COMMENTARY

DIALOGICAL NATURE OF COGNITION

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The overarching message of this monograph is that cognition and cognitive development are inseparable from social adaptation. Although not new, this message has often tended either to be ignored or to take a backseat in the quest for a machinelike description and explanation of cognition and its development. The report of Jaffe, Beebe, Feldstein, Crown, and Jasnow is another wake-up call to the danger of splitting the cognitive from the social.

The complex and careful observations reported in this monograph demonstrate that from the origins of development children do not construe the world in independence of the process by which they establish relationships with other individuals. After reading the report of this research, one should be convinced that the study of cognitive processes (thinking, reasoning, problem solving, concept formation, etc.) cannot and should not be divorced from social processes that allow the individual to commune with others, to manage social proximity, and to search for intimacy.

There are two parts to my commentary. First, to complement Jaffe and collaborators' findings I offer some considerations regarding important developmental changes marking the 1st year of life. My point is that we should avoid the temptation to reduce infants to a fixed quantity of intelligence or interpersonal skills that would explain long-term predictions and stability of behavioral outcome, whether IQ or attachment patterns. In fact, the story is much more complex, involving major developmental transitions and changes between birth and age 12 months.

In the second part of this commentary, I make a theoretical plea for the socially grounded nature of cognition. This plea is inspired by the remarkable findings compiled in this monograph. These findings demonstrate

the reliable link between interpersonal (vocal) coregulation at age 4 months and attachment patterns as well as cognitive abilities at age 12 months. Particularly remarkable is the fact that the assessment of cognition was based on test items that are not obviously social. These were items originally designed to be purely cognitive, involving for the most part physical objects such as stacking blocks or looking for hidden objects (Bayley, 1969).

Social-Cognitive Development in the 1st Year

There is a danger that the general picture of the infant that emerges from the findings of Jaffe and collaborators will suggest to some that the infant exhibits potentially "innate" interpersonal sophistication and a sophisticated information processing capacity, along with a stability of behavior that extends across the 1st year of life. Such nondevelopmental conclusions, however, are not warranted. By comparing infants at ages 4 and 12 months, the monograph skips over major behavioral reorganizations that occur during the 1st year of life. My first goal in this commentary is to provide a reminder of those developments.

The monograph affirms the view that 4-month-old infants are full-fledged participants in bidirectional exchanges with social partners. The way they coregulate their vocal exchanges is, in some respect, analogous to the way adults interact. Jaffe et al. show in minute detail that, "aspects of adult dialogic structure are already in place at age 4 months." They show, for example, that infants tend to match switching pause duration, pausing for periods comparable to those of the adult before taking their turn in vocal exchanges. As Jaffe et al. remind us, this is a well-documented fact found in the literature on the pragmatics of conversation among adults (Crown, 1991; Jaffe & Feldstein, 1970; cited by Jaffe et al. in their monograph).

The early ability of infants to coconstruct rhythms of vocal exchanges with adults is combined with an exquisite sensitivity to context. The monograph demonstrates very convincingly that not only do 4-month-olds coregulate their vocal exchanges in an adult manner, but this sophisticated coregulation is modulated by the degree of novelty of the social partner. The research suggests that, as for adults (Crown, 1991), tighter conversational coordinations are expressed when conversing with a novel compared to a familiar person. Furthermore, this phenomenon is compound with the novelty of the location where the conversation takes place (i.e., laboratory as opposed to home).

Jaffe et al. reveal that 4-month-old infants engaging in protoconversation are not merely passive responders to adults' solicitations; rather, they are active participants exploring and discriminating social partners in situ. Infants at this age already manifest timing aspects characterizing

the pragmatics of mature social exchanges that are potentially the basis of procedural memories associated with specific individuals. As suggested by the authors, these representations of "timing pragmatics" could be the basis of social discrimination by the young infant (e.g., mother vs. stranger) and apparently are the source of developing patterns of attachment. But what is the origin of this remarkable social sophistication?

