The perceived self

Ecological and interpersonal sources of self-knowledge

Edited by

ULRIC NEISSER
Emory University

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ULRIC NEISSER

This book brings new ideas to bear on an old problem. The old problem is that of self-knowledge and the self; the new ideas are based on analyses of ecological and social perception. James J. Gibson (1979) was the first theorist to insist that perceiving the self is an inevitable counterpart of perceiving the environment. Gibson's ideas are basic to the notion of an *ecological self*, which will be elaborated in this chapter. But the view of perception to be presented here is not simply ecological; it is social as well. Face-to-face interaction between individuals establishes a sense of an *interpersonal self* that is very different from anything the inanimate environment can offer. Both forms of self-perception appear very early in life, and both give rise to the experience of effective agency that is such an important component of self-awareness. They are the foundation on which other, more intellectual aspects of the self are built.

Because the term *self* has more than one meaning, it is best to begin with definitions. Distinctions among various kinds of self have been proposed for more than a century: William James's (1890) contrast between the "I" and the "me" was only the first of many such contrasts. A few years ago I contributed to this tradition with a cognitive analysis, that is, one that focuses on forms of information (1988). In my view people have access to five basically different kinds of information about themselves. Each kind specifies a different aspect of the individual and thus implicitly defines a different sort of self. This volume, the first of several based on that analysis, focuses on ecological and interpersonal forms of self-knowledge. These are the first forms of self to develop in early infancy. Other forms – the remembered, private, and conceptual selves – are also important but arise only later. The ecological and interpersonal selves are also unique in being *perceived*: They need not be recalled, imagined, constructed, or conceptualized.

One very different meaning of self must be set aside before we begin. Much folk psychology and many religious traditions postulate an inner self of some kind, a "real me" who is (or should be) ultimately responsible for behavior. That hypothesis is rejected here. None of the five selves in my scheme are homunculi of this sort; rather, it is the *whole person* who perceives, acts, and is responsible. On this point the ecological approach is in full agreement with most contemporary philosophy (e.g., Dennett, 1991a), as well as with neuroscience (e.g., Churchland & Sejnowski, 1992). The brain

is not organized by any Cartesian flow toward and from some inmost center but by richly parallel processing and modular subdivision. Daniel Dennett makes this point with characteristic flair.

> Searching for the self can be somewhat like [this]. You enter the brain through the eye, march up the optic nerve, round and round in the cortex, looking behind every neuron, and then, before you know it, you emerge into daylight on the spike of a motor nerve impulse, scratching your head and wondering where the self is. (1991b, p. 355)

In the argument to be presented here, a self is not a special part of a person (or of a brain); it is a whole person considered from a particular point of view. The ecological self, for example, is the individual considered as an active agent in the immediate environment. Such agents perceive *themselves*, among other things: where they are, how they are moving, what they are doing, and what they might do, whether a given action is their own or not. The interpersonal self is the same individual considered from a different point of view: namely, as engaging in face-to-face interaction with others. These interactions are perceived too, just as positions and movements are. We can see and hear and feel what we are doing, both ecologically and interpersonally.

It is not only adults who perceive themselves in these ways; babies do too. Modern research leaves no doubt that young infants perceive their environments, their conspecifics, and themselves. They see what is within their reach, maintain a specific awareness of things that have gone out of sight, and distinguish their own actions from those of other individuals. They engage in lively social interactions with other people and are aware of the extent to which they control those interactions themselves. The fact that these achievements appear in the first weeks and months of life makes self-perception especially important: It is the first and most fundamental form of self-knowledge.

