

THE CULTURAL
ORIGINS OF
HUMAN COGNITION

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JOINT ATTENTION AND CULTURAL LEARNING

*He who considers things in their first growth
and origin . . . will obtain the clearest view of them.*

—Aristotle

The conclusion from our comparison of human and nonhuman primates is that the understanding of conspecifics as intentional beings like the self is a uniquely human cognitive competency that accounts, either directly on its own or indirectly through cultural processes, for many of the unique features of human cognition. But this cognitive competency does not just emerge all at once in human ontogeny and then function in the same way throughout. To the contrary, the human understanding of others as intentional beings makes its initial appearance at around nine months of age, but its real power becomes apparent only gradually as children actively employ the cultural tools that this understanding enables them to master, most importantly language. To fully understand the human adaptation for culture, then, we need to follow out its developmental course for some time—and so that is what I intend to do in Chapters 4–6. In this chapter I describe and attempt to explain what happens at nine months of age.

Early Infant Cognition

By all appearances human neonates are extremely fragile and almost totally helpless creatures. They are unable to feed themselves, to sit or locomote independently, or to reach and grasp objects. Their vi-

sual acuity is very poor, and of course they know virtually nothing of the cultural and linguistic activities going on around them. It was thus reasonable for William James (1890) at the turn of the century to suppose that the infant's experiential world is "a blooming, buzzing confusion." But in the past two decades developmental psychologists have discovered that newborn and very young infants possess a number of cognitive competencies that are not readily apparent in their overt behavior. This is true for the understanding of objects, for the understanding of other persons, and for the understanding of self.

Understanding Objects

In his classic works on human infancy, Piaget (1952, 1954) provided a theory of infant cognition that is the starting point for all subsequent accounts. Piaget noted that at around four months of age infants begin reaching for and grasping objects; at around eight months of age they begin looking for objects that have disappeared, even removing obstacles in their attempts to grasp them; and at around twelve to eighteen months they begin to follow the spatial displacements of objects, both visible and invisible, to new locations, and to understand something of the spatial, temporal, and causal relations among objects. Piaget hypothesized that all of these developmental changes in sensory-motor behavior were a result of infants' active manipulations and explorations of objects, as they constructed reality through converging lines of sensory and motor information.

A major challenge to the Piagetian view has come from researchers who have found that human infants have some understanding of an independently existing physical world at an age that coincides with their earliest manipulations of objects—before they could have had time to use those manipulations to "construct" that world. For example, Baillargeon and associates (see 1995 for a review) have found that if infants are not required by researchers to manipulate objects—but only to view scenes and look longer when their expectations are violated—they display an understanding of objects as independent entities, existing when they are not being ob-

served, by three or four months of age (at around the time of their very first deliberate manual manipulations). Using this same methodology, Spelke and colleagues (1992) have shown further that infants at this same early age understand a number of other principles that govern the behavior of objects including such things as that objects cannot be in two places at one time, that objects cannot pass through one another, and so forth. And again, infants seem to understand these principles before they have had much experience with manipulating objects. Human infants go on later in their first year of life to display other types of understanding of objects in space; for example, before their first birthdays they can categorize objects perceptually, estimate small quantities and keep track of them despite perceptual occlusion, mentally rotate objects, and navigate in space in ways suggesting something like a cognitive map (see Haith and Benson, 1997, for a review).

There are methodological issues surrounding this new way of assessing infant cognition in terms of looking behavior (see Haith and Benson, 1997), but the important point for current purposes is that these are all cognitive skills possessed by nonhuman primates. As detailed in Chapter 2, nonhuman primates are skillful at object permanence, cognitive mapping, perceptual categorization, estimating small quantities, and mentally rotating objects—presumably because they have a representational understanding of objects in space of the same general type as that of humans. Thus, human infants are simply playing out their primate heritage; it is just that, because they are born in such an altricial state perceptually and motorically, it takes them some time to do so.

Understanding Other Persons

There is not nearly as much research on young infants' understanding of other persons. It is clear that human infants are very social creatures from the moment they are born, if not before. From just a few hours after birth human infants look selectively at schematic drawings of human faces over other perceptual patterns (Fantz, 1963); while still *in utero* they seem to be in the process of habituat-

ing to their mothers' voices (Decasper and Fifer, 1980); and from fairly early in development infants clearly recognize other persons as animate beings that are different from physical objects (Legerstee, 1991)—all in the general primate pattern. However, there are two social behaviors that might suggest that human infants are not just social like other primates, but rather are “ultra-social.”

First, as outlined by Trevarthen (1979) and others, from soon after birth human infants engage in “protoconversations” with their caregivers. Protoconversations are social interactions in which the parent and infant focus their attention on one another—often in a face-to-face manner involving looking, touching, and vocalizing—in ways that serve to express and share basic emotions. Moreover, these protoconversations have a clear turn-taking structure. Although there are differences in the way these interactions take place in different cultures—especially in the nature and amount of face-to-face visual engagement—in one form or another they seem to be a universal feature of adult-infant interaction in the human species (Trevarthen, 1993a, 1993b; Keller, Schölmerich, and Eibl-Eibesfeldt, 1988). Some researchers, especially Trevarthen, believe that these early interactions are “intersubjective,” but in my view they cannot be intersubjective until infants understand others as subjects of experience—which they will not do until nine months of age (see the next section). Nevertheless, these early interactions are deeply social in that they have emotional content and turn-taking structure.

Second, in the context of these early social interactions, human neonates mimic some body movements of adults, especially some movements of the mouth and head. Meltzoff and Moore (e.g., 1977, 1989) found that from very soon after birth human infants reproduce such things as tongue protrusions, mouth openings, and head movements. Although these actions are behaviors infants already know how to perform and so they are just increasing their frequency in the presence of a matching stimulus (as some bird species mimic the vocal productions of adults early in their development), Meltzoff and Moore (1994) found that six-week-old infants could modify one of their natural behaviors (tongue protrusions) to match the behavior of an adult as she moved it from one side of the mouth to the

other in an effortful manner. It is thus possible that neonatal imitation reflects a tendency of infants not just to mimic known movements but in some sense to "identify" with conspecifics (Meltzoff and Gopnik, 1993). If true, this would be in line with Stern's (1985) view that infants' matching of adult emotional states via "affect attunement" reflects a very deep identification process as well.

It is unclear whether nonhuman primates engage in protoconversations or neonatal mimicking in the same way as humans. For the most part nonhuman primate mothers and infants do not engage in the kinds of intense face-to-face engagement characteristic of Western middle-class mothers and infants, but they do stay in constant physical contact and so their interactions may, like the interactions of some non-Western mothers and infants, reflect protoconversations of a different sort. There is one study of a single, human-raised chimpanzee infant mimicking tongue protrusion in much the same way as human infants (Myowa, 1996), but there are no studies of chimpanzee mimicking of other kinds of actions or the making of adjustments to reproduce novel movements. Whether very young human infants are social in ways unique to the species—or whether human social uniqueness awaits further developments at nine months of age or beyond—is thus an open question at this point. It is in any case not an unreasonable hypothesis that human infants display an especially powerful social attunement with their caregivers from soon after birth, as reflected in their tendency to interact both in reciprocally sensitive ways in protoconversations and in ways that require matching operations as they attempt to reproduce adult behaviors.

