

Blackwell Handbook of Infant Development

Edited by

Gavin Bremner and Alan Fogel

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Contents

List of Contributors	viii
Introduction	x
Part I Perception and Cognition	
Introduction	1
1 Visual Perception <i>Alan Slater</i>	5
2 Hearing, Listening, and Understanding: Auditory Development in Infancy <i>Anne Ernald</i>	35
3 Action in Infancy - Perspectives, Concepts, and Challenges: The Development of Reaching and Grasping <i>Ad W. Smitsman</i>	71
4 Cognitive Development: Knowledge of the Physical World <i>J. Gavin Bremner</i>	99
5 Infant Learning and Memory <i>Catalyn Roue-Collier and Rachel Barr</i>	139
6 Functional Brain Development During Infancy <i>Mark H. Johnson</i>	169
7 Origins of Self-concept <i>Philippe Rochat</i>	191
8 Joint Visual Attention in Infancy <i>George Butterworth</i>	213
9 Mind Knowledge in the First Year: Understanding Attention and Intention <i>Vasudevi Reddy</i>	241

Chapter Seven

Origins of Self-concept

Philippe Rochat

Introduction

Questions regarding the origins and nature of self-knowledge are arguably the most fundamental in psychology. What is knowledge about oneself made of and where does it come from? The aim of this chapter is to discuss recent progress in infancy research that sheds new light on these questions. The issue of whether self-knowledge finds its root in language development is first considered. On the basis of recent empirical evidence, I will then assert that self-knowledge does not depend exclusively on language development. Infancy research demonstrates that self-knowledge is expressed at an *implicit* level long before children become symbolic and competent talkers. The main idea running through the chapter is that at the origin of explicit and conceptual self-knowledge (i.e., self-concept) is an implicit knowledge about the self developing in the preverbal child. The focus here is on the nature of early implicit self-knowledge and its link to later-emerging explicit self-knowledge.

In general, the chapter will try to show that infants from birth, and particularly from 2 months of age, develop two types of implicit self-knowledge. On one hand, infants develop implicit knowledge about their own body via self-exploration and self-produced action on objects. On the other, they develop specific knowledge about their own affective dispositions via interaction and reciprocation with others. The origins of these two types of implicit self-knowledge are, respectively, *perceptual* and *social*.

But prior to this presentation, the origins of self-knowledge in relation to language and the emergence of symbolic functioning by the second year of life should briefly be sketched.

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Self and Language

We all have some notions of who we are and what distinguishes us from others. We know what we look like, have some sense of our relative power, as well as the personality we project to the outside world. We have a sense of what belongs to us and what doesn't, the things we excel in and those we don't. In short, we all have some explicit conception of ourselves, a so-called explicit *self-concept*. The explicit self-concept of adults is to a large extent articulated in words as we frequently engage in talking about ourselves, perform silent monologues, and display a universal compulsion for internal speech, adopting the self as audience and as sole witness of . . . ourselves.

An explicit, hence reflective, conception of the self is already apparent at the early stage of language acquisition. As argued by Bates (1990), "the acquisition of any natural language requires a preexisting theory of self – a theory of the self as distinct from other people, and a theory of the self from the point of view of one's conversational partners" (p. 165). By 18 months, infants start to mark contrasts between themselves and other people in their verbal production. They express semantic roles that can be taken either by themselves or by others (Bates, 1990). Does that mean, however, that the nature of self-concept is primarily linguistic? In other words, does it imply that the roots of an explicit sense of self are to be found in language and its development?

It is feasible that self-concept emerges under the pressure of growing linguistic competence, essentially a linguistic epiphenomenon. With language would come self-marking and labeling, with children somehow compelled to become explicit about who they are in terms of their own desires (e.g., "Candy!"), beliefs (e.g., "Katy nice!"), feelings (e.g., "Happy!"), and other states of mind (e.g., the unfortunately too typical "Mine!"). Communicating verbally does indeed require much explicit reference to the self as the subject of action, intentions, and beliefs.

The idea that the emergence of self-concept is linked to the development of language is corroborated by the roughly synchronous developmental timing of mirror self-recognition in the young child. By the time children start to utter their first conventional words, using arbitrary sounds that are acknowledged by their community as standing for things in the world, they also start to show clear signs of self-recognition in mirrors. It is also by the middle of the second year, around the time children typically start to speak, that they also start to show self-referencing (e.g., pointing to themselves) and self-conscious emotions (e.g., embarrassment) in front of mirrors (Lewis & Brooks-Gunn, 1979). In the context of the famous mirror "rouge task," this is evident when children perceive their own reflection, noticing that a stain of rouge has been surreptitiously smeared over their face (as an illustration, see Figure 7.1).

From the perspective of evolution, formal and generative language is what differentiates humans from other animal species. Interestingly, self-concept is also a trademark of humans, including a few of our close primate relatives who demonstrate mirror self-recognition in the context of the "rouge" task (i.e., orangutans and chimpanzees; see the thorough review by Tomasello & Call, 1997). Thus, if language and self-concept are connected in child development, they also appear to be linked as major cognitive trademarks in primate evolution (Gallup, 1982; Povinelli, 1993).

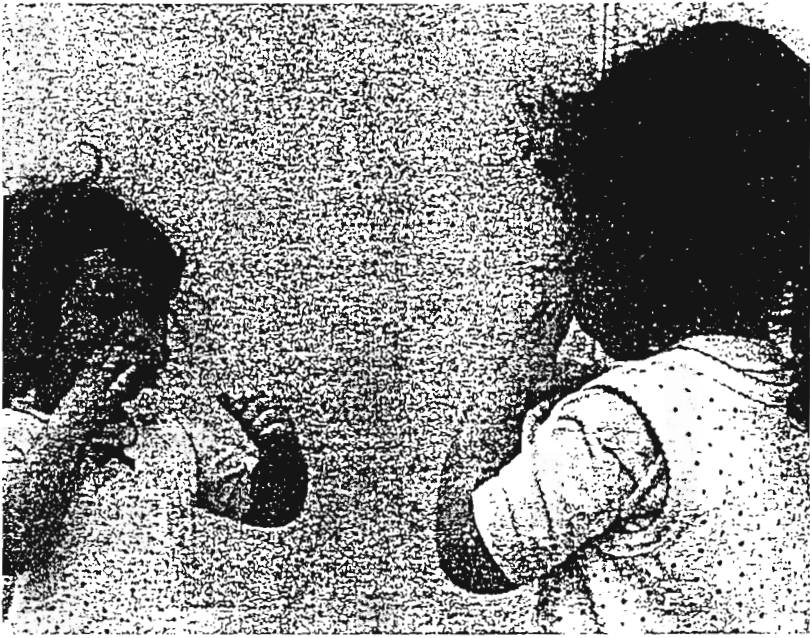


Figure 7.1 Self-referencing and embarrassment manifested by an 18-month-old infant in front of a mirror during the rouge test. (Photo Pascale L. R.)