Perception may be the first form of self-awareness, but it is by no means the only one. A brief account of the others, and of the aspects of the self that they establish, is appropriate at this point. Perhaps most important, all human beings subscribe to a wide array of beliefs and assumptions about themselves. Taken together, these beliefs constitute the self-concept or *conceptual* self (Neisser, 1988). In its mature form, the conceptual self leans heavily on cultural forms. My own self-concept, for example, includes such categories as "professor," "husband," "father," "American," and "cognitive psychologist." Each of these roles – and I have many more – brings expectations, evaluations, and obligations in its train. The evaluations are especially important: I may think of myself as smart or stupid, good-looking or ugly, praiseworthy or worthless. The key phrase here is "think of myself." These aspects of the self are not directly perceived; as forms of reflective self-consciousness, they appear only when I *think* about myself or my situation.

Evidence from developmental psychology suggests that the conceptual self appears near the end of the first year. Younger infants have active ecological and interpersonal selves, but they do not take themselves as objects of thought. The ability to think explicitly about oneself probably begins with the realization that someone else is doing so already – that is, on becoming aware that one is the object of another person's attention. That awareness is not possible until about the tenth month, when shared attention (to events and objects) begins to be a common mode of parent–child interaction (Bruner, 1983; Tomasello, 1988). Only then does the child begin to understand what other people are attending to or talking about. On some occasions, what they are attending to is the child in question. Only when this is understood can the self-concept begin. (For a more detailed account of this development, see Michael Tomasello's chapter 9.)

Then there are life narratives. It seems likely that all adults in all cultures occasionally recount their experiences to others and to themselves as well. Such stories establish a version of the self-concept that transcends the present moment: a *temporally extended* self. This remembered self appears much later in childhood than the self-concept, per se. Even the most talkative young children live chiefly in the present, with little to say about the past or the future. Two-year-olds can recall something about prior experiences when asked (Fivush, Gray, & Fromhoff, 1987), but they do not swap stories about old times; more generally, they do not think of themselves as having life narratives. Such narratives, along with the skills of producing them, are acquired only in the third year or later (Fivush & Hudson, 1990; Neisser & Fivush, in press).

Because it is based on memory and reconstructions, the self remembered does not have the same claim to accuracy as the self perceived. Often, the way we remember things is not the way they really were. The fallibility of memory has led some contemporary theorists to argue that the self is nothing but a constructed narrative, and a self-serving one at that. This argument must be rejected. The ecological and interpersonal selves are directly perceived rather than constructed, and they are in place long before the self-narrative begins.

A further source of self-knowledge must also be considered. The inner quality of conscious experience – of thoughts and images, pains and dreams, "raw feels" and feelings – is unique to each individual. Because these experiences are intrinsically private, they are often thought to define the self in an essential way. I believe, however, that the uniqueness of conscious experience is not equally important to everyone. The *private self* is a focus of attention for some people – Jung (1921/1971) called them "introverts" – but not for others. In any case, the fact that consciousness is uniquely private is probably discovered rather late. Although 2-year-olds surely have conscious experiences, they do not focus on the fact that those experiences are theirs

alone. The privacy of mental life becomes salient only later in development, perhaps in connection with the "theories of mind" that seem to mature around age 4 or 5 (e.g., Astington, Harris, & Olson, 1988).

The remainder of this chapter deals with various aspects of self-perception. We begin with the ecological self: first with location and movement, then action and agency. Then we consider social perception and the interpersonal self. Finally, we turn to early development: the ecological self in infancy and the beginnings of interpersonal experience.

The ecological self: Location and movement

In my view, the claim that we perceive ourselves is coherent only in the framework of a particular theory of perception: James Gibson's (1966, 1979) ecological approach. (Earlier attempts to understand self-perception were largely unsuccessful; see Franklin Shontz's chapter 5 for a historical review.) In that theory perception has a special status. Gibson often called it "direct," meaning that the perceptual systems pick up information that invariantly specifies an objectively existing state of affairs. Unlike other forms of knowing, perception is not constructive or inferential. The rich information normally available to vision, for example, enables us to see the environment and our own actions as they really are.