Understanding Self

As infants interact with their physical and social environments, they also experience themselves in certain ways. Of special importance, in directing behaviors at external entities infants experience their own behavioral goals as well as the outcome of their actions on the environment as external entities accede to or resist their goal-directed activities—the so-called "ecological self" (Neisser, 1988,

1995; Russell, 1997). In this way, infants come to know something of their own behavioral capabilities and limitations in certain situations, for example, as they refrain from reaching for objects that are too far away or that would require a destabilizing postural adjustment (Rochat and Barry, 1998). Also, when infants explore their own bodies they experience a correspondence of behavioral plan and perceptual feedback unlike anything else in their experience (Rochat and Morgan, 1995). Although very little research of this type has been done with nonhuman primates, there are studies showing that some species know enough about their own skills to "bail out" of tasks that exceed their capabilities (Smith and Washburn, 1997), and it would seem to be a common observation that nonhuman primates know something about their own motoric capabilities and limitations as they navigate through space in somewhat novel environments (Povinelli and Cant, 1996). It is thus very likely that human infants' sense of an ecological self is something they share with their primate relatives. There is very little research directed specifically at young infants' understanding of themselves as social agents, at least partly because it is unclear what a sense of social self means at this early age.

The Nine-Month Revolution

At around nine to twelve months of age human infants begin to engage in a host of new behaviors that would seem to indicate something of a revolution in the way they understand their worlds, especially their social worlds. If there is some question about whether infants' social cognition is different from that of other primates in the months before this revolution, after it there can be no doubt. At nine months of age human infants begin engaging in a number of so-called joint attentional behaviors that seem to indicate an emerging understanding of other persons as intentional agents like the self whose relations to outside entities may be followed into, directed, or shared (Tomasello, 1995a). In this section I describe this new set of behaviors, in the next section I attempt to explain their ontogenetic origins, and in the final section of the chapter I show how they lead

quite naturally into the processes of cultural learning that serve to launch infants into the world of culture.

The Emergence of Joint Attention

Six-month-old infants interact dyadically with objects, grasping and manipulating them, and they interact dyadically with other people, expressing emotions back and forth in a turn-taking sequence. If people are around when they are manipulating objects, they mostly ignore them. If objects are around when they are interacting with people, they mostly ignore them. But at around nine to twelve months of age a new set of behaviors begins to emerge that are not dyadic, like these early behaviors, but are triadic in the sense that they involve a coordination of their interactions with objects and people, resulting in a referential triangle of child, adult, and the object or event to which they share attention. Most often the term *joint attention* has been used to characterize this whole complex of social skills and interactions (see Moore and Dunham, eds., 1995). Most prototypically, it is at this age that infants for the first time begin to flexibly and reliably look where adults are looking (gaze following), to engage with them in relatively extended bouts of social interaction mediated by an object (joint engagement), to use adults as social reference points (social referencing), and to act on objects in the way adults are acting on them (imitative learning). In short, it is at this age that infants for the first time begin to “tune in” to the attention and behavior of adults toward outside entities.

Not unrelatedly, at around this same age infants also begin to actively direct adult attention and behavior to outside entities using deictic gestures such as pointing or holding up an object to show it to someone. These communicative behaviors represent infants’ attempts to get adults to tune in to *their* attention to some outside entity. Moving beyond their dyadic ritualizations such as “arms-over-head” as a request to be picked up—which resemble in many ways chimpanzees’ dyadic ritualizations (as described in Chapter 2)—these deictic gestures are clearly triadic in that they indicate for an adult some external entity. Also important is the fact that among these early deictic ges-

tures are both imperatives, attempts to get the adult to do something with respect to an object or event, and declaratives, attempts to get adults simply to attend to some object or event. Declaratives are of special importance because they indicate especially clearly that the child does not just want some result to happen, but really desires to share attention with an adult. It is thus the contention of some theorists, including me, that the simple act of pointing to an object for someone else for the sole purpose of sharing attention to it is a uniquely human communicative behavior (e.g., Gómez, Sarriá, and Tamarit, 1993), the lack of which is also a major diagnostic for the syndrome of childhood autism (e.g., Baron-Cohen, 1993).

Based on the relatively consistent findings of many studies, it has been known for some time that all of these different behaviors—both those in which infants tune in to adults and those in which they try to get adults to tune in to them—typically emerge at nine to twelve months of age. Recently, however, Carpenter, Nagell, and Tomasello (1998) investigated this issue specifically by following the social-cognitive development of twenty-four children from nine to fifteen months of age. At monthly intervals these infants were assessed on nine different measures of joint attention: joint engagement, gaze following, point following, imitation of instrumental acts, imitation of arbitrary acts, reaction to social obstacles, use of imperative gestures, and use of declarative gestures (including proximal gestures such as “show” and distal gestures such as “point”). In each case, very stringent criteria were used to ensure that infants were attempting either to follow into or to direct the adult’s attention or behavior (e.g., alternating attention between goal and adult)—not just reacting to a discriminative stimulus. The findings of most importance in the current context were these:

- Considered individually, each of the nine joint attentional skills emerged for most children between nine and twelve months of age.
- All of these skills emerged in close developmental synchrony for individual children, with nearly 80 percent of the infants mastering all nine tasks within a four-month window.

- Age of emergence was intercorrelated for all the skills (although only moderately since near simultaneous emergence of the skills led to low individual variability).

Importantly, the decalage that was observed within individual children's development had a clear explanation since there was a very consistent ordering of tasks across children. Twenty of the twenty-four children first passed tasks that required sharing/checking of adult attention in close proximity (e.g., simply looking up to the adult during joint engagement), then tasks that required following into adult attention to more distal external entities (e.g., gaze following), and finally tasks that required directing adult attention to external entities (e.g., pointing for an adult to a distal entity). Figure 3.1 depicts these three situations. The explanation for this ordering is that the tasks of sharing/checking simply required the child to look to the adult's face; in this case the children only had to know "that" the adult was present and attending. In contrast, the tasks in which infants either followed or directed adult attention required them to zero in on precisely "what" the adult was attending to—with comprehension (following adult attention or behavior) preceding production (directing adult attention or behavior). Quite clearly knowing "what" external entity an adult is focused on requires more precise joint attentional skills than simply knowing "that" an adult is attending to the interaction as a whole. The conclusion is thus that for virtually all infants the whole panoply of joint attentional skills emerge in fairly close developmental synchrony, in moderately correlated fashion, with a highly consistent ordering pattern across children reflecting the different levels of specificity in joint attention required.

The findings of this study are thus generally consistent with a whole host of studies in which one or more of these early social-cognitive skills are investigated individually (reviewed in detail by Carpenter, Nagell, and Tomasello, 1998). What this study demonstrates with special clarity is that the emergence of joint attentional skills at nine to twelve months of age is a coherent developmental phenomenon that requires a coherent developmental explanation.