Based on Jaffe et al.'s findings, there is the danger of jumping too quickly to the conclusion that this interpersonal sophistication may be "innate" or "hard wired" into the biology of the neonate (see, e.g., Trevarthen, 1979). This conclusion, however, would overlook the major developmental achievements that occur in the first few weeks of postnatal life, which lead infants toward the interpersonal and communicative skills so well captured in this monograph. In fact, a great deal happens prior to age 4 months in terms of socialization and mental growth. What follows is a reminder that the younger infants studied by Jaffe et al. are already the product of marked behavioral transformations and important experiential changes. I will later turn to a consideration of developmental changes that occur between age 4 months and age 12 months when the infants were retested.

Age 2 Months: Revolution With a Social Smile

Between birth and age 4 months, significant development changes take place both in the way infants enter into relationships with others and in the way they interact with physical objects. Until the 2nd month, the behavior of the healthy term infant in many ways resembles the behavior of the healthy fetus in the last 2 to 3 months of pregnancy. Ultrasonic techniques allowing for fine analysis of fetal behavior reveal the unquestionable continuity between pre- and postnatal behavior (De Vries, Visser, & Prechtl, 1982; Prechtl, 1984). Until approximately 6 weeks outside the womb, infants behave essentially as externalized fetuses (Rochat & Striano, 1999a). Their wake-sleep cycle is comparable, many of their patterns of sensory motor coordination are similar to that expressed in the womb, and each demonstrates a capacity for learning by habituation and dishabituation to novel multimodal events (De Casper & Fifer, 1980; DeCasper et al., 1994; Marlier, Schaal, & Soussignan, 1998).

By approximately age 6 weeks, infants appear to wake up to the world. Their state regulation shifts markedly. By this age, there is a dramatic increase in the amount of time infants spend in an awake and alert state, the state in which infants appear to process new information and explore their environment (Wolff, 1987). Accompanying this state regulation change, infants manifest for the first time socially elicited smiling in face-to-face interaction with a social partner. This is an unmistakable and crucial event

recognized with delight by parents and caretakers who typically discover a person in their infant.

The emergence of externally elicited smiling marks the beginning of an explicit bidirectional sense of shared experience between infants and the people surrounding them. It is, in many ways, the true beginning of intersubjectivity, the beginning of a long conversation with others, a psychological birth that follows by a few weeks the biological birth of the infant. The timing of this psychological birth appears to be remarkably robust, regardless of the variety of care-giving practices surrounding the infant (Barr, Bakeman, Konner, & Adamson, 1987).

From age 2 months on, infants interact with people and objects in new ways. There are changes in what guides the infant's attention, changes in the infant's preferences, changes in the process of scanning objects, and, most important, changes in the way the infant interacts with other persons. From being discriminative, the infant's social stance becomes reciprocal and conversational (Rochat, 2001a).

The developmental change in social stance is particularly important in that it opens new possibilities for rapid developments. The entry into reciprocal exchanges with others involves the kind of bidirectional vocal transactions depicted in the present monograph, along with eye exchanges, facial expressions, and postural, tactual, and tonic transactions. All of these contribute to a transformation not only of the infants' construal of the others with whom they enter into relationships, but also of their way of construing and acting on *physical* objects in the world as indexed by the Bayley test.

From the time they smile at other persons, and up to age 4 months and beyond, infants develop social expectancies and begin to explore systematically the consequences of their own actions on objects (Rochat, 2001b; Rochat, Querido, & Striano, 1999; Rochat & Striano, 1999b). They become deliberate agents expecting both reciprocity from others and efficacy in their action on objects. In short, there is a long and marked development leading infants to become the sophisticated 4-month-old communicators depicted by Jaffe and collaborators. Often, much of this development is unrecognized, and its mechanisms remain largely unknown.

