: Academic Press.
- Laboratory of Comparative Human Cognition. (1983). Culture and cognitive development. In P. H. Mussen (Series Ed.) & W. Kessen (Vol. Ed.), *Handbook of child psychology: Vol. 1. History, theory, and methods* (pp. 294-356). New York: Wiley.
- Lacasa, P., Herranz-Ybarra, P., Martín-del-Campo, B., & Pardo-de-León, P. (1994, July). *The role of children's goals when they plan texts together in the classroom*. Paper presented at the International Congress of Applied Psychology, Madrid.
- Lacasa, P., & Villuendas, D. (1990). Adult-child and peer relationship: Action, representation, and learning process. *Learning and Instruction*, *2*, 75-93.
- Lamphere, L. (1977). *To run after them: Cultural and social bases of cooperation in a Navajo community*. Tucson: University of Arizona Press.
- Lancy, D. F. (1980). Play in species adaptation. *Annual Review of Anthropology*, *9*, 471-495.
- Lave, J. (1988a, May). *The culture of acquisition and the practice of understanding* (Rep. No. IRL 88-0007). Palo Alto, CA: Institute for Research on Learning.
- Lave, J. (1988b). *Cognition in practice*. Cambridge, England: Cambridge University Press.
- Lave, J., & Wenger, E. (1991). *Situated learning: Legitimate peripheral participation*. Cambridge, England: Cambridge University Press.
- Lazarowitz, R., & Karsenty, G. (1990). Cooperative learning and students' academic achievement, process skills, learning environment, and self-esteem in tenth-grade biology classrooms. In S. Sharan (Ed.), *Cooperative learning: Theory and research* (pp. 123-149). New York: Praeger.
- Lempers, J. D. (1979). Young children's production and comprehension of nonverbal deictic behaviors. *Journal of Genetic Psychology*, *135*, 93-102.
- Leont'ev, A. N. (1981). The problem of activity in psychology. In J. V. Wertsch (Ed.), *The concept of activity in Soviet psychology* (pp. 37-71). Armonk, NY: Sharpe.
- Lerner, G. H. (1993). Collectivities in action: Establishing the relevance of conjoined participation in conversation. *Text*, *13*, 213-245.
- Levin, I., & Druyan, S. (1993). When sociocognitive transaction among peers fails: The case of misconceptions in science. *Child Development*, *64*, 1571-1591.
- Lewis, M., & Feiring, C. (1981). Direct and indirect interactions in social relationships. In L. P. Lipsett (Ed.), *Advances in infancy research* (Vol. 1, pp. 129-161). Norwood, NJ: ABLEX.
- Light, P., Foot, T., Colbourn, C., & McClelland, I. (1987). Collaborative interactions at the microcomputer keyboard. *Educational Psychology*, *7*, 13-21.
- Light, P., & Glachan, M. (1985). Facilitation of individual problem solving through peer interaction. *Educational Psychology*, *5*, 217-225.
- Light, P., Littleton, K., Messer, D., & Joiner, R. (1994). Social and communicative processes in computer-based problem solving. *European Journal of Psychology of Education*, *9*, 93-109.
- Litowitz, B. E. (1993). Deconstruction in the zone of proximal development. In E. A. Forman, N. Minick, & C. A. Stone (Eds.), *Contexts for learning* (pp. 184-196). New York: Oxford University Press.
- Little Soldier, L. (1989). Cooperative learning and the Native American student. *Phi Delta Kappan*, *71*, 161-163.
- Lock, A. (1978). The emergence of language. In A. Lock (Ed.), *Action, gesture and symbol: The emergence of language* (pp. 3-18). London: Academic Press.
- Lomov, B. F. (1978). Psychological processes and communication. *Soviet Psychology*, *17*, 3-22.
- Lubomudrov, C. (in press). Decision making in a learning community. In L. Bartlett, C. Goodman Turkkanis, & B. Rogoff (Eds.), *Learning as a community*. New York: Oxford University Press.
- Luria, A. R. (1987). Afterword to the Russian edition. In R. W. Rieber & A. S. Carton (Eds.), *The collected works of L. S. Vygotsky: Vol. 1, Problems of general psychology* (pp. 359-373). New York: Plenum Press.
- Lutz, C., & LeVine, R. A. (1982). Culture and intelligence in infancy: An ethnopsychological view. In M. Lewis (Ed.), *Origins of intelligence: Infancy and early childhood* (pp. 1-28). New York: Plenum Press.
- MacLachlan, P. (1989). Dialogue between Charlotte Zolotow and Patricia MacLachlan. *Horn Book*, *65*, 740-741.
- Magkaev, V. K. (1977). An experimental study of the planning function of thinking in young schoolchildren. In M. Cole (Ed.), *Soviet developmental psychology: An anthology* (pp. 606-620). White Plains, NY: Sharpe.
- Manning, M. L., & Lucking, R. (1993). Cooperative learning and multicultural classrooms. *Clearing House*, *67*, 12-16.
- Mannle, S., & Tomasello, M. (1989). Fathers, siblings, and the Bridge Hypothesis. In K. Nelson & A. van Kleeck (Eds.),

- Children's language* (Vol. 6, pp. 23-42). Hillsdale, NJ: Erlbaum.
- Martinez, M. A. (1987). Dialogues among children and between children and their mothers. *Child Development*, 58, 1035-1043.
- Martini, M. (1994). Peer interactions in Polynesia: A view from the Marquesas. In J. L. Roopnarine, J. E. Johnson, & F. H. Hooper (Eds.), *Children's play in diverse cultures*. Albany, NY: SUNY Press.
- Martini, M., & Kirkpatrick, J. (1981). Early interactions in the Marquesas Islands. In T. M. Fields, A. M. Sostek, P. Vietze, & P. H. Leiderman (Eds.), *Culture and early interactions* (pp. 189-213). Hillsdale, NJ: Erlbaum.
- Martini, M., & Kirkpatrick, J. (1992). Parenting in Polynesia: A view from the Marquesas. In J. L. Roopnarine & D. B. Carter (Eds.), *Parent-child socialization in diverse cultures: Vol. 5. Annual advances in applied developmental psychology* (pp. 199-222). Norwood, NJ: ABLEX.