This view is reinforced by the very different set of studies by Gergely and colleagues (Gergely et al., 1995; Csibra et al., in press). These researchers showed nine-month-old infants a dot on a screen moving in what to adult eyes was a clearly goal-directed manner toward a specific location on that same screen, detouring around an obstacle to do so. Infants clearly demonstrated that they viewed the movements of the dot as goal directed: they dishabituated if it made identical movements when the obstacle was removed (thus making the phantom detour unnecessary), but they remained habituated to the dot's behavior, however variable its trajectories might be, so long as it was directed to the same goal. Importantly, six-month-old infants did not show this same sensitivity to the goals of the actors. Rochat, Morgan, and Carpenter (1997) found similar evidence for nine-month-olds' but not six-month-olds' understanding of intentional action in a situation in which infants viewed one moving ball "chasing" another in a goal-directed manner. These findings using infant habituation and preferential looking techniques thus provide strong converging evidence for the importance of nine months of age in infants' social-cognitive development—using as a measure of

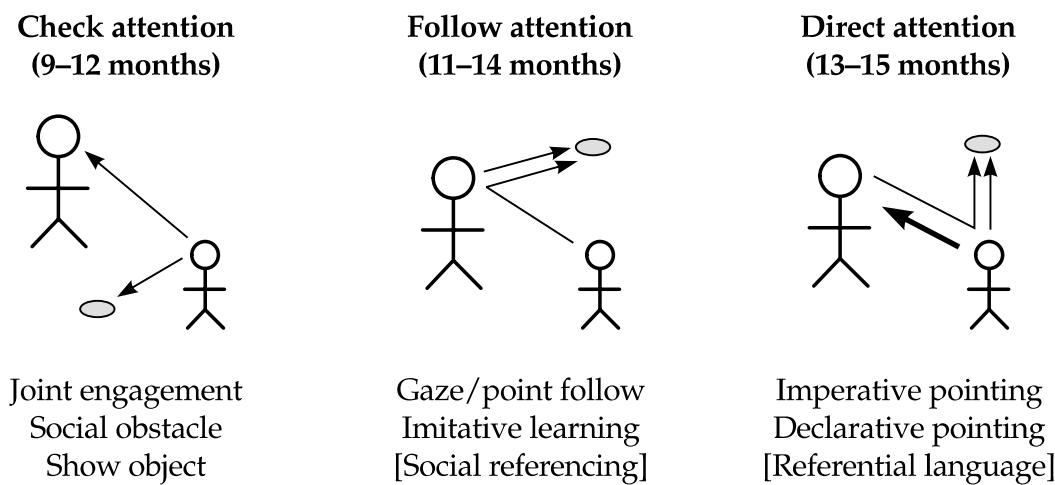


Figure 3.1 Three main types of joint attentional interaction and their ages of emergence in the study by Carpenter, Nagell, and Tomasello (1998). (Approximately 80 percent of subjects in designated age ranges.)

infant cognition behavioral responses of a very different type from children's naturally occurring joint attentional behaviors.

Joint Attention and Social Cognition

There is currently much controversy over the nature of the infant social cognition that underlies these emerging triadic behaviors. Some theorists believe that human infants have adult-like social cognition from birth, and that the emergence of joint attentional behaviors at nine to twelve months of age simply reflects the development of behavioral performance skills for manifesting this cognition in overt behavior. For example, Trevarthen (1979, 1993a) has claimed that infants are born with a dialogic mind, with an innate sense of "the virtual other," and only need to acquire the motoric skills necessary to express this knowledge behaviorally. Trevarthen's evidence for this view is infants' complex dyadic social interactions in the early months, what he has dubbed "primary intersubjectivity." Most impressively, in the study of Murray and Trevarthen (1985), two-month-olds seemed to display an exquisite sensitivity to the contingencies of social interactions with others, which he interprets as evidence that the infant understands the subjectivity of the other. However, a number of researchers who have recently attempted to replicate these results have had mixed success in doing so, and more importantly none of them interprets infants' interactive behaviors as anything other than social contingency analysis (Rochat and Striano, 1999; Nadel and Tremblay-Leveau, 1999; Muir and Hains, 1999). In addition, it seems clear that five-month-old infants have all of the motoric skills necessary to follow the gaze of others (they visually track moving objects) and to point for them (they both reach for objects and extend their index fingers quite often), and so motoric limitations alone cannot explain why young infants, if they are so socially sophisticated, do not engage in triadic joint attentional behaviors—nor do motoric limitations explain infants' failures in looking-time studies involving intentional actions whose behavioral demands are minimal (e.g., those of Gergely et al., 1995).

Some other nativist theorists (e.g., Baron-Cohen, 1995) believe that infants are preprogrammed with several independent social-cognitive modules, including an Eye Direction Detector, an Intention Detector, and a Shared Attention Mechanism. In Baron-Cohen's view, each of these modules has its own predetermined developmental timetable that is affected neither by the ontogeny of the other modules nor by the organism's interactions with the social environment. Infants are not born knowing about other persons, but they do not have to learn about them either; the appropriate cognitive modules simply mature on their ineluctable timetables during the first months of life. The problem in this case is that the data simply are not consistent with this view. Evidence from the Carpenter, Nagell, and Tomasello (1998) study, and indirect evidence from other studies, shows that the key skills in this account (gaze following, understanding intentional action, and joint engagement) emerge in close developmental synchrony and in a correlated fashion at nine to twelve months of age. These facts are dissonant with an account in terms of several independent modules, nor is there any empirical support for the view that the emergence of these skills does not require some kind of social interaction with others (see also the critique of Baldwin and Moses, 1994).

Other theorists believe that infants' triadic interactions at nine to twelve months of age represent learned behavioral sequences. In particular, Moore (1996; Barresi and Moore, 1996) believes that the behaviors that emerge at nine to twelve months of age are independent behavioral skills, each of which has its own critical stimuli, environmental contingencies, and learning history that does not depend on sophisticated social-cognitive skills. For example, infants learn to follow gaze by turning (perhaps initially accidentally) in the direction of adults and then finding some interesting sight there. They look to the face of the adult in these and similar interactions because adult smiles and encouragement are rewarding as well. To explain the developmental synchrony and interrelatedness of the different social-cognitive skills, Moore invokes the emergence of a new information-processing ability to focus attention on two things simultaneously. The problem is that, to my knowledge, this informa-

tion-processing ability has never been independently measured and related to early social cognition. Indeed, in the Carpenter, Nagell, and Tomasello (1998) study, there were several object-related tasks that might be expected to depend to some degree on this same hypothesized information-processing skill, but they did not fit into the observed developmental sequence of skills or correlate consistently with the social-cognitive measures.

In my view, then, the data force us to look for an explanation of joint attention that is more coherent than any of these alternatives, whether nativistic or learning-based, in the sense that it explains why all of the different joint attentional behaviors emerge as they do and when they do. That is, we need a theoretical account that answers both of these questions:

- Why do all of the joint attentional skills emerge together in correlated fashion?
- Why is nine months the age at which this happens?

My own candidate, not surprisingly, is the view that infants begin to engage in joint attentional interactions when they begin to understand other persons as intentional agents like the self (Tomasello, 1995a). Intentional agents are animate beings who have goals and who make active choices among behavioral means for attaining those goals, including active choices about what to pay attention to in pursuing those goals. Not all behavior is intentional in this sense, of course; for example, eye blinks and other reflexes may have biological functions that are analogous to goals, but goals are things that individuals have, and these individuals make voluntary choices about how to meet those goals based on their assessment of the current situation. Gergely et al. (1995) speak of these kinds of things as “rational” action—an organism’s behavior makes sense to us if we understand how it is making behavioral choices that help it to achieve its goals.

In addition, I have argued that we should think of attention as a kind of intentional perception (Tomasello, 1995a). Individuals intentionally choose to attend to some things and not to others in ways

that are directly related to the pursuit of their goals. Gibson and Rader (1979) give the example of a painter and a mountain climber staring at the same mountain in preparations for their respective activities; they see the same thing but they attend to very different aspects of it. The almost simultaneous ontogenetic emergence of the many different joint attentional behaviors, all of which rely in one way or another on the understanding of other persons as perceiving, behaving, goal-directed beings—supplemented by experimental findings such as those of Gergely and colleagues—strongly suggests that these joint attentional behaviors are not just isolated cognitive modules or independently learned behavioral sequences. They are all reflections of infants' dawning understanding of other persons as intentional agents. Perhaps no joint attentional behavior by itself provides unequivocal evidence for this understanding, but together they are convincing—perhaps especially those joint attentional behaviors that require the infant to determine precisely "what" the adult is focused on or doing, since they show a clear understanding of the adult's attention. But infants still have much to learn about other persons and how they work. In particular, we will see in later chapters that in acquiring their skills of linguistic communication young children learn much about how to follow into and direct adult attention very precisely. And, of course, one-year-old children do not know enough about the connection between perception and action to intervene effectively in the process, for example, by producing deceptive perceptual cues to trick the adult into acceding to their wishes—a skill that awaits some two or three years of further practice in interacting with others. What we are witnessing here is the very beginnings of the process.