This approach assumes that the perceptual systems of animals evolved to take advantage of objectively existing information. The aim of the study of perception is to identify that information, to discover what it specifies, and to determine how it is picked up. Such an enterprise must begin naturalistically, with perceivers in free movement through the ordinary environment. That analysis soon reveals something that earlier theories had ignored: The available information specifies a lot about perceivers themselves as well as about their environments. "Egoreception accompanies exteroception, like the other side of a coin. . . . One perceives the environment and coperceives oneself" (Gibson, 1979, p. 126).

As you walk across a room, many kinds of information enable you to perceive your own movement and its trajectory. There is kinesthetic feedback from joints and muscles, as well as detection of acceleration in the vestibular organs; there are the echoing sounds of your footsteps, and especially the systematic changes of optical structure available to your eyes. Vision is perhaps the most important of these for the ecological self. To understand why, we need another Gibsonian concept: the *optic array*. The room through which you are walking (like any space in any illuminated environment) includes an infinite number of potential points of observation. Each point is surrounded by a "shell" of optical structure; that is, light is reflected to it from all directions. Consider, for example, the point at which your right eye is now located. One sector of the structure available there consists of light from the right-hand wall; another sector (embedded in the first) of

light is perhaps reflected from a picture on that wall; other sectors are from the ceiling, the lamp, the book, and so on. Now consider that every shift to a new viewing point must change that optical structure. Movement of the observer always gives rise to a systematic *optic flow,* which precisely specifies the movement that produced it. It is optic flow, more than anything else, that enables you to see your own path of motion through the environment.

Several different kinds of optic flow can be distinguished analytically. As you move parallel to a wall, for example, every contour and texture element in the corresponding sector of the array streams backward. Under evolutionary conditions, this kind of flow uniquely specified movement of the observer; it did not occur otherwise. Unsurprisingly, then, artificially established parallel flow is enough to produce the experience of egomotion. This phenomenon is easily studied with the aid of a "moving room" (Lee, 1980; Lishman & Lee, 1973). A person standing on the (motionless) laboratory floor will sway in gentle synchrony as the surrounding walls are moved slightly back and forth. With larger displacements, subjects have a compelling experience of egomotion even though they are actually standing still.

Another important source of information for the ecological self is *occlusion.* The direction of your line of sight toward any stable object (except one exactly straight ahead) must change as you move forward. For that reason, objects that are fully visible from one position may be shifted behind other ("occluding") objects during the course of the motion. This specifies the relative positions of the objects: The occluded one is always farther away than the one that hides it. Even without actual occlusion, the changing visual directions of various objects ("differential motion parallax") specify your own path of motion precisely.

Another kind of optic flow, *looming,* occurs whenever an object moves toward you. The corresponding sector of the optic array gets larger and larger; just before contact, it may fill the entire visual field. The rate of this magnification is especially informative; with fixed velocity, it specifies the time of the impending collision (Lee, 1980). This means that the optic array specifies aspects of the future as well as the present, giving you what Lee (see his chapter 3) calls "prospective control" over your actions and their consequences. Taken together, these various forms of optic flow specify the position and movement of the ecological self quite precisely.

The self is specified in other modalities as well, including vestibular proprioception, somatic proprioception, and touch. Hearing too: bats depend on the *acoustic array* established by reflected sound. Despite this difference, bats' sense of where they are in the environment is entirely comparable to ours (cf. David Lee's chapter 3 on this point). Blind people also make use of information in the acoustic array, though not so sensitively as bats. Indeed, blind persons using "facial vision" (which, despite its name, is actually based on sound) can perceive the layout of the near environment surprisingly well (Hull, 1990).

The ecological self: Action and agency

The ecological self is a doer: We are just as aware of our actions and their effects as of our movements. This awareness, too, concerns the future as well as the present. As Gibson (1979) pointed out, any given situation affords some actions and not others. Right now, for example, the floor of my study affords walking and its door affords passage. What this means is simply that I can walk across the room and go out the door if I want to. Other examples: I can pick up a pencil from the desk and write with it; I can also throw it across the room, use it to press a computer key, or drop it in the wastebasket. Every situation offers infinitely many such *affordances*, of which only a few are perceived and even fewer realized in action. They depend on the individual as well as the situation, varying from species to species and person to person.