- Masur, E. F. (1982). Mothers' responses to infants' object-related gestures: Influences on lexical development. *Journal of Child Language*, 9, 23-30.
- Matusov, E. L. (1995, April). *Intersubjectivity without agreement*. Paper presented at the American Educational Research Association, San Francisco.
- Matusov, E. L., Bell, N., & Rogoff, B. (submitted). *Collaboration and assistance in problem solving by children differing in cooperative schooling backgrounds*. Manuscript submitted for publication.
- McArthur, D., Stasz, C., & Zmuidzinis, M. (1990). Tutoring techniques in algebra. *Cognition and Instruction*, 7, 197-244.
- McLane, J. B. (1987). Interaction, context, and the zone of proximal development. In M. Hickmann (Ed.), *Social and functional approaches to language and thought* (pp. 267-285). Orlando, FL: Academic Press.
- McNamee, G. D. (1980). *The social origins of narrative skills*. Unpublished doctoral dissertation, Northwestern University, Evanston, IL.
- Mehan, H. (1976). Assessing children's school performance. In J. Beck, C. Jenks, N. Keddie, & M. F. D. Young (Eds.), *Worlds apart* (pp. 161-180). London: Collier Macmillan.
- Mehan, H. (1979). *Learning lessons: Social organization in the classroom*. Cambridge, MA: Harvard University Press.
- Meloth, M. S., & Deering, P. D. (1994). Task talk and task awareness under different cooperative learning conditions. *American Educational Research Journal*, 31, 138-165.
- Mercer, N. (1995). *The guided construction of knowledge: Talk amongst teachers and learners*. Clevedon, England: Multilingual Matters.
- Merrill, D. C., Reiser, B. J., Merrill, S. K., & Landes, S. (1995). Tutoring: Guided learning by doing. *Cognition and Instruction*, 13, 315-372.
- Mervis, C. B. (1984). Early lexical development: The contributions of mother and child. In C. Sophian (Ed.), *Origins of cognitive skills* (pp. 339-370). Hillsdale, NJ: Erlbaum.
- Messer, D. J. (1980). The episodic structure of maternal speech to young children. *Journal of Child Language*, 7, 29-40.
- Messer, D. J., Joiner, R., Loveridge, N., Light, P., & Littleton, K. (1993). Influences on the effectiveness of peer interaction: Children's level of cognitive development and the relative ability of partners. *Social Development*, 2, 279-294.
- Michaels, S., & Cazden, C. B. (1986). Teacher/child collaboration as oral preparation for literacy. In B. B. Schieffelin & P. Gilmore (Eds.), *The acquisition of literacy*. Norwood, NJ: Erlbaum.
- Miller, M. (1987). Argumentation and cognition. In M. Hickmann (Ed.), *Social and functional approaches to language and thought* (pp. 225-249). Orlando, FL: Academic Press.
- Mistry, J. (1993). Cultural context in the development of children's narratives. In J. Altarriba (Ed.), *Cognition and culture: A cross-cultural approach to psychology* (pp. 207-228). New York: Elsevier.
- Mistry, J., & Rogoff, B. (in press). *Meaningful purpose in children's remembering*. Manuscript submitted for publication.
- Moll, L. C., & Whitmore, K. F. (1993). Vygotsky in classroom practice: Moving from individual transmission to social transaction. In E. A. Forman, N. Minick, & C. A. Stone (Eds.), *Contexts for learning* (pp. 19-42). New York: Oxford University Press.
- Morelli, G. A., Rogoff, B., & Angelillo, C. (submitted). *Cultural variation in children's involvement in mature activities or in specialized child activities*. Manuscript submitted for publication.
- Mosier, C. E., & Rogoff, B. (1994). Infants' instrumental use of their mothers to achieve their goals. *Child Development*, 65, 70-79.
- Mosier, C. E., & Rogoff, B. (submitted). *Cultural variation in young siblings' roles: Autonomy and responsibility*. Manuscript submitted for publication.
- Mugny, G., & Doise, W. (1978). Socio-cognitive conflict and structure of individual and collective performances. *European Journal of Social Psychology*, 8, 181-192.
- Mugny, G., Perret-Clermont, A.-N., & Doise, W. (1981). Interpersonal coordinations and social differences in the construction of the intellect. In G. M. Stephenson & J. M. Davis (Eds.), *Progress in applied psychology* (Vol. 1, pp. 315-343). New York: Wiley.
- Murray, L., & Trevarthen, C. (1985). Emotional regulation of interactions between 2-month-olds and their mothers. In

- T. M. Field & N. Fox (Eds.), *Social perception in infants* (pp. 177-197). Norwood, NJ: ABLEX.
- Nelson, J., & Aboud, F. E. (1985). The resolution of social conflict between friends. *Child Development*, 56, 1009-1017.
- Nelson, K. E. (1995, April). *Social narrative as a "cure" for childhood amnesia*. Paper presented at the meetings of the Society for Research in Child Development, Indianapolis.
- Nelson, K. E., Denninger, M. S., Bonvillian, J. D., Kaplan, B. J., & Baker, N. D. (1984). Maternal input adjustments and non-adjustments as related to children's linguistic advances and to language acquisition theories. In A. D. Pellegrini & T. D. Yawkey (Eds.), *The development of oral and written language in social contexts* (pp. 31-56). Norwood, NJ: ABLEX.
- Nelson-Le Gall, S. (1985). Help-seeking behavior in learning. In E. W. Gordon (Ed.), *Review of research in education* (Vol. 12, pp. 55-90). Washington, DC: American Educational Research Association.
- Nelson-Le Gall, S. (1992). Children's instrumental help-seeking: Its role in the social acquisition and construction of knowledge. In R. Hertz-Lazarowitz & N. Miller (Eds.), *Interaction in cooperative groups*. Cambridge, England: Cambridge University Press.
- Newman, D., Griffin, P., & Cole, M. (1984). Social constraints in laboratory and classroom tasks. In B. Rogoff & J. Lave (Eds.), *Everyday cognition: Its development in social context* (pp. 172-193). Cambridge, MA: Harvard University Press.