In child development, although language and explicit self-concept appear connected in the timing of their emergence, it does not mean that they are mutually dependent. On one hand, there is much ground to assume that language acquisition and the learning of word meanings rest on an understanding of self as intentional. When children hear a new word and learn that *this* particular word stands for *that* specific object or event in the world, they connect the intention of others with their own to communicate about objects and events in the environment (Tomasello & Akhtar, 1995). The child clearly shows the distinct notion of others and of him or herself as intentional communicators (Tomasello, 1995). On the other hand, children do not wait until they are symbolically competent to express some *implicit* or *preconceptual* self-knowledge. As proposed by William James over a century ago, it is necessary to distinguish implicit and explicit levels of self-knowledge.

Self-knowledge Without Language

In his seminal writing on the self, James (1890) distinguishes the “Me” and the “I” as two basic aspects of the self. The “Me” corresponds to the self that is identified, recalled, and talked about. It is the conceptual self that emerges with language and which entails explicit re-cognition or re-presentation. It is beyond the grasp of infants, who by defini-

tion are preverbal, not yet expressing themselves within the conventions of a shared symbol system. On the other hand, there is the self that is basically implicit, not depending on any conscious identification or recognition. The "I" is also referred to as the *existential self* (Lewis & Brooks-Gunn, 1979) or the *implicit self* (Case, 1991). It is, for example, the sense of their own body expressed by young infants when they start to reach and grasp objects around them. Infants implicitly express a sense of themselves as agent (reachers) as well as a sense of their own physical situation in the environment (objects around them are perceived by the infant as reachable and graspable depending on size and distance; see Rochat, 1997). Infancy research shows that the "I" is expressed long before any signs of a conceptual (explicit) sense of self (the "Me").

If we accept James's distinction, the question is what kind of relation these two fundamental aspects of the self entertain, and in particular, how do they relate in their development? One possibility is that they are developing independently of each other and that somehow their functioning is parallel and unrelated. Another possibility, proposed here and supported by infancy research, is that the development of the conceptual self emerging by the second year is *rooted in* and *prepared by* an implicit sense of self already present at birth and developing from the outset (the early sense of an existential self or "I" following James's distinction).

In the tradition set by James but expanding his work, Neisser (1991) further distinguishes two kinds of *implicit self* or "*Is*" manifested in early infancy, long before the developmental emergence of a conceptual self. Neisser proposes that from the outset of development, infants have two kinds of selves within either the social or physical domain. Each domain provides the infant with specific perceptual information specifying different aspects of the self: the *interpersonal* in the social domain, and the *ecological self* in the physical domain.

The interpersonal self grows out of the infant's transactions with others, in particular the developing sense of shared experience and reciprocity. In the physical domain, infants develop a sense of their own body in relation to other objects, what Neisser labels "the ecological self." The ecological self is the sense infants develop of their own physical body as a differentiated, situated agent in relation to other objects furnishing the environment. The ecological self develops as infants interact with physical objects and also as they perceive their own body directly via self-exploration (see below, Rochat, 1998; Rochat & Morgan, 1995).

Neisser's conceptualization of the self in infancy is justified based on a growing body of observations provided by current infancy research (see Butterworth, 1995). We will see next that this research demonstrates that at the origin of development, infants manifest a sense of the ecological as well as the interpersonal self.

The Self in Infancy

Infants from a very early age differentiate perceptually between self- and non-self-stimulation, namely, between themselves and other entities in the environment. Early on, for example, infants differentiate between their own movements in the environment,

whether passively or actively produced, and the independent movements of objects observed from a stationary point in space (Kellman, Gleitman, & Spelke, 1987). Young infants and even newborns respond with markedly different postural adjustments (e.g., straightening of the trunk or head movements) when they are surreptitiously set in motion, or if their surrounding is set in motion with them maintained stationary (Bertenthal & Rose, 1995; Jouen & Gapenne, 1995).

Aside from being situated in the environment, infants also manifest an implicit sense of their own effectivity in the world. From birth, infants learn to be effective in relation to objects and events. *For example, within hours after birth, neonates are capable of learning to suck in certain ways and apply specific pressures on a dummy pacifier to hear their mother's voice or see their mother's face* (DeCasper & Fifer, 1980; Walton, Bower, & Bower, 1992). This remarkable instrumental learning capacity testifies to the fact that early on infants manifest a sense of themselves as an *agent* in the environment, an important aspect of the (implicit) ecological self (Neisser, 1995; Rochat, 1997).

As we will see, in the social domain there is also good evidence of implicit self-knowledge. From at least 2 months of age infants start to reciprocate with others, smiling, gazing, and cooing in face-to-face exchanges with a social partner. They show some signs of what Trevarthen (1979) coined "primary intersubjectivity," the sense of shared experience infants manifest in dyadic face-to-face interactions. When social partners adopt a sudden still-face, staring at the infant with a neutral, frozen facial expression, infants from 2 months of age react with strong negative facial expressions: they gaze away, smile markedly less, and even cry (Toda & Fogel, 1993; Tronick, Als, Adamson, Wise, & Brazelton, 1978). This robust phenomenon suggests that infants already have an implicit sense of others, as well as of themselves, as reciprocating (social) agents. They expect social partners to reciprocate in certain ways to their *own* emotional displays. If they smile, they expect others to reciprocate with analogous emotional expressions.