Recent research has shown that affordances are accurately perceived. We see at a glance whether objects are within reach (Carello, Grosofsky, Reichel, Solomon, & Turvey, 1989), doors are wide enough to walk through (Warren & Whang, 1987), or chairs are the right height to sit on (Mark, 1987). Such perception is necessarily "body-scaled" (Warren, 1984) – that is, the distance that matters for reaching is not measured in inches but in relation to our own bodily dimensions and capabilities. Partly for this reason, the perception of affordances is subject to constant learning and recalibration. A floor that afforded only crawling to a baby at 11 months affords walking a few weeks later; a fence that afforded leaping when I was 30 may afford only clambering when I am 60; the affordances of a pond change dramatically when one learns to swim.

It would be a fact that the pencil affords throwing, even if doing so had never occurred to me. By insisting on the objective existence of affordances, Gibson broke with a long-established tradition. Although phenomenologists often note that the world and the self are perceived in terms of possible action, they typically assign such possibilities to some nonphysical realm: to the "phenomenal field," for example, or the "behavioral world." As Gibson defined them, however, affordances are in the *real* world. They are discovered rather than invented. Indeed, they must be discovered if the individual is to survive.

Once an affordance has been perceived and the appropriate action initiated, that action must be appropriately controlled. In the view of most contemporary action theorists, such control depends in part on motor programs or schemata. Although Gibson did not share this view (he was suspicious of all mental models and structures), it seems inescapable to me. As Marc Jeannerod points out in chapter 4, "It is hard to conceive of motor devices that would be entirely driven by external events." (The schemata do not control every detail of every movement, however. Other determinants

include the inertial properties of body parts and the couplings between them; cf. Kelso, 1982; Turvey, 1990.) One convincing argument for the existence of motor schemata is that many rapid actions are fully planned in advance. In catching a ball, for example, the last 200–300 ms of movements are executed independently of visual feedback (Whiting, Gill, & Stephenson, 1970). Yet even in such "open-loop" movements, we are aware of what we do; the activity of the control schemata gives rise to a kind of awareness.

Sometimes the precise direction of an upcoming movement is established only after a critical stimulus has appeared. Under these conditions the time needed to shift the focus of the control schema to a new environmental target can be measured. Georgopoulos and Massey (1987) have done just that. Stimuli were presented in a timed reaching task, but the subjects did not reach directly toward the stimulus. Instead they had to reach in a direction offset from the stimulus by a predefined angle (say, 35° clockwise). Reaction times increased linearly with the amount of offset, suggesting that the subjects had to shift their conrol schemata ("imagined movement vectors," p. 361) across the field before beginning the reach itself. M. J. Wraga and I (Neisser & Wraga, 1992) have obtained similar results in a key-pressing paradigm. In my view, these rapidly changing, quasi-conscious motor intentions are aspects of the ecological self. In particular, they are responsible for the sense of agency that is so central to ecological self-awareness.

All of us are aware when we have done something ourselves. When I slap my hand on the desk, for example, I see and hear and feel the consequences of my action. The optic and acoustic and mechanical effects occur just when and as they should, given the control schemata that initiated the movement. A very different experience occurs if I passively allow *you* to pick up my hand and bang it on the desk for me. The sensory consequences may be quite similar, but the coincidence with my own intention is missing. In this context, *intention* refers to the activation of particular movement control structures. We perceive actions as our own if and only if their consequences are appropriate to the schema by which they were generated. Dancers, athletes, and others skilled in bodily motion are especially sensitive to that fit. (In chapter 6, Sondra Horton Fraleigh examines dance from this point of view.)

In summary, we perceive our movements and actions veridically, because they are specified by information – especially optic flow information – that is available to the perceptual systems. Personal agency – the fact that we have carried out an action ourselves – is specified by the degree to which the consequences of a movement match the schemata by which it was generated in the first place. Thus the perceived ecological self includes an awareness of where we are, what we are doing, and what we have done.