- Newman, D., Griffin, P., & Cole, M. (1989). *The construction zone: Working for cognitive change in school*. Cambridge, England: Cambridge University Press.
- Newson, J. (1977). An intersubjective approach to the systematic description of mother-infant interaction. In H. R. Schaffer (Ed.), *Studies in mother-infant interaction* (pp. 47-61). New York: Academic Press.
- Newson, J., & Newson, E. (1975). Intersubjectivity and the transmission of culture: On the social origins of symbolic functioning. *Bulletin of the British Psychological Society*, 28, 437-446.
- Nichols, J. D., & Miller, R. B. (1994). Cooperative learning and student motivation. *Contemporary Educational Psychology*, 19, 167-178.
- Nicolopoulou, A. (1993). Play, cognitive development, and the social world: Piaget, Vygotsky, and beyond. *Human Development*, 36, 1-23.
- Nicolopoulou, A., & Cole, M. (1993). Generation and transmission of shared knowledge in the culture of collaborative learning. In E. A. Forman, N. Minick, & C. A. Stone (Eds.), *Contexts for learning* (pp. 283-314). New York: Oxford University Press.
- Nsamenang, A. B. (1992). *Human development in cultural context: A third-world perspective*. Newbury Park, CA: Sage.
- Oakeshott, M. J. (1962). *Rationalism in politics, and other essays*. New York: Basic Books.
- Ochs, E. (1979). Introduction: What child language can contribute to pragmatics. In E. Ochs & B. Schieffelin (Eds.), *Developmental pragmatics* (pp. 1-17). New York: Academic Press.
- Ochs, E. (1988). *Culture and language development: Language acquisition and language socialization in a Samoan village*. Cambridge, England: Cambridge University Press.
- Ochs, E. (1994). Stories that step into the future. In D. Biber & E. Finegan (Eds.), *Sociolinguistic perspectives on register* (pp. 106-135). New York: Oxford University Press.
- Ochs, E., Jacoby, S., & Gonzales, P. (1994). Interpretive journeys: How physicists talk and travel through graphic space. *Configurations*, 1, 151-171.
- Ochs, E., & Schieffelin, B. B. (1994). The impact of language socialization on grammatical development. In P. Fletcher & B. MacWhinney (Eds.), *Handbook of child language*. Oxford, England: Blackwell.
- Ochs, E., Schieffelin, B. B., & Platt, M. (1979). Propositions across utterances and speakers. In E. Ochs & B. B. Schieffelin (Eds.), *Developmental pragmatics*. New York: Academic Press.
- Ochs, E., Taylor, C., Rudolph, D., & Smith, R. (1992). Storytelling as a theory-building activity. *Discourse Processes*, 15, 37-72.
- O'Donnell, A. M., Dansereau, D. F. (1992). Scripted cooperation in student dyads: A method for analyzing and enhancing academic learning and performance. In R. Hertz-Lazarowitz & N. Miller (Eds.), *Interaction in cooperative groups: The theoretical anatomy of group learning* (pp. 120-141). Cambridge, England: Cambridge University Press.
- O'Donnell, A. M., Dansereau, D. F., Rocklin, T., Lambiotte, J. G., Hythecker, V. I., & Larson, C. O. (1985). Cooperative writing: Direct effects and transfer. *Written Communication*, 2, 307-315.
- Olson, S. L., Bates, J. E., & Bayles, K. (1984). Mother-infant interaction and the development of individual differences in children's cognitive competence. *Developmental Psychology*, 20, 166-179.
- Pacifici, C., & Bearison, D. J. (1991). Development of children's self-regulations in idealized and mother-child interactions. *Cognitive Development*, 6, 261-277.
- Packer, M. J. (1983). Communication in early infancy: Three common assumptions examined and found inadequate. *Human Development*, 26, 233-248.
- Packer, M. J. (1993). Away from internalization. In E. A. Forman, N. Minick, & C. A. Stone (Eds.), *Contexts for learning* (pp. 254-265). New York: Oxford University Press.

- Packer, M. J. (1994). Cultural work on the kindergarten playground: Articulating the ground of play. *Human Development*, 37, 259-276.
- Packer, M. J., & Scott, B. (1992). The hermeneutic investigation of peer relations. In T. Winegar & J. Valsiner (Eds.), *Children's development within social context: Vol. 2. Research and methodology* (pp. 75-111). Hillsdale, NJ: Erlbaum.
- Papousek, M., Papousek, H., & Bornstein, M. H. (1985). The naturalistic vocal environment of young infants. In T. M. Field & N. Fox (Eds.), *Social perception in infants* (pp. 269-298). Norwood, NJ: ALEX.
- Palincsar, A. S., Brown, A. L., & Martin, S. M. (1987). Peer interaction in reading comprehension instruction. *Educational Psychologist*, 22, 231-253.
- Parrinello, R. M., & Ruff, H. A. (1988). The influence of adult intervention on infants' level of attention. *Child Development*, 59, 1125-1135.
- Patterson, C., & Roberts, R. (1982). Planning and the development of communication skills. In D. Forbes & M. Greenberg (Eds.), *Children's planning strategies: New directions for child development* (pp. 29-46). San Francisco: Jossey-Bass.
- Pea, R. D. (1993). Practices of distributed intelligence and designs for education. In G. Salomon (Ed.), *Distributed cognitions* (pp. 47-87). Cambridge, England: Cambridge University Press.
- Pea, R. D., & Gomez, L. M. (1992). Distributed multimedia learning environments: Why and how? *Interactive Learning Environments*, 2, 73-109.
- Pearson, P. D., & Gallagher, M. C. (1983). The instruction of reading comprehension. *Contemporary Educational Psychology*, 8, 317-344.
- Pepper, S. C. (1942). *World hypotheses: A study in evidence*. Berkeley: University of California Press.
- Perlmutter, M., Behrend, S. D., Kuo, F., & Muller, A. (1989). Social influences on children's problem solving. *Developmental Psychology*, 25, 744-754.
- Perret-Clermont, A. -N. (1993). What is it that develops? *Cognition and Instruction*, 11, 197-205.