Early on, others are social mirrors in which infants contemplate and learn about themselves via imitation (Meltzoff & Moore, 1995) and the behavioral mirroring provided by caretakers who tend to feed back to the infant what they just did. Adult mirroring of the infant contains rich information about the self, characterized by systematic exaggeration of infants' emotions and precise marking of such mimicking by the adult (Gergely & Watson, 1999). In short, there is now good evidence as well as solid ground for the early development of an implicit sense of self as *social agent*, reciprocating with people in systematic ways and developing social expectations (Rochat, Querido & Striano, 1999; Rochat & Striano, 1999a).

The abundance of findings supporting the existence of both an ecological and interpersonal self at the origin of development contrasts sharply with the theoretical assertions that have been traditionally put forth by developmentalists. Current research has radically changed the traditional view of an originally confused infant devoid of any implicit sense of self. Infants do not appear to start off in a state of fusion and confusion in regard to their situation in the environment. James's (1890) famous account of the world of newborns as a "blooming, buzzing confusion" does not fare well with current infancy research.

In general, the view of an initial state of undifferentiation between the infant and the environment (e.g., Mahler, Pine, & Bergman, 1975; Piaget, 1952; Wallon, 1942/1970)

needs to be revised in light of evidence of remarkable abilities in newborns for instrumental learning, social attunement, as well as differential responding to self- and non-self-stimulation (DeCasper & Fifer, 1980; Rochat & Hespos, 1997; Walton, Bower, & Bower, 1992). What remains unclear, however, is how various kinds of implicit sense of self might develop to become explicit beyond infancy, when for example infants start explicitly to label and to recognize themselves in mirrors. If we accept Neisser's assertion of an implicit sense of the ecological and interpersonal self that would develop prior to language, questions remain as to how they develop and relate to each other. Do they develop independently? Does one precede the other? Do they need to be integrated for infants eventually to become explicit about themselves, such as through self-recognition in mirrors or starting to label themselves as *persons*?

Different Views on the Origins of Self-knowledge

For some infancy researchers like Fogel (1993, 1995) or Lewis (1999), the implicit sense of self in infancy develops primarily through *relationships with others*. An implicit sense of the interpersonal self is viewed as central to infant psychological development and as having some developmental precedence over others. In the tradition of George Herbert Mead (1934), the emphasis is on an early sense of self molded into the adult state via social interaction (see also Meltzoff & Moore, 1995, regarding early imitation and the origin of self).

Although focusing on the interpersonal world of infants, Stern (1985) proposes that infants in the first two months of their life develop an implicit sense of themselves that is somehow presocial, not yet based on a reciprocation with others *per se*. For Stern, during the first two months of life, infants develop an implicit sense of what he calls the *emergent self*. The emergent self precedes the development of the *core self*, which corresponds to Neisser's interpersonal self (Neisser, 1991, 1995). In Stern's view, during the first two months, infants primarily experience their own behavioral organization in terms of fluctuating states, growing sensorimotor organization, and in terms of learning about the relations between various sensory experiences: simultaneous sounds and sights, smells and touch stimulation, proprioceptive and visual sensations. The sense of an emergent self would correspond to both a sense of the process and of the product of growing intermodal and sensorimotor integration (Stern, 1985, p. 45). As a by-product of early sensorimotor learning and experience, the sense of an emergent self would be primary, developing in relative independence of social interactions.

Between 2 and 6 months, when infants start to reciprocate with people and view others as differentiated entities with distinct histories, Stern proposes that infants then develop the sense of a *core self* that is interpersonal, based on the relationship with others emphasized by Fogel (1993). Once again, in Stern's view, there is a developmental precedence of a sense of self as a functioning entity that feels, acts, and develops, over a sense of self (the core or interpersonal self) that is revealed to infants exclusively in social interactions.

Other infancy researchers emphasize the importance of an implicit sense of the self infants develop by interacting with their environment, without putting a par-

ticular emphasis on either physical or social objects (people). Eleanor J. Gibson (1988, 1995) construes self-knowledge within the general context of infants learning about what the physical and social objects afford for action, so-called *affordances* (J. J. Gibson, 1979).

In the process of exploring and detecting affordances, E. J. Gibson suggests that infants learn first about their own *effectivities* as perceiver and actors in a meaningful environment. For example, by detecting mouthable objects, sucking on them and eventually extracting food from them, infants come to grasp their own capacities for perception and action. This is, according to Gibson, a primary sense of self developing from birth, long before children can start to talk about or recognize themselves in mirrors.

In summary, to account for the implicit sense of self infants appear to manifest from the outset of development, infancy researchers distinguish different kinds of preconceptual knowledge pertaining to the self: knowledge infants develop in the physical domain (e.g., the ecological self) and social domain (e.g., the interpersonal self). Different theories are proposed as to how these kinds of selves might relate in development, some emphasizing the primacy of the interpersonal self (e.g., Fogel, 1993; Meltzoff & Moore, 1995), and others considering them as emerging in succession (Stern, 1985; but also Neisser, 1991), or on a more equal footing (E. J. Gibson, 1995). The problem of their integration and the extent to which this integration might contribute to the development of the conceptual self emerging by the second year remains an open question. What research shows, however, is that both perceptual and social factors need to be considered in trying to capture the developmental origins of self-concept. These two factors are reviewed next.

Perceptual Origins of Self-knowledge

The body is a primary object of perceptual exploration in infancy. As infants move and act, they perceive their own body moving and acting, hence detect its own organization, its physical characteristics, as well as its own vitality. As proposed by J. J. Gibson (1979), perceiving and acting always entail co-perceiving oneself, perception and action being inseparable. When, for example, we perceive and act on objects, we situate ourselves in relation to these objects, co-perceiving ourselves as perceivers and actors. In an analogous way, when newborns move about, kick, cry, suck, or systematically bring their hand to the mouth (Butterworth & Hopkins, 1988; Rochat, Blass, & Hoffmeyer, 1988), they pick up perceptual information that *specifies their own body as a unique entity in the environment* (e.g., double-touch information in the case of hand-mouth contacts, Rochat, 1995; see below).