The interpersonal self: I and Thou

Human beings are social creatures. In many societies people spend most of their waking lives within sight and earshot of one another. Even in cultures where one is often alone, the most meaningful occasions involve communication with others. That communication may be based on close physical contact, as when we embrace; on acoustical signals, as when we speak to one another; on visual information, as when we smile or exchange gestures; and perhaps on other modalities too. Often, it involves several modalities at once. We value this communication, and would hardly be human without it. William James puts the case eloquently:

> No more fiendish punishment could be devised, were such a thing physically possible, than that one should be turned loose in society and remain absolutely unnoticed by all the members thereof. If no one turned round when we entered, answered when we spoke, or minded what we did, but if every person we met "cut us dead," and acted as if we were non-existing things, a kind of rage and impotent despair would ere long well up in us, from which the cruellest bodily tortures would be a relief; for these would make us feel that, however bad might be our plight, we had not sunk to such a depth as to be unworthy of attention at all. (1890, vol. I, pp. 293–294)

People do, usually, turn round when we enter and answer when we speak. We do the same for them. Mutuality of behavior is the rule, not only among humans but for many other species as well. Crickets call to crickets, frogs to frogs; dogs and apes and monkeys encounter each other in systematic, species-specific ways. Every such exchange brings something new into existence: a series of reciprocated behaviors occurring at a particular time and place. Those behaviors are *perceptible.* What is perceived is not merely the other's behavior, but its reciprocity with one's own. Both participants are engaged in a mutual enterprise, and they are aware of that mutuality.

Considered as a participant in a shared communicative activity, each member of such a dyad is an *interpersonal self.* Where the ecological self is an active agent in the physical environment, the interpersonal self is an agent in an ongoing social exchange. That self, too, is perceived: We see ourselves as the target or focus of the other person's attention and as cocreator of the interaction itself. Gibson's claim about ecological perception, quoted earlier, transposes naturally to the social case: "Egoreception accompanies alteroception like the other side of a coin. . . . One perceives the other and coperceives oneself" (modified from Gibson, 1979, p. 126). This is true whether we are returning an embrace or just maintaining eye contact, improvising in a jazz group or just taking turns in a conversation.

Human beings confirm one another's selfhood in so many ways that it is impossible to list them all. Almost every personal encounter is mutually regulated: A directs behavior toward B, and B to A, in a reciprocal pattern that both establish together and both perceive. This pattern exists objectively and observably. It depends on communication – especially on what Ross

Buck (see chapter 12) calls "spontaneous communication," which he distinguishes from symbolic and linguistic processes. Nevertheless, my argument is not the same as Buck's. For him, communicative behaviors are important mainly because they transmit information about the participants' inner states. Buck conceives of such behaviors – facial expressions, for example – as messages from a sender to a receiver; the receiver then treats the messages as information about the sender's motives and emotions. Although this may often happen, it is not essential to interpersonal exchange as defined here. In my view, patterns of reciprocated behavior exist in their own right. A mutual embrace is a perceptible fact, whatever the true feelings of the embracing participants and whatever they may believe about each other. The interpersonal self is not an inner state to be communicated, or chiefly a detector of such states in others; it is simply a person engaged in a social exchange.

To be sure, we do often perceive the feelings of others in a very immediate way. This is possible because, as Solomon Asch (1952) noted many years ago, there is a natural congruence between feelings and their expressions. The gestures that express anger exhibit the same focused force as the feeling of anger itself, and a loving touch has just the tender quality of the mood that produced it. Under ideal conditions, then, expressive behaviors fit their emotions perfectly. Nevertheless, it is unwise to define social perception in terms of awareness of other people's feelings. For one thing, social perceiving begins at an age where this would be quite implausible. Although infants engage in "protoconversations" (Bateson, 1975) a few weeks after birth, they do not think of others as having specific mental states until about age 4 (Astington et al., 1988). For another, perceiving or inferring other people's feelings from their expressions is a very uncertain process. The relation between behaviors and inner states is culturally modulated; in addition, it can be deliberately altered or suppressed. What *is* certain, in contrast, is perception of the gestures themselves in relation to one's own behavior. You may be mistaken about your partner's thoughts but not about the fact that she is maintaining eye contact; about her real feelings but not about the touch of her hand. Assessing feelings is a chancy business, but actual social behavior is easily perceived. So, too, is the target of that social behavior, the interpersonal self.