- Perret-Clermont, A. -N., Perreé, J. F., & Bell, N. (1991). The social construction of meaning and cognitive activity in elementary school children. In J. M. Levine, L. B. Resnick, & S. Behrend (Eds.), *Socially shared cognition* (pp. 41-62). New York: APA Press.
- Perret-Clermont, A. -N., & Schubauer-Leoni, M. -L. (1981). Conflict and cooperation as opportunities for learning. In P. Robinson (Ed.), *Communication in development* (pp. 203-233). London: Academic Press.
- Peterson, C., & McCabe, A. (1994). A social interactionist account of developing decontextualized narrative skill. *Developmental Psychology*, 30, 937-948.
- Peterson, P., Wilkinson, L., Spinelli, F., & Swing, S. (1982). *Merging the progress-product and the sociolinguistic paradigms: Research on small-group processes*. Paper presented at the conference on "Student Diversity and the Organization, Processes and Use of Instructional Groups in the Classroom," Wisconsin Center for Educational Research, Madison.
- Petitto, A. L. (1983). *Long division of labor: In support of an interactive learning theory*. Unpublished manuscript, University of Rochester, New York.
- Phelps, E., & Damon, W. (1989). Problem solving with equals: Peer collaboration as a context for learning mathematics and spatial concepts. *Journal of Educational Psychology*, 81, 639-646.
- Piaget, J. (1926). *The language and thought of the child*. New York: Harcourt, Brace.
- Piaget, J. (1977/1928). Logique génétique et sociologie. In *Etudes sociologiques* (pp. 203-239). Geneva, Switzerland: Librairie Droz. (Reprinted from "Revue Philosophique de la France et de l'Etranger," 53, nos. 3 and 4, pp. 161-205, 1928)
- Piaget, J. (1977). Les opérations logiques et la vie sociale. In *Etudes sociologiques* (pp. 143-171). Geneva, Switzerland: Librairie Droz.
- Piaget, J. (1977/1963). Problèmes de la psycho-sociologie de l'enfance. In *Etudes sociologiques* (pp. 320-356). Geneva, Switzerland: Librairie Droz. (Reprinted from *Traité de sociologie*, pp. 229-254, by G. Gurvitch, 1963, Paris: PUF)
- Plumert, J. M., & Nichols-Whitehead, P. (1996). Parental scaffolding of young children's spatial communication. *Developmental Psychology*, 32, 523-532.
- Pontecorvo, L., & Girardet, H. (1993). Arguing and reasoning in understanding historical topics. *Cognition and Instruction*, 11, 365-395.
- Pribram, K. H. (1990). From metaphors to models: The use of analogy in neuropsychology. In D. E. Leary (Ed.), *Metaphors in the history of psychology* (pp. 79-103). Cambridge, England: Cambridge University Press.
- Radziszewska, B. (1993, April). *Sociocognitive processes in adult-child and peer collaboration on conservation of area and volume tasks*. Unpublished manuscript, California State University, Long Beach.
- Radziszewska, B., & Rogoff, B. (1988). Influence of adult and peer collaborators on children's planning skills. *Developmental Psychology*, 24, 840-848.
- Radziszewska, B., & Rogoff, B. (1991). Children's guided participation in planning imaginary errands with skilled adult or peer partners. *Developmental Psychology*, 27, 381-389.
- Reese, E., Haden, C. A., & Fivush, R. (1993). Mother-child conversations about the past: Relationships of style and memory over time. *Cognitive Development*, 8, 403-430.

- Rheingold, H. L. (1969). The social and socializing infant. In D. A. Goslin (Ed.), *Handbook of socialization theory and research* (pp. 779-790). Chicago: Rand McNally.
- Rheingold, H. L. (1982). Little children's participation in the work of adults, a nascent prosocial behavior. *Child Development*, 53, 114-125.
- Riegel, K. F. (1979). *Foundations of dialectical psychology*. New York: Academic Press.
- Rodrigo, M. J., & Batista, M. L. (1995). Planificar para razonar y planificar para trazar rutas: Aprendizaje y transferencia de la planificación en colaboración y por adelantado. *Infancia y Aprendizaje*, 69-70, 183-202.
- Rogoff, B. (1981). Schooling and the development of cognitive skills. In H. C. Triandis & A. Heron (Eds.), *Handbook of cross-cultural psychology* (Vol. 4, pp. 233-294). Rockleigh, NJ: Allyn & Bacon.
- Rogoff, B. (1982). Integrating context and cognitive development. In M. E. Lamb & A. L. Brown (Eds.), *Advances in developmental psychology* (Vol. 2, pp. 125-170). Hillsdale, NJ: Erlbaum.
- Rogoff, B. (1986). Adult assistance of children's learning. In T. E. Raphael (Ed.), *The contexts of school-based literacy* (pp. 27-40). New York: Random House.
- Rogoff, B. (1990). *Apprenticeship in thinking: Cognitive development in social context*. New York: Oxford University Press.
- Rogoff, B. (1992). Three ways to relate person and culture. *Human Development*, 35, 316-320.
- Rogoff, B. (1994). Developing understanding of the idea of community of learners. *Mind, Culture, and Activity*, 1, 209-229.
- Rogoff, B. (1995). Observing sociocultural activity on three planes: Participatory appropriation, guided participation, and apprenticeship. In J. V. Wertsch, P. del Rio, & A. Alvarez (Eds.), *Sociocultural studies of mind* (pp. 139-164). Cambridge, England: Cambridge University Press.
- Rogoff, B. (1996). Developmental transitions in children's participation in sociocultural activities. In A. Sameroff & M. Haith (Eds.), *The five to seven year shift: The age of reason and responsibility* (pp. 273-294). Chicago: University of Chicago Press.
- Rogoff, B. (in press). Evaluating development in the process of participation: Theory, methods, and practice building on each other. In E. Amsel & A. Renninger (Eds.), *Change and development: Issues of theory, application, and method*. Hillsdale, NJ: Erlbaum.
- Rogoff, B., Baker-Sennett, J., Lacasa, P., & Goldsmith, D. (1995). Development through participation in sociocultural activity. In J. J. Goodnow, P. J. Miller, & F. Kessel (Eds.), *Cultural practices as contexts for development* (pp. 45-65). San Francisco: Jossey-Bass.