Age 9 Months Revolution: Triangulation Between Self, Objects, and People

The developmental predictions reported in this monograph, although real, might also give the illusion of a general behavioral stability between ages 4 and 12 months. As with the period between birth and age 4 months, the period from age 4 months to age 12 months is marked by major developments in the way infants construe the world, particularly in the

way they relate to other persons. By age 6 months, the primacy of face-to-face exchanges tends to decrease as infants become increasingly infatuated with the exploration of physical objects. Research in my own lab has shown over and over again that between ages 4 and 6 months there is a very robust decrease in the relative amount of visual attention paid by the infant to a soliciting social partner (e.g., Rochat, Striano, & Blatt, in press, 2001). From a stage dominated by an interest in person, infants move to a stage dominated by an interest in objects. Postural development and the emergence of independent locomotion, generally by 9 to 12 months of age, support infants' propensity to explore ever larger areas of their physical environment (Campos, J. J., Anderson, D. I., Barbu-Roth, M. A., Hubbard, E. M., Hertenstein, M. J., and Witherington, D. (2000), Travel Broadens the Mind, *Infancy*, 1(2), 149–219). Interestingly, it is also at around this age that infants begin to exhibit stranger anxiety, or what is sometime labeled as the "8th month anguish" (Spitz, 1965). Stranger anxiety and the increased fear of separation from primary caretaker(s) is probably closely related to infants' ever-expanding object exploration that leads them away from the immediate proximity of mother, whom however they still need as secure base.

In fact, infants at about this age face a major dilemma. They are pulled by two contradictory forces: the drive to explore increasingly larger portions of the object world and the drive to remain close and maintain contact with primary caretakers (Rochat, 2001a). This fundamental dilemma, which I believe to be universal and a major source of progress for the infant, is somehow resolved when, beginning at age 9 months, the infant begins to incorporate others into his or her exploration of the physical world via joint engagement.

From age 9 months, infants make efforts to incorporate other people in their foray into the world of objects. They begin to display joint attention, social referencing, and imperative gestures such as pointing. They also begin to comprehend symbolic gestures and they utter their first words to communicate with others about specific events and things occurring in an environment that is explicitly shared (Carpenter, Nagell, & Tomasello, 1998; Tomasello, 1995a, 1999).

Just as by age 2 months infants show first unambiguous signs of shared experience via smiling (so-called "primary" intersubjectivity; Trevarthen, 1979), by age 9 to 12 months infants bring intersubjectivity to a dramatically new level, the level of a referential triangle between the self, objects, and people.

The developments briefly outlined here serve as a reminder of the major transformations that occur in the 1st year of life, but they do not diminish the remarkable predictive findings reported by Jaffe and collaborators in their monograph. On the contrary, these developmental trans-

formations make the Jaffee et al. findings all the more striking. Indeed, a major question is how the stability and apparent order found in this monograph are possible in the face of so many profound developmental changes. It appears that for the authors, what remains stable is the temporal information processing ability of the infant—specifically the general capacity to parse temporal events that are coconstructed with a social partner as well as the general capacity to respond to novelty.

This mediating mechanism is put forth by Jaffe et al. to account for both interpersonal transmission of style with respect to attachment at age 12 months, and the infant's mental status at the same age as measured by the Bayley test. However, as noted by the authors, the Bayley test is both a measure of cognitive and social abilities requiring infants to process the pragmatics of the communicative exchange as the test is administered, as well as the object of the test itself. Obviously, a test is never *purely* cognitive, particularly at age 12 months. It is always part of a complex social exchange between individuals adopting specific roles, either the role of tester or tested, with all the authority and submission attached to each. Therefore, it is indeed reasonable that the predictions of attachment pattern and mental ability at age 12 months have a common social-cognitive denominator, in particular the ability to process and sequence temporal events that are coconstructed in interaction with others.

Next, I would like to push this idea further by suggesting that cognition is ontogenetically rooted in social exchanges, whether real as depicted in this monograph, or virtual as in private dialogical thinking emerging later in older children and adults. The general idea is that an essential aspect of thinking and reasoning as higher functions is their framing in the ongoing dialogues we carry on with others, and that we also constantly carry on with ourselves (Fernyhough, 1996; Vygotsky, 1962, 1978; Wertsch, 1991).