Self-produced action comes with the experience of uniquely contingent and analog perception across modalities. This is an important feature of what infants gain from engaging in self-exploration. This experience specifies the body as differentiated from other objects in the environment. When my hand crosses my visual field, for example, I perceive that it is my hand and not someone else's, because I see it as well as I feel it proprioceptively moving at exactly the same time and by a commensurate amount. The ex-

perience of the body entails proprioception with contingent and analog inputs from other sense modalities.

The robust propensity of infants from birth, and even prenatally, to bring their hand in contact with the mouth and face provides a perceptual experience that specifies the body in a unique way. This experience, in addition to proprioception, entails a "double touch," a specific self-experience. When the hand of infants touches their face or mouth, the tactile sensation goes both ways in reference to their own body: the hand feels the face and at the same time, the face feels the hand. Again, this double-touch experience uniquely specifies their own body as opposed to other objects in the environment.

Rochat and Hespos (1997) tested newborn infants within 24 hours of their birth to see whether they would manifest a discrimination between double-touch stimulation specifying themselves, and external (one-way) tactile stimulation specifying non-self objects. For testing, we used the robust rooting response all healthy infants manifest from birth and by which tactile stimulation at the corner of the mouth is followed by the infant's headturn with mouth opening toward the stimulation. Following a simple procedure, we recorded the frequency of rooting in response to either external tactile stimulation, the experimenter stroking the infant's cheek, or in response to tactile self-stimulation when infants spontaneously brought one of their hands in contact with their cheek. We found that newborns tended to manifest rooting responses almost three times more often in response to external compared to self-stimulation. These observations suggest that already at birth, infants pick up the intermodal invariants (single touch or double touch combined with proprioception) that specify self- versus external stimulation, showing evidence of an early sense of their own body, hence an early perceptually based sense of themselves.

The early sense of the body developed by infants from birth does not only pertain to the physical body, but also to the dynamics of their own affectivity. The intermodal experience of the body is inseparable from feelings about their own vitality (Stern, 1985, 1999). Suppose that an infant engages in exploring her own hands by raising and moving them in front of her eyes. Suppose now that in a sudden burst of excitement, she claps them together. Aside from the intermodal perception of joint touch and proprioception, as well as the double-touch experience we discussed above, the infant perceives the dynamic of her own vitality: from calm to being excited, then calm again. This dynamic is perceived both privately and publicly. It is privately experienced because the infant feels from within a state change, from being calm to being excited with specific waxing and waning of tensions. It is publicly experienced because the hands move accordingly in front of the infant's eyes. In a way, the movement of the hands is a choreography of what the infant feels from within. Self-exploratory activity thus provides infants with an opportunity to objectify the feelings of their own vitality via perceived self-produced action of the body (Rochat, 1995).

By at least 3 months of age and as a result of self-produced action and perception, infants manifest an intermodal calibration of their own body. Recent evidence shows that young infants develop a sense of perfect contingency and invariant co-variations across modalities that specify the body as a dynamic entity with particular characteristics. This calibration is necessary not only to provide the perceptual foundations of self-knowledge, but also for infants to use their body in order to act on objects in the environment.

Daniel Stern (1985) reports some striking observations made with "Siamese twins" or physically conjoint twins. These infants were congenitally attached on the ventral surface, facing one another. They shared no organs and were surgically separated at 4 months. Stern and colleagues noticed that often they would suck one another's fingers. A week before separation, Stern and his colleagues conducted a series of tests to assess the extent to which these infants, despite their odd situation of forced binding, differentiated what was part of their own body and what belonged to the attached sibling. In one of the tests, they compared each infant's reactions to the gentle removal from their mouth of either their own fingers they were sucking, or the fingers of their sibling. They found that the twins responded differentially depending whether it was theirs or the other's hand that was removed.

These observations corroborate our own with healthy newborns who showed differential rooting responses to their own hand touching their face compared to the finger of an experimenter (Rochat & Hespos, 1997). In these observations, infants show that they differentiate between two basic categories of perceptual information, one category pertaining to their own body, the other to surrounding entities. This information is intermodal and in most instances involves a sense of self-produced action via proprioception.

If young infants appear capable of perceiving their own body as a differentiated entity, the question is what exactly do they perceive of their own bodies as physical and acting entities. We performed research demonstrating that infants from at least 3 months of age are aware of complex aspects of their own body as a dynamic and organized entity with particular featural characteristics (Morgan & Rochat, 1998; Rochat, 1998; Rochat & Morgan, 1995). We measured 3- to 5-month-old infants' preferential looking to different views of their own body. For example, facing two television screens, infants saw on each of them their own body videotaped from the waist down. Both views were on-line, thus perfectly contingent. When infants moved their legs, they saw them moving simultaneously on either of the screens (see Figure 7.2).

Within this experimental setup, we measured infants' preferential looking for either view. One of the views presented their own legs as they would be specified via direct visual-proprioceptive feedback, for example by bringing them in the field of view while laying supine in their crib. The other view provided an experimentally modified on-line view of their own legs.

In general, what we found is that from 3 months of age, infants tend to look significantly longer at the view of the legs that is unfamiliar, namely that violates the visual-proprioceptive calibration of the body in terms of general movement directionality, relative movement of the limbs, as well as overall leg configuration in relation to the rest of the body (Rochat, 1998). In particular, infants are shown to look significantly longer as well as to move their legs more, while looking at a view of their legs that reverses by 180° the seen and felt directionality of movement, or that reverses the way legs move in relation to each other. In all, this research suggests that by moving and acting, infants from at least 3 months of age manifest an intermodal calibration of their own body, developing an intermodal body schema. This body schema is an implicit, perceptually based "protorepresentation" of the body as specified by the intermodal redundancy accompanying perception and action. The intermodal redundancy specifying the body is experi-

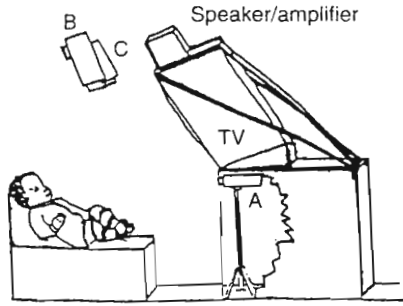


Figure 7.2(a) Apparatus and experimental setup of the infant wearing black and white socks while reclined in front of the large TV monitor projecting an on-line view of the legs from the waist down. Camera A provided a close-up of the infant's face for the analysis of gazing at the display as cameras B and C each provided a particular view of the legs (i.e., ego vs. reversed ego view).