- Rogoff, B., Baker-Sennett, J., & Matusov, E. (1994). Considering the concept of planning. In M. M. Haith, J. B. Benson, R. J. Roberts, Jr., & B. F. Pennington (Eds.), *The development of future-oriented processes* (pp. 353-373). Chicago: University of Chicago Press.
- Rogoff, B., & Chavajay, P. (1995). What's become of research on the cultural basis of cognitive development? *American Psychologist*, 50, 859-877.
- Rogoff, B., Ellis, S., & Gardner, W. (1984). The adjustment of adult-child instruction according to child's age and task. *Developmental Psychology*, 20, 193-199.
- Rogoff, B., & Gardner, W. P. (1984). Adult guidance of cognitive development. In B. Rogoff & J. Lave (Eds.), *Everyday cognition: Its development in social context* (pp. 95-116). Cambridge, MA: Harvard University Press.
- Rogoff, B., & Gauvain, M. (1986). A method for the analysis of patterns, illustrated with data on mother-child instructional interaction. In J. Valsiner (Ed.), *The individual subject and scientific psychology* (pp. 261-290). New York: Plenum Press.
- Rogoff, B., Gauvain, M., & Ellis, S. (1984). Development viewed in its cultural context. In M. H. Bornstein & M. E. Lamb (Eds.), *Developmental psychology* (pp. 533-571). Hillsdale, NJ: Erlbaum.
- Rogoff, B., Malkin, C., & Gilbride, K. (1984). Interaction with babies as guidance in development. In B. Rogoff & J. V. Wertsch (Eds.), *Children's learning in the "zone of proximal development"* (pp. 31-44). San Francisco: Jossey-Bass.
- Rogoff, B., Matusov, E., & White, C. (1996). Models of teaching and learning: Participation in a community of learners. In D. Olson & N. Torrance (Eds.), *Handbook of education and human development: New models of learning, teaching, and schooling*. London: Basil Blackwell.
- Rogoff, B., Mistry, J., Göncü, A., & Mosier, C. (1993). Guided participation in cultural activity by toddlers and caregivers. *Monographs of the Society for Research in Child Development*, 58(7, Serial No. 236).
- Rogoff, B., Mistry, J., Radziszewska, B., & Germond, J. (1992). Infants' instrumental social interaction with adults. In S. Feinman (Ed.), *Social referencing and the social construction of reality in infancy* (pp. 323-348). New York: Plenum Press.
- Rogoff, B., Radziszewska, B., & Masiello, T. (1995). Analysis of developmental processes in sociocultural activity. In L. Martin, K. Nelson, & E. Tobach (Eds.), *Sociocultural psychology: Theory and practice of doing and knowing* (pp. 125-149). Cambridge, England: Cambridge University Press.
- Rogoff, B., Sellers, M. J., Pirrotta, S., Fox, N., & White, S. H. (1975). Age of assignment of roles and responsibilities to children: A cross-cultural survey. *Human Development*, 18, 353-369.

- Rommetveit, R. (1985). Language acquisition as increasing linguistic structuring of experience and symbolic behavior control. In J. V. Wertsch (Ed.), *Culture, communication, and cognition: Vygotskian perspectives* (pp. 183-204). Cambridge, England: Cambridge University Press.
- Roschelle, J. (1992). Learning by collaborating: Converging conceptual change. *Journal of the Learning Sciences*, 2, 235-276.
- Rubtsov, V. V. (1981). The role of cooperation in the development of intelligence. *Soviet Psychology*, 19, 41-62.
- Rubtsov, V. V., & Guzman, R. Y. (1984-1985). Psychological characteristics of the methods pupils use to organize joint activity in dealing with a school task. *Soviet Psychology*, 23, 65-84.
- Sarbin, T. (1976). Cross-age tutoring and social identity. In V. Allen (Ed.), *Children as teachers: Theory and research on tutoring* (pp. 27-40). New York: Academic Press.
- Saxe, G. B., Gearhart, M., & Guberman, S. B. (1984). The social organization of early number development. In B. Rogoff & J. V. Wertsch (Eds.), *Children's learning in the "zone of proximal development"* (pp. 19-30). San Francisco: Jossey-Bass.
- Scaife, M., & Bruner, J. (1975). The capacity for joint visual attention in the infant. *Nature*, 253, 265-266.
- Schaffer, H. R. (Ed.). (1977). *Studies in mother-infant interaction*. New York: Academic Press.
- Schaffer, H. R. (1984). *The child's entry into a social world*. London: Academic Press.
- Schaffer, H. R., Hepburn, A., & Collis, G. M. (1983). Verbal and nonverbal aspects of mothers' directives. *Journal of Child Language*, 10, 337-355.
- Schallert, D. L., & Kleiman, G. M. (1979, June). *Some reasons why teachers are easier to understand than textbooks* (Reading Ed. Rep. No. 9). Urbana-Champaign: University of Illinois, Center for the Study of Reading. (ERIC Report No. ED 172 189)
- Schieffelin, B. B. (1991). *The give and take of everyday life: Language socialization of Kaluli children*. Cambridge, England: Cambridge University Press.
- Schneiderman, M. H. (1983). "Do what I mean, not what I say!" Changes in mothers' action directives to young children. *Journal of Child Language*, 10, 357-367.
- Schoenfeld, A. H. (1989). Ideas in the air: Speculations on small group learning, environmental and cultural influences on cognition, and epistemology. *International Journal of Educational Research*, 13, 71-88.
- Schoenfeld, A. H. (1993, February). *Reflections on doing and teaching mathematics*. Unpublished manuscript, University of California, Berkeley.
- Schrage, M. (1990). *Shared minds*. New York: Random House.
- Schubauer-Leoni, M.-L., Bell, N., Grossen, M., & Perret-Clermont, A.-N. (1989). Problems in assessment of learning: The social construction of questions and answers in the scholastic context. *International Journal of Educational Research*, 13, 671-684.
- Scollon, R. (1976). *Conversations with a 1-year-old*. Honolulu: University of Hawaii Press.