Thinking as Real and Virtual Dialogues

Thinking is both private and public. We solve problems in interaction with others as well as on our own. Thinking alone and thinking with others are, in fact, strikingly analogous situations. In both cases we tend to engage in dialogues, whether real or virtual. In thinking—for example, trying to solve a problem, build a theory, or defend a case—we are constantly playing devil's advocate to test our construct. For an adult, it is hard to imagine any problem-solving situation without such real or virtual role taking. As a case in point, overt monologues while thinking are not uncommon, and they are even uncontrollable for many. This is not abnormal behavior. Rather, it appears to be the expression of a real and highly meaningful phenomenon, namely the fact that, at least for adults,

private thoughts are framed as virtual social exchanges involving virtual interlocutors.

This idea is certainly not new (see Bakhtin, 1981, in relation to literature; Cole, 1985; Fernyhough, 1996; Vygotsky, 1962, 1978; and Wertsch, 1991, in relation to psychology and developmental cognition in particular; and Fridlund, 1994, in relation to the expression of emotion and real or virtual audience effects). However, relatively few systematic efforts have been made by contemporary researchers to conceptualize thinking, problem solving, reasoning, or even social cognition in these dialogical terms. This is remarkable considering that we can all agree that at least part of our conscious interpersonal and thought processes entails inner dialogues that closely resemble brainstorming with real people.

Thinking as virtual dialogues is a major avenue of cognitive progress, and consequently it is a major avenue of knowledge acquisition and the process by which knowledge is redescribed to become more explicit (Karmiloff-Smith, 1992; Tomasello, 1999). Virtual dialogues are analogous to and, in fact, modeled after the process by which one gains knowledge via tutoring and problem solving in interaction with real interlocutors. It is obvious that virtual dialogues are not available from the beginning of language, and thinking itself requires a good deal of development before these dialogues become available. Specifically, symbolic functioning and some basic ability to switch perspectives and adopt different virtual roles or "voices" (i.e., the acquisition of a "theory of mind") are necessary prerequisite abilities. The first evidence of virtual dialogues in children seems to occur at around 2 to 3 years of age when they first begin to engage in pretend play (Harris, 1994; Tomasello, 1999). Role taking in the form of virtual dialogues is the hallmark of early pretend play, which in turn is the hallmark of childhood.

The artifacts that surround children, such as toys and other miniature replicas of real things, nourish the propensity to pretend, to adopt roles, and ultimately to create virtual dialogues. Parental culture is very systematic in nurturing this propensity by surrounding the child with pretend opportunities via manufactured toys and games. Note however that this cultural scaffolding is especially prominently promoted in the industrialized West, although toys probably exist in all cultures, at least in higher social classes.

Thinking via the process of virtual dialogues opens several developmental opportunities to the child. As in tutoring and learning via interaction with someone else, it is a major source of knowledge and problem resolution. When discussing issues or problems with someone else or in a group, whether in casual conversations or in more formal settings (e.g., the classroom), there is always on-line tutoring and mutual consolidation of thoughts and ideas. Coconstructing ideas and resolving problems in

negotiation with others allow individuals to bypass their own cognitive limitations. I believe that such social-cognitive dialectic or instructive social exchanges are re-created in virtual dialogues as a source of cognitive progress for the individual. This idea was formulated many years ago by Vygotsky (1962, 1978) in relation to children's internalization of culture and language expressed in internal speech.