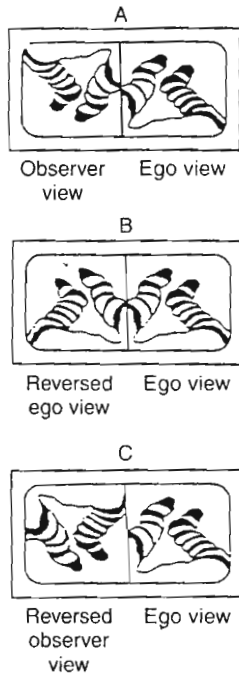


Figure 7.2(b) The two views of their own legs as seen by the infant on the TV in the three experimental conditions studied in Rochat and Morgan (1995): (A) observer view vs. ego view (Experiment 1); (B) reversed ego view vs. ego view (Experiment 2); (C) reversed observer view vs. ego view (Experiment 3).

enced and explored by infants from birth. Considering the rich behavioral repertoire of fetuses 20 weeks and older, it may also be experienced in the confines of pregnancy (e.g., Precht, 1984).

In summary, from the earliest age, perception and action specify the body as a differentiated entity among other entities in the environment. Early on, infants appear to

calibrate their own body based on intermodal (i.e., perceptual) invariants that specify the sense of their own ecological self: a sense of their *own bodily self* that is differentiated, situated, and acts as an agent in the physical environment (Neisser, 1991; Rochat, 1997). This may form the perceptual origins of what will eventually develop as an explicit or conceptual sense of self by the second year of life.

Social Origins of Self-knowledge

If infants learn about themselves by being actors in the physical world, another major source of self-knowledge comes from social interactions. Not unlike adults, very early on children objectify themselves in others, searching for social approval and learning about themselves as differentiated, unique entities. As adults, we use others to reveal who we are, as a sort of social mirror. Much of how we perceive ourselves is measured against how we think others perceive us. Self-perception is inseparable from our perception of others as *on-lookers of us*. This is what being "self-conscious" means and it is close to impossible to escape the so-called "audience effect." People are undoubtedly the main source of feedback by which we objectify ourselves. This process is also evident from the outset of development.

As mentioned above, the first words of children are mainly oriented toward attracting attention of others to objects, but also mainly to themselves. When children keep calling parents to watch them doing what they view as challenging feats, such as jumping off a diving board or riding their bicycle with no training wheels, they seek confirmation of who they think they are: courageous, outrageous, funny, or smart, aside from attempting to impress an audience. The perception of themselves becomes essentially social. They project and recognize themselves in others. In this process, self- and social knowledge are inseparable. But what about infants, prior to any explicit expression of such process via language? Infancy research points to the fact that from a very early age infants learn about themselves by monitoring others and the way they respond to their own behavior.

The most common way parents interact with their young baby is by reciprocating and *mirroring* their emotions. There is much parental imitation of their infant in early face-to-face interaction. In this process the emotions displayed by infants are fed back to them, amplified, and clearly demarcated with exaggerated gestures and intonations (Gergely & Watson, 1999). This emotional mirroring is certainly a source of self-knowledge for the infant as it provides them with a perceptual scaffolding for the objectification of their own affects: what they feel from within, project to the outside and are externalized as they are reflected back to them by the social partner. In this process, infants are exposed to an explicit, analyzable form of what they feel privately at an implicit level (Rochat, 1995).

As adults, we are strongly compelled to empathize with babies. When for example they start to show signs of distress and start to cry, we typically comfort them by providing physical proximity, stroking their back while adopting a sad voice with lowered brows and inverted U shaped mouth. In doing so, we actually provide infants with an emotional *simulation* of what they are supposed to feel, a simulation of their subjective life.

When infants monitor people's faces and begin to reciprocate in face-to-face interaction, they lay down the foundations of both social and self-awareness. Because of the strong propensity of adults to engage in mirroring and affective attunement, they also learn about

themselves being somehow simulated or *reenacted*. From the earliest age, caretakers present infants with a social mirror that reflects back to them their own vitality and affective life, in some sort of a running commentary they are compelled to produce as in the case of sportcasters verbalizing and mimicking actions back to an audience. Aside from the sense of the ecological self infants develop by acting and perceiving the physical environment, this emotional simulation by caretakers is probably also at the origin of explicit *self-consciousness*, clearly manifested by infants once they pass the symbolic gateway marking the end of infancy, referring to themselves verbally and identifying themselves in mirrors.

Prior to the symbolic gateway, the idea of an implicit self-knowledge gained by young infants in their interaction with others is supported by numerous studies demonstrating sophisticated social attunement of the infant from birth, in particular their propensity to pay special attention to faces (see Butterworth, chapter 8 in this volume), and to imitate social partners.

Over the last 20 years, many studies have reported cases of imitative responses in very young infants. In well-controlled laboratory conditions, neonates only a few hours old are shown to reproduce a remarkably wide range of gestural acts modeled by an experimenter, such as tongue protrusion, lip pursing, and head and finger movements (Meltzoff & Moore, 1977, 1995). If such precocious imitative ability has been replicated in various laboratories around the world, the interpretation of the phenomenon continues to cause much controversy. For some "leaner" interpreters of neonatal imitation, it is essentially a fleeting phenomenon, limited to one gesture (i.e., tongue protrusion) and determined by low-level processes such as automatic release mechanisms (Anisfeld, 1991) or rigidly triggered oral exploration (Jones, 1996). On the contrary, for Meltzoff and Moore neonatal imitation is the expression of a much richer ability, the expression of an active cross-modal matching between vision and proprioception (Meltzoff & Moore, 1997). In particular, in the case of facial imitation, the infant sees the model and reproduces motorically a corresponding gesture *without* any possibility of a visual-visual comparison between model and imitative response. Thus, if one accepts the view that infants are actually engaged in an attempt to match their own motoric response to the specific behavior displayed by the adult, neonatal imitation does entail an *active* intermodal matching process of self to others. More importantly, it also entails that infants from birth do not behave in a social vacuum, but rather are actively linking their own behavior to the behavior of others.