- Scribner, S. (1976). Situating the experiment in cross-cultural research. In K. F. Riegel & J. A. Meacham (Eds.), *The developing individual in a changing world* (Vol. 1, pp. 310-321). Chicago: Aldine.
- Scribner, S. (1985). Vygotsky's uses of history. In J. V. Wertsch (Ed.), *Culture, communication, and cognition: Vygotskian perspectives* (pp. 119-145). Cambridge, England: Cambridge University Press.
- Scribner, S., & Cole, M. (1973). Cognitive consequences of formal and informal education. *Science*, 182, 553-559.
- Scribner, S., & Cole, M. (1981). *The psychology of literacy*. Cambridge, MA: Harvard University Press.
- Serpell, R. (1982). Measures of perception, skills and intelligence. In W. W. Hartup (Ed.), *Review of child development research* (Vol. 6, pp. 392-440). Chicago: University of Chicago Press.
- Sharan, S. (1990). Cooperative learning and helping behaviour in the multi-ethnic classroom. In H. C. Foot, M. J. Morgan, & R. H. Shute (Eds.), *Children helping children* (pp. 151-176). New York: Wiley.
- Sharan, S., & Shaulov, A. (1990). Cooperative learning, motivation to learn, and academic achievement. In S. Sharan (Ed.), *Cooperative learning: Theory and research* (pp. 173-202). New York: Praeger.
- Sharan, Y., & Sharan, S. (1992). *Expanding cooperative learning through Group Investigation*. New York: Teachers College Press.
- Shatz, M. (1987). Bootstrapping operations in child language. In K. E. Nelson & A. van Kleeck (Eds.), *Children's language* (Vol. 6, pp. 1-22). Hillsdale, NJ: Erlbaum.
- Shedd, J. B., & Weaver, B. M. (1995, April). *Reconstructing processes inside and outside the classroom: Curriculum emphasis and adult collaboration in elementary schools*. Paper presented at the meeting of the American Educational Research Association, San Francisco.
- Shotter, J. (1978). The cultural context of communication studies: Theoretical and methodological issues. In A. Lock (Ed.), *Action, gesture, and symbol: The emergence of language* (pp. 43-78). London: Academic Press.
- Shotter, J., & Newson, J. (1982). An ecological approach to cognitive development: Implicate orders, joint action, and intentionality. In G. Butterworth & P. Light (Eds.), *Social*

- cognition studies in the development of understanding (pp. 32-52). Brighton, England: Harvester Press.
- Sigel, I. E. (1982). The relationship between parental distancing strategies and the child's cognitive behavior. In L. M. Laosa & I. E. Sigel (Eds.), *Families as learning environments for children* (pp. 47-86). New York: Plenum Press.
- Sigel, I. E., & Cocking, R. R. (1977). Cognition and communication: A dialectic paradigm for development. In M. Lewis & L. A. Rosenblum (Eds.), *Interaction, conversation, and the development of language: The origins of behavior* (Vol. 5, pp. 207-226). New York: Wiley.
- Slavin, R. E. (1987). Developmental and motivational perspectives on cooperative learning: A reconciliation. *Child Development*, 58, 1161-1167.
- Slavin, R. E. (1990). *Cooperative learning: Theory, research, and practice*. Boston: Allyn & Bacon.
- Snow, C. E. (1977). Mother's speech research: From input to interaction. In C. Snow & C. Ferguson, (Eds.), *Talking to children* (pp. 31-49). Cambridge, England: Cambridge University Press.
- Snow, C. E. (1982). Are parents language teachers? In K. Borman (Ed.), *Social life of children in a changing society* (pp. 81-95). Hillsdale, NJ: Erlbaum.
- Snow, C. E. (1984). Parent-child interaction and the development of communicative ability. In R. Schiefelbusch & J. Pickar (Eds.), *The acquisition of communicative competence* (pp. 69-107). Baltimore: University Park Press.
- Socha, T. J., & Socha, D. M. (1994). Children's task-group communication. In L. R. Frey (Ed.), *Group communication in context: Studies of natural groups* (pp. 227-246). Hillsdale, NJ: Erlbaum.
- Solomon, D., Watson, M., Schaps, E., Battistich, V., & Solomon, J. (1990). Cooperative learning as part of a comprehensive classroom program designed to promote prosocial development. In S. Sharan (Ed.), *Cooperative learning: Theory and research* (pp. 231-260). New York: Praeger.
- Sorce, J. F., Emde, R. N., Campos, J., & Klippert, M. D. (1985). Maternal emotional signaling: Its effect on the visual cliff behavior of 1-year-olds. *Developmental Psychology*, 21, 195-200.
- Stipek, D. J. (in press). Is child-centered early childhood education really better? In S. Reifel (Ed.), *Advances in early education and day care*. Greenwich, CT: JAI Press.
- Stone, C. A. (1993). What is missing in the metaphor of scaffolding? In E. A. Forman, N. Minick, & C. A. Stone (Eds.), *Contexts for learning* (pp. 169-183). New York: Oxford University Press.
- Subbotskii, E. V. (1987). Communicative style and the genesis of personality in preschoolers. *Soviet Psychology*, 25, 38-58.
- Sugarman-Bell, S. (1978). Some organizational aspects of pre-verbal communication. In I. Markova (Ed.), *The social context of language* (pp. 49-66). New York: Wiley.
- Sutter, B., & Grensjo, B. (1988). Explorative learning in the school? Experiences of local historical research by pupils. *Quarterly Newsletter of the Laboratory of Comparative Human Cognition*, 10, 39-54.
- Sylva, K., Bruner, J. S., & Genova, P. (1976). The role of play in the problem-solving of children 3-5 years old. In J. S. Bruner, A. Jolly, & K. Sylva (Eds.), *Play: Its role in development and evolution* (pp. 244-257). New York: Basic Books.
- Tharp, R. G. (1993). Institutional and social context of educational practice and reform. In E. A. Forman, N. Minick, & C. A. Stone (Eds.), *Contexts for learning* (pp. 269-282). New York: Oxford.
- Tharp, R. G., & Gallimore, R. (1988). *Rousing minds to life: Teaching, learning, and schooling in social context*. Cambridge, England: Cambridge University Press.