The question thus arises: If the emergence of joint attention is indeed a revolution in infants' understanding of other persons, where does it come from? I have provided some evidence that from very early in development human infants may be social in some ways that other primates are not—as evidenced by their engaging in proto-conversations and neonatal mimicking—but these do not involve joint attention or any other form of the understanding of others as intentional agents. So the question that arises is how these earlier

and later social-cognitive developments are related, if indeed they are related, and why they culminate in the understanding of others as intentional agents at precisely nine months of age.

A Simulation Explanation of the Nine-Month Revolution

Social theorists from Vico and Dilthey to Cooley and Mead have stressed that our understanding of other persons rests on a special source of knowledge that is not available when we attempt to understand the workings of inanimate objects, namely the analogy to the self. The key theoretical point is that we have sources of information about the self and its workings that are not available for any external entity of any type. As I act I have available the internal experience of a goal and of striving for a goal, as well as various forms of proprioception (correlated with exteroception) of my behavior as I act toward the goal—which serve to relate goal and behavioral means. To the extent that I understand an external entity as “like me,” and can therefore attribute to it the same kinds of internal workings as my own, to that extent can I gain extra knowledge of a special type about how it works. Presumably, the analogy is closest and most natural when it is applied to other persons.

My theoretical attempt here is to use this general insight about the relation of self understanding and the understanding of others to explain the nine-month social-cognitive revolution. In general, the argument is that in attempting to understand other persons human infants apply what they already experience of themselves—and this experience of the self changes in early development, especially with regard to self-agency. The hypothesis is that as this new experience of self-agency emerges, a new understanding of others emerges as a direct result. The current approach may thus be thought of as one version of a simulation model in which individuals understand other persons in some sense by analogy with the self—since others are “like me”—in a way that they do not do, at least not in the same way, with inanimate objects—since they are much less “like me.”

The Link between Self and Other

Relying mainly on findings from research on neonatal imitation, Meltzoff and Gopnik (1993) propose that infants understand that other persons are “like me” from birth—with much learning of specifics still to come (see also Gopnik and Meltzoff, 1997). But they do not give any account in which this “like me” stance plays an integral role in subsequent social-cognitive developments, and in particular they do not link it specifically to the emergence of joint attentional behaviors at nine to twelve months of age. Indeed, as adherents of one version of the “theory theory,” Meltzoff and Gopnik believe that infants come to understand other persons by using the same kind of protoscientific theorizing they use in all other domains of cognition. The “like me” stance plays no real role in this process, but rather the new developments at nine months of age are just a result of direct observation of and inferences about the behavior of other people (and indeed Gopnik, 1993, argues that we know others’ intentional states as well as we know our own, and in some cases better).

In agreement with Meltzoff and Gopnik, my own view is that infants’ early understanding of other persons as “like me” is indeed the result of a uniquely human biological adaptation—although the precise age at which it emerges in ontogeny and the amount and types of personal experience necessary in the species-typical developmental pathway remain unclear (see Baessi and Moore, 1996). This understanding—which in any case is present within the first few months of life—is then a key element in infants’ coming to understand others as intentional agents at nine months of age. That is, it becomes a key element when the other indispensable factor enters the picture—and this other factor explains why nine months is a special age. This other factor is infants’ new understanding of their own intentional actions. Since other persons are “like me,” any new understanding of my own functioning leads immediately to a new understanding of their functioning; I more or less simulate other persons’ psychological functioning by analogy to my own, which is most directly and intimately known to me. Consequently, the spe-

cific hypothesis is that when infants come to a new understanding of their own intentional actions, they then use their “like me” stance to understand the behavior of other persons in this same way. And there is evidence that eight to nine months of age is indeed a special age in infants’ understanding of their own intentional actions.

Self Becomes Intentional

In the first months of life infants understand that their behavioral actions achieve results in the external environment, but they do not seem to know how or why they do this. Piaget (1952, 1954) devised a number of clever experiments in which infants produced interesting effects on mobiles, toys, and household objects, and then were given the opportunity to reproduce those effects—sometimes in slightly modified circumstances that called for an accommodation on the infant’s part. For the first six to eight months of life, Piaget’s infants basically repeated behaviors that reproduced interesting results, but they made very few accommodations for the exigencies of particular situations. For example, if the infant managed to shake a rattle and produce an interesting sight and sound because her hand was tethered via a string to the suspended rattle, removal of the string did not lead to any changes of behavior; the infant made the same arm movements. Piaget observed many other instances of this “magical” thinking about how actions produce results in the external world.

But at around eight months of age, Piaget’s infants seemed to display a new understanding of action-outcome relations. The new behaviors that evidenced this new understanding were (a) the use of multiple behavioral means to the same goal, and (b) the recognition and use of behavioral intermediaries in the pursuit of goals. For example, when the infants wanted to reach a toy, and Piaget placed a pillow as an obstacle in the way, prior to eight months of age the infants either would start interacting with the pillow, forgetting the original toy, or else would stay focused on the toy and simply become frustrated; but at eight months of age the infants reacted to the intervention of the pillow by pausing, then removing the pillow or smashing it down, then proceeding deliberately to grasp the toy.

The converse of the removal of obstacles was the use of intermediaries, mostly human intermediaries, to achieve goals. For example, when the infants wanted to operate some toy and could not, they would push the adult's hand toward it and wait for a result (in a very few cases they attempted to use inanimate intermediaries as tools, but these were mostly used a few months later).

Although it is fair to say that prior to eight months of age infants are acting intentionally in the general sense that they are acting toward a goal, the use of multiple means to the same end and the use of intermediaries indicates a new level of intentional functioning (Frye, 1991). A means that was useful toward a goal in one circumstance may be replaced by another in another circumstance; the infant must choose. And it may even happen that a behavior that on one occasion was an end in itself, for example, smashing down a pillow, is now only a means to a greater end (grasping the toy). The implication is thus that infants now have a new understanding of the different roles of ends and means in the behavioral act. They have come to differentiate the goal they are pursuing from the behavioral means they use to pursue that goal much more clearly than in their previous sensory-motor actions. When the infant removes an obstacle and proceeds without hesitation to the goal, it is plausible to assume that she had a distinct goal in mind ahead of time (presumably in the form of an imagined state of affairs in the world), kept this goal in mind throughout the time in which she was removing the obstacle, and clearly differentiated this goal from the various behavioral means among which she had to choose in order to attain the goal.

Simulating the Intentional Actions of Others

Piaget (1954) hypothesized that infants' initial attribution of causal powers to entities other than the self occurs with other persons: "People . . . are very probably the first objectified sources of causality because, through imitating someone else, the subject rapidly succeeds in attributing to his model's action an efficacy analogous to his own" (p. 360). This general approach is the essence of my account as

well, although in his very cursory treatment of the subject Piaget does not make the critical distinction between the understanding of others as sources of self-movement and power, that is, as animate beings, and the understanding of others as beings that make behavioral and perceptual choices, that is, as intentional beings. Indeed, in my view, human infants very likely understand others as animate beings with powers of self-movement much before eight to nine months of age—in a manner similar to all primates—because this understanding does not rely on any kind of identification with the self or attribution of intentionality; self-generated movement can be directly perceived and distinguished from movement that is forced by outside agents. But understanding others as intentional beings—with goals, attention, and decision-making powers—is another thing again.