Other research demonstrates that the behavioral matching effort displayed by young infants is not merely reduced to the reproduction of body part movements in another person, but also to an *affective* matching of others. Social mirroring appears to be a two-way phenomenon from the very beginning of life. If caretakers have the proclivity to reproduce infants' actions and affects in scaffolding face-to-face interactions, infants from birth are also inclined to do the same. Field, Woodson, Greenberg, & Cohen (1982) observed that newborn infants tend to reproduce facial expressions of happiness, sadness, or surprise. In their study newborns were observed while facing the experimenter, who displayed in successive episodes such well-contrasted emotions. They showed a significant widening of the lips when attending to the happy expression of the experimenter, increased protrusion of lower lips during the sad expression episode, and increased opening of the eyes and mouth during the surprise episode. Via early imitation of facial expressions, infants do not only match the surface characteristics of others with their own,

but also others' feelings, in particular their dispositional characteristics in relation to their own (happy, sad, or surprised). Early facial imitation allows infants from birth to establish intersubjectivity with others and specify their own dispositional (affective) qualities by matching those of others.

The early propensity to imitate is probably a major mechanism by which infants start objectifying their own actions and affective dispositions. In matching the behavior of others, they also simulate themselves. Infants from birth do acquire knowledge about themselves via their inclination to reproduce the action and emotion of others.

The combination of adults' systematic scaffolding of face-to-face exchanges and young infants' early proclivity to imitate others is an important aspect of what constitutes the developmental origins of self-knowledge. In the context of protoconversations and play games typically initiated by caretakers (e.g., peek-a-boo games, see below), infants specify themselves as a function of how others respond to them, in particular how contingent and attuned they are to their *own* behavior (Trevarthen, 1979).

By imitating each other, the infant-adult pair engages primarily in reciprocating affects and feelings. Such reciprocation is at the origin of intersubjectivity, itself foundation of early social cognition and, I propose, an important source of implicit self-knowledge, in particular of the self as a *communicative agent* (the interpersonal self according to Neisser, 1991). Via mutual imitation adults and infants can probe the degree to which they communicate with one another.

Evidence of a developing interpersonal self in early infancy is now numerous. By the second month, when starting to reciprocate by smiling and engaging in long bouts of gazing toward others (Wolff, 1987), infants are shown to become increasingly sensitive to specific timing in social interaction and develop expectations regarding the behavior of others in relation to the self (Rochat & Striano, 1999a). Such timing indexes the quality of communicative flow, and in particular the level of relative matching between their own dispositions and those displayed by the social partner. The social expectations developing by the second month are inseparable from the developing sense of the interpersonal self or social self of infants.

As an illustration, we recently explored the sensitivity of 2- to 6-month-old infants to the relative structure of the interactive frame offered by an adult stranger (Rochat et al., 1999). The rationale for this study was to capture how infants from 2 months on refine their ability to detect regularities in ongoing social interaction and develop specific expectations based on a sensitivity to the structure of the interaction. We hypothesized that between 2 and 6 months infants develop specific expectations in the dyadic context based on cues specifying the *quality* of response of a social partner to their own behavior, in other words, *the relative attunement of the social partner to the self*.

We videotaped 2-, 4-, and 6-month-old infants interacting with a female stranger in a face-to-face situation that did not include any touching. Aside from baseline periods, in two different experimental conditions, the experimenter introduced the infant to a peek-a-boo routine that was either structured or unstructured. In the structured condition, the peek-a-boo routine was strictly organized into three phases articulating a total of eight subroutines. In the unstructured condition, the experimenter was wearing an ear-piece connected to a tape recorder playing instructions of subroutines to be performed in a random, disorganized way. In other words, in the unstructured condition, the experi-

menter engaged in a *scrambled*-peek-a-boo game, with unrelated subroutines that did not coalesce to form a compelling, socially attuned script.

The scoring of infants' smiling and gazing at the experimenter revealed that 2-month-olds looked toward the experimenter and smiled equally in both the structured and unstructured peek-a-boo conditions. In contrast, 4- and 6-month-olds looked significantly more toward the experimenter and smiled markedly less in the unstructured compared to the structured peek-a-boo condition.

In all, these results illustrate how from a diffuse sense of others' attunement to the self, by 4 months infants begin to monitor social partners in the way they relate to them. Based on such monitoring, infants develop an implicit sense of an interpersonal or social self, expecting not only that others pay attention and smile at them, but also that they relate to them in ways that are attuned or contingent with their own behavior (Murray & Trevarthen, 1985; Stern, 1985).

Origins of Self-recognition

From an implicit sense of their own physical, behaving body and an implicit sense of themselves as social entities, how do infants develop an *explicit sense of themselves* as indexed by mirror self-recognition? What are the origins of the conceptual self manifested by children when they start to speak and pass the symbolic threshold that separates infancy from childhood? In this last section, we can speculate that mirror self-recognition is one of the first signs of explicit self-concept that originates from the fusion of implicit self-knowledge developed in the physical and social domains over the first months of life. The rationale for such discussion is that, although mirror self-recognition is limited to one particular experience (i.e., the specular or mirror image of the self), it informs us about what it takes for infants to become explicit about themselves, hence to have a conceptual sense of self as "Me" in addition to the existential sense of self as "I."

Three-month-old infants placed in front of mirrors spend much time exploring their reflection, staring at themselves in the eyes and moving their limbs often with smiles and cooing (Amsterdam, 1972). They are attracted by their specular image but that does not mean that they yet *recognize* themselves in it. They are using the opportunity offered by the mirror to experience and explore the perfect contingency and spatial calibration between proprioception and vision. This opportunity is unique and possibly particularly attractive to infants because it also offers the visual-proprioceptive experience of larger portions of the body, much larger than the hands and feet perceivable directly in certain postures. As adults, we also use the optical affordance of mirrors to work on our appearance, except that the behavior of fixing hair and making up is an explicit expression that we know it is us in the mirror.