- Toma, C. (1991a, April). *Speech genre of school in U.S. and Japan*. Paper presented at the meeting of the American Educational Research Association, Chicago.
- Toma, C. (1991b, October). *Explicit use of others' voices for constructing arguments in Japanese classroom discourse: An analysis of the use of reported speech*. Paper presented at the Boston University Conference on Language Development, Boston.
- Toma, C. (1992, September). *Who is in control? An analysis of the discourse space among a child and parents*. Paper presented at The First Conference for Socio-Cultural Research, Madrid.
- Tomasello, M. (1992). The social bases of language acquisition. *Social Development*, 1, 67-87.
- Tomasello, M. (1995). Joint attention as social cognition. In C. Moore & P. Dunham (Eds.), *Joint attention: Its origins and role in development* (pp. 103-129). Hillsdale, NJ: Erlbaum.
- Tomasello, M. (in press). The cultural roots of language. In B. Velichkovsky & D. Rumbaugh (Eds.), *Naturally human: Origins and destiny of language*. Princeton, NJ: Princeton University Press.
- Tomasello, M., & Farrar, M. J. (1986). Joint attention and early language. *Child Development*, 57, 1454-1463.
- Tomasello, M., Mandle, S., & Kruger, A. C. (1986). Linguistic environment of 1- to 2-year-old twins. *Developmental Psychology*, 22, 169-176.
- Trevarthen, C. (1980). Instincts for human understanding and for cultural cooperation: Their development in infancy. In M. von Cranach, K. Foppa, W. Lepenies, & D. Ploog (Eds.), *Human ethology: Claims and limits of a new discipline* (pp. 530-594). Cambridge, England: Cambridge University Press.

- Trevarthen, C., & Hubley, P. (1978). Secondary intersubjectivity: Confidence, confiding and acts of meaning in the first year. In A. Lock (Ed.), *Action, gesture and symbol: The emergence of language* (pp. 183-229). London: Academic Press.
- Trevarthen, C., Hubley, P., & Sheeran, L. (1975). Les activités innées du nourrisson. *La Recherche*, 6, 447-458.
- Tronick, E. Z. (1982). *Social interchange in infancy: Affect, cognition, and communication*. Baltimore: University Park Press.
- Tudge, J. R. H. (1992). Processes and consequences of peer collaboration: A Vygotskian analysis. *Child Development*, 63, 1364-1379.
- Tudge, J. R. H., Fordham, J., Lawrence, C., & Rogoff, B. (1995, March). *When adult-child and peer dyads collaborate: Learning how to use educational and recreational computer games*. Paper presented at the meetings of the Society for Research in Child Development, Indianapolis.
- Tudge, J. R. H., & Rogoff, B. (1989). Peer influences on cognitive development: Piagetian and Vygotskian perspectives. In M. Bornstein & J. Bruner (Eds.), *Interaction in human development* (pp. 17-40). Hillsdale, NJ: Erlbaum.
- Tudge, J. R. H., & Winterhoff, P. (1993a). Vygotsky, Piaget, and Bandura: Perspectives on the relations between the social world and cognitive development. *Human Development*, 36, 61-81.
- Tudge, J. R. H., & Winterhoff, P. (1993b). Can young children benefit from collaborative problem-solving? Tracing the effects of partner competence and feedback. *Social Development*, 2, 242-259.
- Valdez-Menchaca, M. C. (1987, April). *The effects of incidental teaching on vocabulary acquisition by young children*. Paper presented at the meetings of The Society for Research in Child Development, Baltimore.
- Valsiner, J. (1984). Construction of the zone of proximal development in adult-child joint action: The socialization of meals. In B. Rogoff & J. V. Wertsch (Eds.), *Children's learning in the "zone of proximal development"* (pp. 65-76). San Francisco: Jossey-Bass.
- Valsiner, J. (Ed.). (1986). *The individual subject and scientific psychology*. New York: Plenum Press.
- Valsiner, J. (1987). *Culture and the development of children's action*. New York: Wiley.
- Valsiner, J. (in press). Bounded indeterminacy in discourse processes. *Infancia y Aprendizaje*.
- Valsiner, J., & van der Veer, R. (1993). The encoding of distance: The concept of the zone of proximal development and its interpretations. In R. R. Cocking & K. A. Renninger (Eds.), *The development and meaning of psychological distance* (pp. 35-62). Hillsdale, NJ: Erlbaum.
- Vandell, D. L., & Wilson, K. S. (1987). Infants' interactions with mother, sibling, and peer: Contrasts and relations between interaction systems. *Child Development*, 58, 176-186.
- Vandenberg, B. (1980). Play, problem-solving, and creativity. In K. H. Rubin (Ed.), *Children's play* (pp. 49-68). San Francisco: Jossey-Bass.
- van der Veer, R., & Valsiner, J. (1991). *Understanding Vygotsky*. Oxford, England: Blackwell.
- Verba, M. (1993). Cooperative formats in pretend play among young children. *Cognition and Instruction*, 11, 265-280.
- Verba, M. (1994). The beginnings of collaboration in peer interaction. *Human Development*, 37, 125-139.
- Verba, M., & Winnykamen, F. (1992). Expert-novice interactions: Influence of partner status. *European Journal of Psychology of Education*, 7, 61-71.
- Vygotsky, L. S. (1967). Play and its role in the mental development of the child. *Soviet Psychology*, 5, 6-18.
- Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes*. Cambridge, MA: Harvard University Press.
- Vygotsky, L. S. (1987). *Thinking and speech*. In R. W. Rieber & A. S. Carton (Eds.), *The collected works of L. S. Vygotsky* (N. Minick, Trans.) (pp. 37-285). New York: Plenum Press.
- Ward, M. C. (1971). *Them children: A study in language learning*. New York: Holt, Rinehart and Winston.
- Watson-Gegeo, K. A., & Gegeo, D. W. (1989). The role of sibling interaction in child socialization. In P. G. Zukow (Ed.), *Sibling interaction across cultures: Theoretical and methodological issues* (pp. 54-76). New York: Springer-Verlag.