The distinction is critical. Consider the findings of Leslie (1984) and Woodward (1998). Infants five to six months of age show surprise when they observe other people's hands doing things that they normally do not do. Infants at this age thus seem to know that others are animate beings with powers of self-movement that behave in certain ways. This corresponds precisely to the way infants understand their own actions at this age, that is, as procedures that make things happen (see above). But understanding others as animate beings—that is, as beings that make things happen—is not the same thing as understanding others as intentional agents with an interrelated functioning of goal, attention, and behavioral strategy. In the current simulation theory, that awaits developments in which the infant differentiates goals from behavioral means in her own sensory-motor actions. This differentiation will then open up the possibility of understanding others not just as sources of animate power but as individuals who have goals and make choices among various behavioral and perceptual strategies that lead toward those goals. This provides for something of the directedness, or even “aboutness,” dimension of intentionality that is missing when infants only understand that others have the power to make things happen in some global way.

The theory is thus that human infants identify with other human beings from very early in ontogeny, and that this is based on uniquely human biological inheritance (which may or may not require extended interactions with the social environment). As long as infants understand themselves only as animate beings with the ability to make things happen in some generalized way, for the first seven to eight months or so, that is how they also understand other persons. When they begin understanding themselves as intentional agents in the sense that they recognize that they have goals that are clearly separated from behavioral means, at eight to nine months of age, that is how they understand other persons as well. This understanding also paves the way for understanding the perceptual choices that others make—their attention as distinct from their perception—though we currently have little detailed understanding of this process. Although at this point we should not push the argument too far, it is also possible that infants make some of these same kinds of simulations, perhaps somewhat inappropriately, to inanimate objects and that this is the source of their understandings of how some physical events “force” others to happen: the first billiard ball is pushing the second with the same kind of force that I feel when I push it (Piaget, 1954). Perhaps this kind of simulation is weaker for infants than the simulation of other persons because the analogy between themselves and inanimate objects is weaker.

I should say at this point that there have been many objections to the simulation view based on what for me at least is a misunderstanding. The simulation view is often understood to mean that children must first be able to conceptualize their own intentional states before they can use them to simulate the perspective of others. This does not seem to be the case empirically: children do not conceptualize their own mental states before they conceptualize the mental states of others (Gopnik, 1993), nor do they talk about them earlier (Bartsch and Wellman, 1995). But this need not be a problem if simulation is not viewed as an explicit process in which the child conceptualizes some mental content, while still aware that it is her own mental content, and then attributes it to another person in a specific situation. My hypoth-

esis is simply that children make the categorical judgment that others are "like me" and so they should work like me as well. There is no claim that in specific situations children can gain conscious access to their own mental states more easily than they can discern what another person's specific mental states might be; they simply perceive the other's general manner of functioning via an analogy to the self, with their ability to determine specific mental states in specific circumstances depending on many factors. In the most straightforward case, the child simply sees or imagines the goal-state the other person is intending to achieve in much the same way that she would imagine it for herself, and she then just sees the other person's behavior as directed toward that goal in much the same way that she sees her own.

Chimpanzees and Children with Autism

If we now return to a consideration of our nearest primate relatives, we may conclude the following. Chimpanzees and some other non-human primates clearly understand something of the efficacy of their own actions on the environment, and indeed they even engage in many kinds of intentional sensory-motor actions in which they use different means toward the same end, remove obstacles, and use intermediaries such as tools. If they do not understand others as intentional agents, as I believe they do not, then it cannot be because of this factor. Instead, the reason they do not understand others in this way, in my opinion, is the other factor: they do not identify with conspecifics in the same way as human beings do. Although it is pure speculation, one hypothesis is that this may also be the source of their difficulty with physical problems in which they must attempt to understand the causal relations among the actions of inanimate objects; they do not attempt to identify, however imperfectly, with the objects involved. An interesting twist to this story is provided by enculturated apes who seem to acquire some human-like joint attentional skills such as imperative pointing for humans and imitatively learning some instrumental skills (see Chapter 2). But these individual apes still do not point or use their other communicative signals for others declaratively—that is, just in order to

share attention—and they do not engage in various other activities involving cooperation and teaching. The current hypothesis is that although these individuals may learn something about how humans are effective animate agents in their environments—who must be contacted to fulfill virtually every need and desire—no amount of training can provide them with the uniquely human biological predisposition for identifying with others in a human-like manner.

If we posit that human beings biologically inherit a special ability to identify with conspecifics, it is natural to look for individuals who have some kind of biological deficit in this ability, and these are, of course, children with autism. It is well known that children with autism have significant problems with joint attention and perspective-taking. For example, they show a number of deficits in the ability to jointly attend to objects with others (Loveland and Landry, 1986; Mundy, Sigman, and Kasari, 1990), they produce very few declarative gestures (Baron-Cohen, 1993), and they engage very little in symbolic or pretend play, which in many cases involves adopting the role of another. Some high-functioning children with autism can follow the gaze of another, but lower-functioning children with autism are very poor at accommodating to another's perceptual perspective (Loveland et al., 1991). Langdell's overall conclusion (cited in Baron-Cohen, 1988) is that children with autism as a group have "difficulty in taking another person's point of view," and Loveland (1993) characterizes them as basically "acultural." Currently there is no way to know the source of children with autism's problems—there are many competing theories—but one hypothesis is that they have difficulty in identifying with other persons, and this difficulty can take many different forms depending on such things as the developmental timing and severity of the insult and the other cognitive skills that an individual might or might not have to compensate.

Early Cultural Learning

The human understanding of conspecifics as intentional agents is thus a cognitive ability that emanates both from humans' identification with conspecifics, emerging very early in infancy and unique to

the species, and from the intentional organization of their own sensory-motor actions, shared with other primates and emerging at around eight to nine months of age. Both of these skills are biologically inherited in the sense that their normal developmental pathways occur in a variety of different environments within the normal range (all of which include, of course, conspecifics).

This uniquely human form of social understanding has many profound effects on the way human children interact with adults and one another. In the current context the most important of these effects is that it opens the child to the uniquely human forms of cultural inheritance. Children who understand that other persons have intentional relations to the world, similar to their own intentional relations to the world, may attempt to take advantage of the ways other individuals have devised for meeting their goals. Children are also at this point able to tune into the intentional dimension of artifacts that people have created to mediate their behavioral and attentional strategies in specific goal-directed situations. The claim is thus that despite the rich cultural environment into which children may be born, if they do not understand others as intentional agents—as typically developing human infants before nine months of age, non-human primates, and most persons with autism do not—then they will not be able to take advantage of the cognitive skills and knowledge of conspecifics that is manifest in this cultural milieu. Once infants do begin to culturally learn from others, this process has some surprising consequences for how they learn to interact with objects and artifacts, for how they learn to communicate with other persons gesturally, and for how they learn to think about themselves.