Clearly, the behavior of young infants in front of mirrors does not imply the same level of awareness of either adults applying lipstick or toddlers showing embarrassment and manual contact with the face because they discover some rouge has surreptitiously stained their nose, as in the classic rouge task already mentioned at the beginning of this chapter (Gallup, 1982; Lewis & Brooks-Gunn, 1979).

Bahrack, Moss, & Fadil (1996) reported that infants as young as 3 months do show some discrimination between viewing a frontal prerecorded view of themselves or viewing an analogous view of another infant wearing the same bib. Infants were carefully matched for age and gender. In general, infants are reported to spend significantly more time looking at the image of the other child compared to their own. The question is whether this apparent visual discrimination actually means that they *re-cognize* themselves on the TV. In other words, does this discrimination entail some rudiments of self-concept? It is certainly not a direct demonstration of self-concept. This discrimination, although remarkable, probably means that from an early age, infants are familiarized with their own featural (i.e., facial) characteristics and vitality based on previous mirror experiences. In the context of the Bahrack et al. experiment, the feature characteristics of the other child are newer, therefore more interesting to the infant, so explaining their visual preference. The observations reported by Bahrack and her collaborators are no evidence that infants as young as 3 months "know" it is them on the TV.

So, from the early sensitivity to intermodal contingency (Amsterdam, 1972), the early intermodal calibration of the body (Rochat, 1998), and early perceptual learning (Bahrack et al., 1996), how do infants develop the ability to eventually recognize and identify themselves in mirrors?

First, it should be pointed out that, although telling something about self-recognition, the mirror test should be considered with caution to account for the origins of self-concept. Mirrors are unusual objects in the environment, carrying with them the experience of a fundamental paradox: the "*self-other paradox*." As mentioned above, when you look at your own mirror reflection, you perceive aspects of your body that you cannot experience directly, in particular a full view of your face. Considering that eye contact in social exchanges is an important determinant of social interaction from the outset of development, the specular image of a full face with eyes gazing toward the self specifies what is normally experienced with others, not in relation to the self. Therefore, self-recognition in a mirror requires the *suspension* of the normal social experience of others facing you with eye contacts. Mirror reflection of the self is paradoxical in the sense that what is seen in the mirror is the self as another person: it is you in what is normally perceived of another person. As the self in disguise of the other, the specular image reflects what can be called the fundamental *you but not you*, or *self-other paradox*. On one hand, the specular image reflects the self via perfect contingency and spatial analog of visual-proprioceptive information (i.e., the ecological self). On the other hand, it does reflect another (non-self) person as specified by past experience (en-face view with potential eye contact).

The self reflected by mirrors does not match the embodied self infants experience directly from birth, namely, the self situated in the body. Rather, it reflects back to the infant the implicit sense of an *interpersonal or social self* (i.e., themselves interacting with what appears to be someone else).

To some extent, inspecting oneself in a mirror and recognizing that it is "Me" out there on this reflecting surface is very much an "out of the body experience." What mirror self-recognition and other video and picture self-recognition tasks measure is primarily the ability of individuals to suspend what they normally experience of themselves, step back and literally reflect on the new, out of the body aspects the mirror reveals of themselves. Mirror images are indeed physical reflections of the body on a polished surface that call

for mental reflection to be *re-cognized*, hence *conceptualized*. This conceptualization requires the suspension of perceptual experiences typically specifying self *or* others, not self as others.

Observations made by anthropologists introducing reflecting devices to adult individuals who presumably never experienced their own mirror reflection are particularly telling of the fundamental paradox attached to the experience of self in mirrors. Edmund Carpenter (1975) introduced mirrors to members of an isolated tribe (the Biimi) living in the Papuan plateau where neither slate or metallic surfaces exist, and where rivers are murky, not providing clear reflections. Recording the initial reaction of adults confronted for the very first time with a large mirror reflection of themselves, Carpenter reports:

They were paralyzed: after their first startled response – covering their mouths and ducking their heads – they stood transfixed, staring at their images, only their stomach muscles betraying great tension. Like Narcissus, they were left numb, totally fascinated by their own reflections: indeed, the myth of Narcissus may refer to this phenomenon. (Carpenter, 1975, pp. 452–453)

We might add that Narcissus, aside from falling in love with himself, probably got first fascinated with the existential experience of the “self–other” paradox that reflecting surfaces offer.

Despite the intrinsic paradox attached to mirrors, mirror self-recognition tests remain a valid instrument to assess self-knowledge at a conceptual and re-cognitory level. It is particularly valid to assess the ability of children to *objectify* themselves and eventually get over the “self–other” paradox. This requires stepping back and reflectiveness in the sense of mental reflection, beyond direct perception and action.

There are two questions that are of interest from a developmental perspective. The first is, when do infants start to become contemplative in the exploration of themselves, not merely experiencing their embodied self via direct perception and action? The second is, what might be the process enabling infants to adopt a contemplative, reflective stance when exploring themselves? These are important “how” and “why” questions regarding the origins of self-concept. These questions are still wide open for speculation. Nevertheless, in light of recent progress in infancy research, it is possible to speculate (i.e., “reflect”) on the developmental origins of self-recognition, hence self-concept.

Conclusion: Developing Objectification of the Self in Infancy

We have seen that infants appear to be born with an ability to pick up perceptual information that specifies themselves as differentiated from other physical and social entities in the environment. The development of self-knowledge does not start from an initial state of confusion. Infants are born with the perceptual means to discriminate themselves from other objects and people. Early on, they express an implicit sense of themselves as embodied, differentiated, situated, and effective in the physical and social environment. This sense of self corresponds to the ecological and interpersonal selves of infants described by Neisser (1991, 1995).