Language is not a prerequisite for children to experience the basic benefit of conversing with others. As clearly demonstrated in this monograph, infants at age 4 months are already actively engaged in coordinating their interpersonal exchanges. From such coordination they gain the experience of rhythms of vocal and turn states as well as the coconstruction of novel sequencing or temporal parsing of auditory events. In fact, such exchanges enhance temporal parsing. It scaffolds the infant in breaking the flow of perceptual events into analyzable units that can be represented as organized procedural or pragmatic memories, as suggested by Jaffe et al. In other words, *protoconversation provides infants with the unique opportunity to parse and represent perceptual events.* This is probably an important aspect of the ontogenetic roots of collaborative thinking and future thinking as virtual dialogues.

When infants begin to coregulate their transactions with others, they are actually inducted into the realm of instruction and collaboration and are engaged in the coconstruction of experience. This is the source of intersubjectivity or shared experience, but also the origin of thinking as virtual dialogue.

It is worth noting that the parent-infant engagement in extended face-to-face exchanges is a particularly human activity. Nonhuman primates, although they engage in grooming and display much affectionate care for their progeny, do not seem to engage in coconstructed face-to-face dialogues to the same extent that human mothers and infants do, regardless of culture or social status. It is thus reasonable to assume that there is something uniquely human in the instructional and collaborative model offered to infants in face-to-face dialogues. This may be a partial mechanism for the developmental emergence of uniquely human cocognitive adaptations such as language and explicit thinking in the form of real as well as virtual social dialogues.

Others in Mind and the Emergence of Coawareness

The dialogical nature of cognition finds strong support in the fact that beyond infancy, and in particular by the 2nd year, children begin to manifest explicit social coawareness. It is by this time that children begin to express self-consciousness in mirrors and other reflecting devices (Bertenthal & Fisher, 1978; Lewis & Brooks-Gunn, 1979). In identifying

themselves, children actually become aware of how others perceive or, more precisely, how others might perceive them. This explains why children beginning to manifest mirror self-recognition also often manifest embarrassment (Lewis, 1992). What children start to manifest is a sense of the self that is exposed to the public eye. This novel awareness shapes children's cognition and cognitive progress. It also determines their behavior in general. This phenomenon is concisely captured in the following passage:

> There is a thing that happens with children: If no one is watching them, nothing is really happening to them. It is not some philosophical conundrum like the one about the tree falling in the forest and no one hearing it: that is a puzzler for college freshmen. No. If you are very small, you actually understand that there is no point in jumping into the swimming pool unless *they* see you do it. The child crying, "Watch me, watch me," is not begging for attention; he is pleading for existence itself. (M. R. Montgomery, *Saying Goodbye: A Memoir of Two Fathers*, cited by Tomasello, 1995b, p. 449).

By their 2nd year, healthy children (as opposed to children who eventually develop relational impairments such as autism) progress increasingly with others and virtual others in mind. For example, we have recently found that a means-ends problem-solving task (a Piagetian task of pulling a blanket to bring an attractive object within reach) that is easily solved at 9 months of age is not as easily solved by 18-month-old children, who tend to place their effort in requesting help from the experimenter rather than in solving the problem on their own (Goubet, Maire-LeBlond, Poss, & Rochat, 2001).

A simple task typically resolved alone at age 8 months is transformed 10 months later into the primarily social task of including others in its resolution. At the purely surface level of performance, this is a regression. At a deeper level of competence, it is the sign of a big step toward teaching and instruction, two major engines of human cognitive growth.

In conclusion, the intriguing data reported by Jaffe et al. stimulate the revival of radical views on development and the dialogical nature of cognition that I have tried to articulate in the latter part of this commentary. They provide strong empirical vindication to the radical intuitions of previous theorists like Lev Vygotsky who proposed that

> All higher psychological functions are internalized relationships of the social kind, and constitute the social structure of personality. Their composition, genetic structure, ways of functioning—in one word—all their nature is social. Even when they have become psychological processes, their nature remains quasi-social. The human being who is alone also retains the functions of interaction. (Vygotsky, 1960; cited in Valsiner, 1997, p. 154).

This view should inspire more developmental research capturing in systematic ways the dialogical and social nature of cognition as it unfolds in development. This monograph shows how stimulating such research can be, from the outset of development.

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