Culture as Ontogenetic Niche

Organisms inherit their environments as much as they inherit their genomes—this cannot be stressed too much. Fish are designed to function in water, ants are designed to function in anthills. Human beings are designed to work in a certain kind of social environment, and without it developing youngsters (assuming some way to keep them alive) would not develop normally either socially or cognitively.

tively. That certain kind of social environment is what we call culture, and it is simply the species-typical and species-unique “ontogenetic niche” for human development (Gauvain, 1995). I will distinguish two ways in which the human cultural environment sets the context for the cognitive development of children: as cognitive “habitus” and as a source of active instruction from adults. Then I will consider how children learn in, from, and through this environment.

First, the people of a given social group live in a certain way—they prepare and eat foods in certain ways, they have a certain set of living arrangements, they go certain places and do certain things. Because human infants and young children are totally dependent on adults, they eat in these ways, live in these arrangements, and accompany adults as they go and do these things. Broadly speaking, we may call this the “habitus” of children’s development (Bourdieu, 1977). Engaging in the normal practices of the people with whom she grows up—at whatever level of involvement and skill—means that the child has certain experiences and not others. The particular habitus into which a child is born determines the kinds of social interactions she will have, the kinds of physical objects she will have available, the kinds of learning experiences and opportunities she will encounter, and the kinds of inferences she will draw about the way of life of those around her. The habitus thus has direct effects on cognitive development in terms of the “raw material” with which the child has to work, and we can certainly imagine, if only in our nightmares, the havoc that would be wreaked on children’s cognitive development if they were deprived of certain sets of those raw materials.

Although the habitus of groups of human beings and the habitus of groups of chimpanzees are clearly not the same, it is very likely that the processes of individual learning and inference by which the cognitive development of the two species is affected by their life-ways are in many ways similar. Developing chimpanzee youngsters also eat what their mothers eat and go where their mothers go and sleep where their mothers sleep. However, in addition, human adults universally take a more active, interventionist role in their

children's development than do other primates and animals. While for many cultural skills adults take a laissez-faire attitude—and the extent of this differs significantly among different cultures—in all human societies there are some things that adults feel they need to help children to learn. In some cases they provide simple assistance, which may be called, after Wood, Bruner, and Ross (1976), scaffolding. Adults witness children struggling with a certain skill and they do various things to make the task simpler or to draw the child's attention to certain key aspects of the task, or they do a part of the task themselves so that the child will not be overwhelmed with too many variables. In some cultures this kind of instructional format simply takes the form of the adult requiring the child to sit and watch as she weaves a rug or prepares dinner or works in a garden (Greenfield and Lave, 1982). But in all human societies there are some tasks or pieces of knowledge that are thought to be so important that adults feel they must directly instruct youngsters in them (Kruger and Tomasello, 1996). These vary from highly important sustenance activities to the memorizing of family ancestors or religious rituals. The main point is that in both scaffolding and direct instruction the adult takes an interest in the child's acquisition of a skill or piece of knowledge and, in many cases, stays involved in the process until the child learns the material or reaches a certain proficiency level. Bullock (1987) in particular has stressed that such intentional instruction is a very powerful force in cultural transmission as it ensures, to a certain degree of likelihood, that a specific skill or piece of knowledge will indeed be passed along.

King (1991) has reviewed a wealth of evidence concerning the social learning of nonhuman primates and also possible instances of teaching by adult primates—what she calls “information donation.” Regardless of the interpretation of a few interesting anecdotes, the picture is quite clear: developing youngsters in all primate species except humans are mostly left to themselves to acquire the information they need to survive and procreate; the adults do little to donate information to them. One of the most significant dimensions of human culture is therefore the way in which adults actively instruct youngsters. In combination with the general effects of living in a

particular habitus, it is clear that the ontogenetic niche for developing human beings is a richly cultural one.

Imitative Learning

At around nine months of age human children are ready to participate in this cultural world in some profoundly new ways. The first and most important of these is that the nine-month-old's new understanding of other persons as intentional agents enables what I have called cultural learning, the ontogenetically first form of which is imitative learning. That is, whereas in early infancy there was some face-to-face dyadic mimicking of behavior, at nine months the infant begins to reproduce the adult's intentional actions on outside objects. This of course opens up the possibility of acquiring the conventional use of tools and artifacts of various types, and thus represents the first truly cultural learning in my fairly narrow definition of the term. Although there are few systematic data on the question, there are some suggestions that, contrary to popular beliefs, very young children do not often imitate behaviors that adults perform while ignoring the child, but much more often imitate behaviors that adults demonstrate "for" them (Killen and Uzgiris, 1981). If true, this would provide an interesting and fairly direct connecting link between adults' active instruction of children and the earliest forms of cultural learning.

Becoming a member of a culture means learning some new things from other people. But there are many ways to learn new things socially, as we saw in the review of primate social learning in Chapter 2. With respect to objects, including tools and artifacts, there are processes of (a) stimulus enhancement in which an adult picks up an object and does something with it, which makes infants more interested in touching and manipulating that object as well (which then facilitates their own individual learning); (b) emulation learning in which infants see an adult manipulate an object and so learn new things about the dynamic affordance of that object which they might not have discovered on their own; and (c) imitative learning in which the child is learning something about human intentional ac-

tions. Many of the classic studies of children's imitative learning have not included the kinds of control conditions needed to make sure that children are indeed imitating adults' intentional behavior, not simply reproducing the effects adults produce on objects. But there are several recent studies that have included these controls and so are especially convincing demonstrations of infant imitative learning.

Meltzoff (1988) had fourteen-month-old children observe an adult bend at the waist and touch his head to a panel, thus turning on a light. Most infants then performed more or less this same behavior—even though it was an unusual and awkward behavior and even though it would have been easier and more natural for them simply to push the panel with their hand. One interpretation of this behavior is that infants understood (a) that the adult had the goal of illuminating the light; (b) that he chose one means for doing so, from among other possible means; and (c) that if they had the same goal they could choose the same means—an act in which the child imagines herself in the place of the other. Imitative learning of this type thus relies fundamentally on infants' tendency to identify with adults, present from an early age, and on their ability to distinguish in the actions of others the underlying goal and the different means that might be chosen to achieve it, present from nine months. Otherwise, the infants might have engaged in emulation learning in which they simply turned on the light with their hands (which they did not), or else they would have just mimicked the action, like a parrot, without any regard for its goal-directed nature. This last interpretation is a possibility in Meltzoff's study, but it was essentially ruled out in the imitation tasks of Carpenter, Nagell, and Tomasello, (1998). They also gave young infants novel and unusual actions that produced interesting results, but they looked very carefully at the infants' accompanying behaviors as they reproduced the act. They found that between eleven and fourteen months of age the majority of infants both reproduced the unusual action and looked to the interesting result in anticipation—thus demonstrating that they were not just mimicking but rather were imitating a goal-directed action.

Two other recent studies have tested more directly what infants understand about others' intentional actions in the context of imitative learning. In the first, Meltzoff (1995) presented eighteen-month-old infants with two types of demonstrations (along with some control conditions). Infants in one group saw the adult perform actions on objects, much as in previous studies. Infants in the other group, however, saw the adult try but fail to achieve the end results of the target actions; for example, the adult tried to pull two parts of an object apart but never succeeded in separating them. Infants in this group thus never saw the target actions actually performed. Meltzoff found that infants in both groups reproduced the target actions equally well; that is, they appeared to understand what the adult intended to do and performed that action instead of mimicking the adult's actual surface behavior. (And they were much better in both of these conditions than in the control conditions in which the adult just manipulated the objects randomly and the like.) In the second study, Carpenter, Akhtar, and Tomasello (1998) studied infants' imitation of accidental versus intentional actions. In this study, fourteen- to eighteen-month-old infants watched an adult perform some two-action sequences on objects that made interesting results occur. One action of the modeled sequences was marked vocally as intentional ("There!") and one action was marked vocally as accidental ("Woops!")—with order systematically manipulated across sequences. Infants were then given a chance to make the result occur themselves. Overall, infants imitated almost twice as many of the adult's intentional actions as her accidental ones regardless of the order in which they saw them, indicating that they differentiated between the two types of actions and that they were able to reproduce, again, what the adult meant to do and not just her surface behavior.