- Waxman, S., & Gelman, R. (1986). Preschoolers' use of superordinate relations in classification and language. *Cognitive Development*, 1, 139-156.
- Webb, N. M. (1982). Peer interaction and learning in cooperative small groups. *Journal of Educational Psychology*, 74, 642-655.
- Weisner, T. S., & Gallimore, R. (1977). My brother's keeper: Child and sibling caretaking. *Current Anthropology*, 18, 169-190.
- Wells, G. (1975). The contexts of children's early language experience. *Educational Review*, 27, 114-125.
- Wells, G., Chang, G. L. M., & Maher, A. (1990). Creating classroom communities of literate thinkers. In S. Sharan (Ed.), *Cooperative learning: Theory and research* (pp. 95-121). New York: Praeger.
- Wertsch, J. V. (1979a). From social interaction to higher psychological processes. *Human Development*, 22, 1-22.
- Wertsch, J. V. (1979b, March). *The social interactional origins of metacognition*. Paper presented at the meetings of the Society for Research in Child Development, San Francisco.

- Wertsch, J. V. (1984). The zone of proximal development: Some conceptual issues. In B. Rogoff & J. V. Wertsch (Eds.), *Children's learning in the "zone of proximal development"* (pp. 7-18). San Francisco: Jossey-Bass.
- Wertsch, J. V. (1985). *Vygotsky and the social formation of mind*. Cambridge, MA: Harvard University Press.
- Wertsch, J. V. (1991). *Voices of the mind*. Cambridge, MA: Harvard University Press.
- Wertsch, J. V. (1995). The need for action in sociocultural research. In J. V. Wertsch, P. del Río, & A. Alvarez (Eds.), *Sociocultural studies of mind* (pp. 56-74). New York: Cambridge University Press.
- Wertsch, J. V., & Hickmann, M. (1987). Problem solving in social interaction: A microgenetic analysis. In M. Hickmann (Ed.), *Social and functional approaches to language and thought* (pp. 251-266). Orlando, FL: Academic Press.
- Wertsch, J. V., Minick, N., & Arns, F. J. (1984). The creation of context in joint problem-solving. In B. Rogoff & J. Lave (Eds.), *Everyday cognition* (pp. 151-171). Cambridge, MA: Harvard University Press.
- Wertsch, J. V., & Stone, C. A. (1979, February). *A social interactional analysis of learning disabilities remediation*. Paper presented at the International Conference of the Association for Children with Learning Disabilities, San Francisco.
- Wertsch, J. V., & Toma, C. (1995). Discourse and learning in the classroom: A sociocultural approach. In L. P. Steffe & J. Gale (Eds.), *Constructivism in education*. Hillsdale, NJ: Erlbaum.
- Wertsch, J. V., Tulviste, P., & Hagstrom, F. (1993). A sociocultural approach to agency. In E. A. Forman, N. Minick, & C. A. Stone (Eds.), *Contexts for learning* (pp. 336-356). New York: Oxford University Press.
- Whiting, B. B. (1979). *Maternal behavior in cross-cultural perspective*. Paper presented at the meeting of the Society for Cross-Cultural Research, Charlottesville, VA.
- Whiting, B. B. (1980). Culture and social behavior: A model for the development of social behavior. *Ethos*, 8, 95-116.
- Whiting, B. B., & Edwards, C. P. (1988). *Children of different worlds: The formation of social behavior*. Cambridge, MA: Harvard University Press.
- Whiting, B. B., & Whiting, J. W. M. (1975). *Children of six cultures: A psycho-cultural analysis*. Cambridge, MA: Harvard University Press.
- Winograd, T., & Flores, F. (1987). *Understanding computers and cognition*. Reading, MA: Addison-Wesley.
- Wood, D. (1986). Aspects of teaching and learning. In M. Richards & P. Light (Eds.), *Children of social worlds* (pp. 191-212). Cambridge, MA: Polity Press.
- Wood, D., Bruner, J. S., & Ross, G. (1976). The role of tutoring in problem-solving. *Journal of Child Psychology and Psychiatry*, 17, 89-100.
- Wood, D., & Middleton, D. (1975). A study of assisted problem-solving. *British Journal of Psychology*, 66, 181-191.
- Wood, D., Wood, H., Ainsworth, S., & O'Malley, C. (1995). On becoming a tutor: Toward an ontogenetic model. *Cognition and Instruction*, 13, 565-581.
- Wood, D., Wood, H., & Middleton, D. (1978). An experimental evaluation of four face-to-face teaching strategies. *International Journal of Behavioral Development*, 2, 131-147.
- Yager, S., Johnson, R. T., Johnson, D. W., & Snider, B. (1986). The impact of group processing on achievement in cooperative learning groups. *Journal of Social Psychology*, 126, 389-397.
- Youniss, J. (1987). Social construction and moral development: Update and expansion of an idea. In W. M. Kurtines & J. L. Gewirtz (Eds.), *Moral development through social interaction* (pp. 131-148). New York: Wiley.
- Zellermayer, M., Salomon, G., Globerson, T., & Givon, H. (1991). Enhancing writing-related metacognitions through a computerized writing partner. *American Educational Research Journal*, 28, 373-391.
- Zimmerman, B. J., & Rosenthal, T. L. (1974). Observational learning of rule-governed behavior by children. *Psychological Bulletin*, 81, 29-42.
- Zinchenko, V. P. (1985). Vygotsky's ideas about units for the analysis of mind. In J. V. Wertsch (Ed.), *Culture, communication and cognition: Vygotskian perspectives* (pp. 94-118). Cambridge, England: Cambridge University Press.
- Zinchenko, V. P. (1995). Cultural-historical psychology and the psychological theory of activity: Retrospect and prospect. In J. V. Wertsch, P. del Río, & A. Alvarez (Eds.), *Sociocultural studies of mind* (pp. 37-55). New York: Cambridge University Press.
- Zukow, P. G., Reilly, J., & Greenfield, P. M. (1982). Making the absent present: Facilitating the transition from sensorimotor to linguistic communication. In K. E. Nelson (Ed.), *Children's language* (Vol. 3, pp. 1-90). New York: Gardner Press.