These implicit kinds of selves are determined by direct perception and action, not mental reflection or conception. The early propensity of infants to engage in self-exploration when, for example, watching their own legs moving on a TV screen (Rochat, 1998) does not entail any awareness that it is their own legs on the screen. If, as some studies show, infants prefer to look at the view displaying the legs of another baby rather than an on-line view of their own (see, for example, Bahrick & Watson, 1985; Schmuckler, 1995), it is because the visual perception of these legs does not correspond to the proprioceptive perception of their own legs moving. It is not because they recognize that it is another infant kicking on the TV. For infants to recognize that it is their own legs or, on the contrary, that they are the legs of someone else, it would take an additional reflective step, namely, the step toward an *objectification of the self*. Such a process would entail the ability to integrate the sense of the embodied (ecological) self, and the representation of the disembodied "Me" projected on the TV screen.

The question, of course, is how such an integration might come about. To conclude, I will propose that an important determinant of this development might be young infants' propensity to explore their own actions and their consequences via repetition or so-called "circular reactions" (Baldwin, 1884/1925; Piaget, 1952).

By the second month, infants become inquisitive and start reciprocating with others as indexed by the emergence of smiling and eye contact (Wolff, 1987; Rochat & Striano, 1999a). They also become playful in relation to themselves. They start to spend a lot of time self-entertaining, exploring their own body by repeating visually controlled actions either on themselves or on objects. They grab their hands and feet, bringing them in the field of view for long bouts of inspection. They seize any opportunity to reproduce actions that are accompanied by interesting consequences. In addition to perceiving and acting in the context of highly organized action systems (e.g., sucking, rooting, tracking), 2-month-olds compared to newborns express behavioral novelty by engaging in the *contemplation of their own effectivity* based on a sense of the own body (i.e., proprioception) that can be linked to perceived events: the auditory event of self-activating the vocal system, the proprioceptive-visual event of moving a hand in the visual field, of kicking a mobile (Rochat & Striano, 1999b).

In this new process, infants manifest much repetition of actions for the apparent sake of exploring how they feel in their execution and how they are linked to particular perceptual consequences.

This active contemplation of self-produced perceptual consequences (e.g., self-produced sounds or object motion) is probably an important factor in the progressive objectification of the self. Infants need to break away from the direct perception of the embodied self as specified by intermodal invariants and the contingency of others' behavior in order to start *re-presenting* or conceptualizing themselves as object of reflection. That does not mean that the implicit sense of the embodied ecological and social self vanish to be replaced by a conceptual self. Rather, the sense of the ecological and social self, bearing no traces of anything that looks like conscious or intentional processes, is complemented with a new stance on self-perception that allows for explicit representation, as evidenced by mirror self-recognition.

There is certainly an important development, yet largely unspecified, occurring from the time infants seem to show the first signs of breaking away from the direct perception

of the embodied self, to explicit self-recognition. The original process that might trigger this development is the propensity of infants by 2 months to engage and start paying particular attention to the result of their own playful and repetitive actions. With such engagement, they start to probe their own vitality, systematically reproducing certain effects, and discovering themselves as a dynamic system with means to achieve goals (Baldwin, 1884/1925). This process determines a new sense of self as *intentional* or *planful*, in parallel to the direct sense of the embodied self (ecological self) and social self they develop early on in their interaction with objects and people. By intentional (a semantically loaded term), what is meant here is a sense of self as a planning entity that can anticipate future events and relate to past ones, whether physical or social. It is a sense of self which, in contrast to the embodied ecological and interpersonal selves, is not linked to the immediacy or "here and now" aspect of direct perception and action in physical or social contexts. It is actually a sense of self that cuts across the ecological and interpersonal self, transcending them and resting on their integration as suggested by mirror self-recognition.

In conclusion, at the origin of an explicit sense of self, there might be the early ability to contemplate and repeat actions in order to explore their consequences, beyond the immediate, embodied sense of self infants experience from birth in their interaction with physical objects and people. This process, I propose, contributes to an early objectification of the self which eventually develops into an explicit self-concept by the middle of the second year. Aside from this general process, questions remain regarding the factors that lead infants toward self-conceptualization and what the actual content of self-concept is when emerging by the second year of life.

Related Issues

Some theories emphasize the role of social frames from which infants develop a sense of self that is primarily interpersonal (Fogel, 1993; Kaye, 1982). Other theories emphasize the role of active interaction between infants and their environment, whether physical or social (Baldwin, 1884/1925; Piaget, 1952, 1954). Furthermore, some theorists suggest that infants develop first a sense of the core (intermodal) self that eventually grows into an interpersonal and conceptual self (Stern, 1985). On the contrary, other theories state that the concept of self is inseparable from social relationships and the relational narratives infants create in interaction with people (Fogel, 1995).

The debate is still very much open and it is only with more empirical data that we will make progress in approximating what counts in the early development of self-concept, namely, the development of the self recognized in a mirror or objectified in the action on physical objects, but also the self that is conceptualized and develops in relation to others. The question of the origins of self-concept is indeed inseparable from issues regarding the origins of physical knowledge, as well as the origins of social knowledge (Rochat, 1999), emotional development (Lewis, 1992), and theories of mind (Hala, 1997).

Further Reading

- Fogel, A. (1993). *Developing through relationships: Origins of communication, self and culture*. Hemel Hempstead: Harvester Press. A theoretical view on the essentially social nature of self-knowledge, developing from the outset in relation to others.
- Lewis, M. (1992). *Shame: The exposed self*. New York: The Free Press. An account of self-development in infancy and early childhood as it relates to emotional development, in particular the emergence by the second year of life of secondary (self-conscious) emotions such as embarrassment, guilt, and shame.
- Rochat, P. (Ed.). (1995). *The self in infancy: Theory and research*. Amsterdam: North-Holland/Elsevier. An edited volume assembling chapters by major infancy researchers and theorists on the issue of developing self-knowledge in the first year of life.
- Rochat, P. (Ed.). (1999). *Early social cognition: Understanding others in the first months of life*. Mahwah, NJ: Lawrence Erlbaum Associates. An edited volume assembling chapters on the issue of understanding others, but also indirectly on the issue of developing an understanding of the self in interaction with others during the first year of life.

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