Imitative learning thus represents infants' initial entry into the cultural world around them in the sense that they can now begin to learn from adults, or, more accurately, through adults, in cognitively significant ways. It is important that a number of studies have established that this learning is not just about the affordance of objects that are revealed when others manipulate them, or just about surface behavior in the sense of precise motor movements. Instead, from

around their first birthdays, human infants begin to tune in to and attempt to reproduce both the adult's goal and the behavioral means with which she has chosen to pursue that goal. Because infants before this age do not perceive the behavior of others as intentional, they can only emulate the external results the behavior produces or mimic its sensory-motor form. After this age, they cannot but perceive Daddy as "cleaning the table" or "trying to open the drawer"—not simply as making specific bodily motions or producing salient changes of state in the environment—and these intentional actions are what they attempt to reproduce.

Learning the Intentional Affordances of Artifacts

Imitative learning plays an especially important role in children's interactions with certain types of objects, especially cultural artifacts. Early in development, as young infants grasp, suck, and manipulate objects, they learn something of the objects' affordances for action (Gibson, 1979). This is direct individual learning, and it may sometimes be supplemented by emulation learning in which the child discovers new affordances of objects by seeing them do things she did not know they could do. But the tools and artifacts of a culture have another dimension—what Cole (1996) calls the "ideal" dimension—that produce another set of affordances for anyone with the appropriate kinds of social-cognitive and social learning skills. As human children observe other people using cultural tools and artifacts, they often engage in the process of imitative learning in which they attempt to place themselves in the "intentional space" of the user—discerning the user's goal, what she is using the artifact "for." By engaging in this imitative learning, the child joins the other person in affirming what "we" use this object "for": we use hammers for hammering and pencils for writing. After she has engaged in such a process the child comes to see some cultural objects and artifacts as having, in addition to their natural sensory-motor affordances, another set of what we might call intentional affordances based on her understanding of the intentional relations that other persons have with that object or artifact—that is, the intentional rela-

tions that other persons have to the world through the artifact (Tomasello, 1999a).

The distinction between natural and intentional affordances is especially clear in children's early symbolic play because in symbolic play children basically extract the intentional affordances of different objects and play with them. Thus, a two-year-old may pick up a pencil and pretend it is a hammer. But as Hobson (1993) has pointed out, the child is doing more than simply manipulating the pencil in an unusual way. In early symbolic play the infant also looks to an adult with a playful expression—because she knows that this is not the intentional/conventional use of this object and that her unconventional use is something that may be considered "funny." One interpretation of this behavior is that symbolic play involves two crucial steps. First, the infant must be able to understand and adopt the intentions of adults as they use objects and artifacts; that is, the child first understands how we humans use pencils—their intentional affordances. The second step involves the child "decoupling" intentional affordances from their associated objects and artifacts so that they may be interchanged and used with "inappropriate" objects playfully. Thus, the child comes to use a pencil as one would conventionally use a hammer, smiling at the adult in the process to signal that this is not stupidity but playfulness. This ability to detach the intentional affordances of objects and artifacts and to interchange them relatively freely in symbolic play is, for me, very convincing evidence that the child has learned the intentional affordances embodied in many cultural artifacts in a way that is semi-independent of their materiality.

The process is illustrated especially clearly in a recent study by Tomasello, Striano, and Rochat (in press). They had children from eighteen to thirty-five months of age play a game in which the adult signaled which of several objects she wanted and the child pushed that object down a slide to her. In a warm-up task, children of all ages performed almost perfectly when the adult asked for an object by name. In the real task, the adult asked for the object by holding up a toy replica of the target object (e.g., asking for a real hammer by holding up a small plastic hammer). In this case, however, the

younger children were very poor at interpreting the speaker's communicative intentions with the replica—a surprising finding since from the adult perspective the iconicity of the toy hammer should make it especially easy for the child to interpret. One possible reason for this difficulty is that the younger children engaged with the toy object as a sensory-motor object that afforded grasping, manipulating, and the like—which made it difficult to engage with purely as a symbol (and indeed the young children quite often reached for the toy object as the adult held it up). Interestingly, by the time they were twenty-six months old the children were good at using objects as symbols in this game, but not in one special case. They had great difficulties when the object being used as a symbol had another intentional use, for example, when the adult used a cup as a hat. It seems that this added another competing construal of the cup; that is, the cup was simultaneously:

- a sensory-motor object for grasping and sucking;
- an intentional artifact with a conventional use for drinking; and
- a symbol for a hat in this situation.

These results thus show quite clearly that children's understanding of the intentional affordances of objects—deriving ultimately from their observations of and interactions with other persons in the cultural line of development—are something different from, and indeed may compete with, their previously established understanding of the sensory-motor affordances of objects established in the individual line of development.

The hypothesis is thus that when children begin to understand other persons as intentional agents, and so to imitatively learn the conventional use of artifacts through them, the world of cultural artifacts becomes imbued with intentional affordances to complement their sensory-motor affordances—with children's very strong tendency to imitate adult interactions with objects clearly apparent (see Striano, Tomasello, and Rochat, 1999, and Chapter 4). In the domain of objects, this understanding opens up the possibility of symbolic play with the intentional affordances of various objects and artifacts.

Despite the interesting behaviors of some human-raised apes in manipulating human artifacts, this is all uniquely human behavior (Call and Tomasello, 1996). It should also be pointed out that something similar operates in the domain of social conventions that do not use objects, for example, language and other symbolic artifacts comprising communicative conventions, but because the process of learning is somewhat different in this case, I will save this discussion for the next chapter.

Learning to Communicate Gesturally

Another major domain in which imitative learning makes itself felt is the domain of gestural communication. The earliest gestures of human infants are typically dyadic ritualizations that are essentially the same as chimpanzee gestures (see Chapter 2). For example, many children the world over hold their hands over their heads when they want to be picked up (Lock, 1978). Like chimpanzee gestures, early gestures of this type are:

- dyadic, in the sense that there is no outside object involved;
- imperative, in the sense that they are about what the child wants; and
- ritualized, not imitated, so that they are signals (procedures for getting things done) not symbols (conventions for sharing experience).

Then at eleven to twelve months of age children also begin to produce triadic declarative gestures such as some forms of pointing. How children learn to point for other persons is not known at this time, but the two possibilities are ritualization and imitative learning.

Many infants use arm and index finger extension to orient their own attention to things, and, if the adult reacts appropriately, this kind of pointing may become ritualized. In this scenario it would be possible for an infant to point for others while still not understanding their pointing gestures for her—that is, she would understand

pointing from her own perspective only—and indeed a number of empirical studies have found just such a dissociation between comprehension and production in many infants (Franco and Butterworth, 1996). Infants who have learned to point via ritualization will understand it only as an effective procedure for getting others to do things (a signal, just as chimpanzees understand their gestures), not as a shared symbol.