Some ecological psychologists have described interpersonal relations in terms of *social affordances* (see Loveland and Buck, this volume; Walker-Andrews, 1986). Just as the body-scaled size and position of a stick constitute information about its graspability, so, too, does your partner's facial expression constitute information about her receptivity to your social behavior. Indeed, effective social action requires that both kinds of affordances be perceived. Gibson made this point in one of his "Rules for the Visual Control of Locomotion":

To kiss someone, magnify the face-form, if the facial expression is amiable, so as almost to fill the field of view. (It is absolutely essential for one to keep one's eyes open so as to avoid collision. It is also wise to learn to discriminate those subtle invariants that specify amiability.) (1979, p. 233; italics in original)

Like its ecological counterpart, the interpersonal self is an active agent in a real environment. Social actions, too, are executed under the control of internal schemata. You are aware of your own interpersonal activity and of what its result should be. You then perceive its actual result, the appropriate (or perhaps inappropriate) response of your partner. As in the nonsocial case, the fit between intentions and outcomes establishes a strong sense of personal effectiveness.

In emphasizing the similarity of the ecological and interpersonal selves, I must not overlook a significant difference between them. The movement-produced information that specifies the activity of the ecological self is based on universal principles of optics. Those principles are the same for everyone: Parallel optic flow means "I am moving" to any animal with a developed visual system. Patterns of interpersonal behavior, in contrast, are species-specific. Horses do not value eye contact as we do, and cats do not hold hands. The dominant male stare so important for primates has no counterpart among spiders, probably not even among rabbits. These behavior patterns are consequences of natural selection (just as perceptual systems are), but they are very different in different groups. The form that interpersonal behavior takes among primates, for example, is critical for the characteristic patterning of their social life; and among humans, for the development of culture (Tomasello, Kruger, & Ratner, in press).

Is social perception really a special case? In chapter 7, Marjorie Grene argues to the contrary. For her, all knowledge ultimately derives from ecological perception. Gibson would probably have agreed with Grene, but my view is different. The social seems just as basic as the nonsocial, and it originates independently. Without the special contribution of interpersonal experience, normal human forms of knowing could not exist. This is not a new argument. It has been made (in other ways) by such thinkers as Vygotsky (1978) and G. H. Mead (1934).

A particularly powerful formulation is that of the theologian Martin Buber (1923/1955). Buber distinguished two primary modes of human existence, which he called I–It and I–Thou. The I–It relation involves the manipulation of something or someone. (*Manipulation* here includes intellectual analysis.) The encounter with Thou is quite different: Free of manipulation, it involves only direct engagement and commitment. Superficially at least, there is a parallel between Buber's distinction and the present argument. The I of I–It is something like an ecological self, whereas the I of I–Thou is an acutely interpersonal one. But Buber's categories are deeper than this: One can have an objectifying relation (I–It) not only with objects but also with

persons. (This is quite different from encountering them as Thou.) We can even objectify mental entities – our own ideas, for example. This means, I think, that Buber would have taken not only the ecological self but also the remembered, private, and conceptual selves as examples of what he derisively called "It, always It" (1923/1955, p. 5). On the other hand, he describes the encounter with Thou as deeply mysterious. For him, Thou characterizes not only the relations one sometimes achieves with other individuals but those with the divine.