The alternative is that the infant observes an adult point for her and comprehends that the adult is attempting to induce her to share attention to something; that is, she comprehends the communicative goal of the gesture. The child then imitatively learns the gesture by seeing that when she has the same goal she can use the same means, thus creating an intersubjective gestural act for sharing attention. It is crucial that in this learning process the infant is not just mimicking adults sticking out their fingers; she is truly understanding and attempting to reproduce the adult's intentionally communicative act, including both means and end. It is crucial because an intersubjectively understood communicative device can only be created when the child first understands the adult's communicative intention, and then identifies with that communicative intention herself as she produces the "same" means for the "same" end. The intersubjectivity of the resulting communicative symbol—as we should call it in such cases—thus derives from the nature of the learning process. When imitative learning is involved the infant comes to understand that she is using the same communicative behavior as others; we "share" the symbol. I will return to this process in more detail in Chapter 4 when I detail something of the way children use so-called symbolic gestures and language.

Empirically we do not know whether infants learn to point via ontogenetic ritualization or imitative learning or whether, as I suspect, some infants learn in one way (especially prior to their first birthdays) and some learn in the other. And it may even happen that an infant who learns to point via ritualization at some later time comes to comprehend adult pointing in a new way, and so comes to a new understanding of her own pointing and its equivalence to the adult version. Thus, Franco and Butterworth (1996) found that when

many infants first begin to point they do not seem to monitor the adult's reaction at all, but some months later they look to the adult after they have pointed to observe her reaction, and some months after that they look to the adult first, to secure her attention on themselves, before they engage in the pointing act. The hypothesis is thus that sometime soon after their first birthdays human infants begin to imitatively learn to point for others (whether or not they engaged in ritualized pointing prior to this), and it is at this moment that they learn the cultural convention or artifact of pointing in the sense that they understand its intentional and attentional significance.

Learning about Me

No one really knows how infants understand themselves, but Tomasello (1993, 1995b) proposed an account that derives directly from the current account in terms of the understanding of others as intentional agents. The idea is this. As infants begin to follow into and direct the attention of others to outside entities at nine to twelve months of age, it happens on occasion that the other person whose attention an infant is monitoring focuses on the infant herself. The infant then monitors that person's attention to *her* in a way that was not possible previously, that is, previous to the nine-month social-cognitive revolution. From this point on the infant's face-to-face interactions with others—which appear on the surface to be continuous with her face-to-face interactions from early infancy—are radically transformed. She now knows she is interacting with an intentional agent who perceives her and intends things toward her. When the infant did not understand that others perceive and intend things toward an outside world, there could be no question of how they perceived and intended things toward *me*. After coming to this understanding, the infant can monitor the adult's intentional relation to the world including herself (the "me" of William James and George Herbert Mead). By something like this same process infants at this age also become able to monitor adults' emotional attitudes toward them as well—a kind of social referencing of others' attitudes to the self. This new understanding of how others *feel* about

me opens up the possibility for the development of shyness, self-consciousness, and a sense of self-esteem (Harter, 1983). Evidence for this is the fact that within a few months after the social-cognitive revolution, at the first birthday, infants begin showing the first signs of shyness and coyness in front of other persons and mirrors (Lewis et al., 1989).

It is important to emphasize that what happens at the first birthday is not the sudden emergence of a full-blown self-concept, but just the opening up of a possibility. That is, what infants' new-found social-cognitive skills do is to open up the possibility that they may now learn about the world from the point of view of others, and one of the things they may learn about in this way is themselves. Because in cultural learning the infant employs all of the basic learning and categorization processes that she employs in learning about the world directly, her simulations of others' perceptions of her are used to categorize herself relative to other people in various ways. This categorical component is an important dimension of self-concept as well, especially during the preschool period as children understand themselves in terms of concrete categories such as child, male, good at tree climbing, bad at bike riding, and so forth (Lewis and Brooks-Gunn, 1979).

The Ontogenetic Origins of Culture

I have hypothesized that the fundamental social-cognitive ability that underlies human culture is the individual human being's ability to and tendency to identify with other human beings. This capacity is a part of the unique biological inheritance of the species *Homo sapiens*. It may be a part of children's cognitive capacities by the time they are born, or perhaps a few months later. Which kinds of experiential factors, if any, play a role in the ontogeny of this capacity are unknown, and will continue to be unknown to some extent because human development is not something with which scientists can experiment at will. But for children to become significantly different from other primates cognitively, this unique ability must interact during ontogeny with other developing cognitive skills—most im-

portantly, it must interact with the child's own developing intentionality as manifest in the differentiation between goals and behavioral means in her sensory-motor actions on the environment. Given infants' identification with others, experiencing their own intentionality in this new way leads nine-month-olds to the understanding that other persons are intentional agents, like me. This then opens up the possibility that infants may engage in cultural learning through these other persons.

This is nothing other than the ontogenetic origins of Vygotsky's cultural line of cognitive development. It is not that six-month-olds are not cultural beings in the sense that they are enmeshed in the habitus of their cultures. They are, and throughout the first nine months of life they are in the process of becoming members of their cultures in more and more active and participatory ways. But before they understand others as intentional beings with whom they can share attention to outside entities, they are only learning individually about the world into which they were born. After they understand others as intentional agents like themselves, a whole new world of intersubjectively shared reality begins to open up. It is a world populated by material and symbolic artifacts and social practices that members of their culture, both past and present, have created for the use of others. To be able to use these artifacts as they were meant to be used, and to participate in these social practices as they were meant to be participated in, children have to be able to imagine themselves in the position of the adult users and participants as they observe them. Children now come to comprehend how "we" use the artifacts and practices of our culture—what they are "for."

Monitoring the intentional relations of others to the outside world also means that the infant—almost by accident, as it were—monitors the attention of other persons as they attend to her. This then starts the process of self-concept formation, in the sense of the child understanding how others are regarding "me" both conceptually and emotionally. To presage a theme from Chapter 4, this ability to see the self as one participant among others in an interaction is the social-cognitive basis for the infant's ability to comprehend the

kinds of socially shared events that constitute the basic joint attentional formats for the acquisition of language and other types of communicative conventions.

It is significant that children with autism have biological deficits in precisely the complex of skills we have been focused on here (Baron-Cohen, 1995; Hobson, 1993; Happé, 1995; Loveland, 1993; Sigman and Capps, 1997). They have problems in a variety of joint attentional skills, they have problems in imitative learning, they do not engage in symbolic play normally, they do not seem to have self-understanding of the same type as typically developing children, and they have difficulties in learning and using linguistic symbols in communicatively appropriate ways (as we shall see in Chapter 4). There is great variability in all of these things in children with autism, fading over into allied disorders such as Asperger's Syndrome, and so it is dangerous to make any general claims. For now, I would simply like to point out that if we think of the ontogeny of the uniquely human social-cognitive ability to participate in culture not as a direct causal connection from genes to adults, but rather as a process that takes many months and years to unfold as children at various stages of development interact with their physical and social environments, we can certainly imagine that different kinds of problems at different developmental steps along the way can lead to radically different outcomes in the cognitive development of these unfortunate children.

Overall, virtually everyone agrees that something dramatic happens in human infants' social cognition at around nine months of age. Whereas the social cognition of human infants before this age shares much with that of nonhuman primates, with perhaps some special features, by nine months of age there can be no doubt that we are dealing with processes of social cognition that are unique to the species. There is still a long way to go before children will understand such things as false beliefs, but in the current context the understanding of others as intentional agents is the crucial step in the ontogeny of human social cognition because it enables infants to begin their lifelong voyage down the cultural line of development. By empowering them to engage in various processes of cultural

learning and the internalization of the perspectives of other persons, this new understanding enables infants to culturally mediate their understanding of the world through that of other persons, including the perspectives and understanding of other persons that are embodied in the material and symbolic artifacts created by other persons far removed in space and time.