The relation of Buber's ideas to those presented here (and in Neisser, 1988) is discussed by James Gustafson in chapter 15. Gustafson also considers the work of Mead (1934), including Mead's famous concept of a "generalized other." Like Mead and unlike Buber, the present approach takes "a basic stance that is 'scientific' in a modern North American sense – the external observer seeking to provide a genetic or causal explanation of the emergence of self and mind" (Gustafson, chapter 15, p. 281). But even in such a cognitively oriented enterprise, the special status of interpersonal experience and social feeling must not be overlooked. That experience begins very early in life, and the emotions that accompany it are unique. Awareness of interpersonal engagement does not depend on anything else in experience: not on inference, not on reflection, not even on ecological perception. Thou cannot be reduced to a category of It.

The notion that there is something unique about interpersonal encounter can be extended still further. In the last chapter of this volume David Jopling shows how the "philosophy of dialogue," as set out by Buber and Emmanuel Levinas, challenges basic Cartesian assumptions. Perhaps the deepest of those assumptions is that of the interiority of the mind: Consciousness is somehow inside, the world outside. This assumption gives rise to the so-called "problem of other minds." Because each person's experience is private, how can we know what anyone else's inner life is like? The philosophy of dialogue avoids this problem because it does not begin with private experience. The encounter with the "other" is primary instead; no self and no life experience exist before that encounter. If we take social interaction itself as the basic event, the problem of other minds disappears.

I believe that this is a valuable insight, but only half the story. It is true that direct face-to-face interaction establishes a preconceptual form of knowing: knowledge of the "other" and of the self as engaged with that other. But it is not the only such form of knowing: Ecological knowledge, obtained through interaction with the physical environment, is equally direct. Both forms of perception are present from early infancy, long before the more sophisticated conceptual forms of self-knowledge begin to appear. The remainder of this chapter focuses on those early achievements.

The ecological self in infancy

Perception is the most fundamental source of self-knowledge, in two different senses. In one sense, it is fundamental because we can rely on it: Whatever we may be wrong about, we at least perceive our immediate ecological and social situation as it really is. In another sense, it is fundamental simply because it is first (Neisser, 1991). Even very young infants, still many months away from having a self-concept, are keenly aware of themselves as active agents in real physical and social settings.

That awareness has not always been obvious. Throughout most of psychology's history, from Locke to James to Freud to Piaget, the mental life of infants was regularly described as no better than a buzzing confusion. Where we (as adults) see real and persisting objects, babies were believed to see only blurs of visual sensation; where we experience ourselves as distinct individuals, they were thought to experience only "oneness" with their mothers. Realistic perception was described as a late intellectual achievement, based on the slow accumulation of memories and associations. For the most part (Piaget being the exception), these views were not based on empirical observation. Instead, philosophers simply tried to imagine what primitive perceiving must be like. The results of modern infant research suggest that they didn't get it right.

The richest relevant data concern environmental perception and the ecological self. *Looming* is a well-studied example. Many investigators (e.g., Ball & Tronick, 1971) have shown that young infants will flinch from an expanding optical display. (This behavior has also been demonstrated in a wide range of animal species.) Their perception of these displays is apparently much like ours – that is, they see a rapidly approaching object. Interestingly, their defensive flinch is not a simple reflex. They do not move away from a looming aperture, such as a framed window; instead, they lean forward to see what it may reveal (Carroll & Gibson, 1981).

Parallel flow in the optic array specifies movement of the ecological self to young children, just as it does to adults. This was first shown by Lee and Aronson (1974) in the moving room. A slight movement of the room's walls is enough to make standing 12-month-olds falls down. (They fall in trying to brace themselves against the illusory egomotion.) Butterworth and Hicks (1977) have shown that parallel flow affects the posture of 6-month-old infants, and Butterworth (1990) cites work that extends this finding back to 2 months. Based on these and related findings, Butterworth (1990, 1992) has independently developed an argument similar to that presented here, that the beginnings of self-perception are based on the kinetic structure of the optic array.

The case of *occlusion* is especially interesting, because it bears on Piaget's concept of "object permanence." When one object goes behind another, its visible surface gradually disappears from the optic array. This "texture