# PSYCHOLOGICAL PERSPECTIVES ON THE SELF

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# 2 The Self-Concept and Other Daemons

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> *But wouldst thou bid the daemons fly,*
> *Like mist before the dawning sky.*
>
> —Sir Walter Scott

The concept of a self-concept is part of a legacy. People have always classified, labeled, and explained their behavior. For lack of facts they have often resorted to verbal devices: They have invented inner agents, mental processes, traits, and cognitive structures which—grammatically, anyway—seem to explain things. The self-concept and its close relatives, self-knowledge, and self-awareness, are a subset of the many inventions of this sort which have been handed down to modern psychology.

Phrenologists explained behavior by measuring bumps on the head. In some respects modern psychologists have moved backwards, for the explanatory fictions they promote do not even have physical status. The Devil has given way to short-term memory, associations, the ego, mental images, personality traits, expectations, attitudes, intelligence, semantic networks, schemes and schemas, rule structures, processing units, and mental software. It is no surprise that the promoters claim that the new explanatory fictions are better than the old—but they are fictions nonetheless.

There are alternatives. We are organisms, and the behavior of organisms, both covert and overt, can be studied using not only the methods but the most stringent criteria of explanation employed in the natural sciences. Facts about anatomy, physiology, genes, and ontogenic and phylogenic histories are preferable to verbal inventions. Admittedly, progress has been slow—in part, because of the promotion of explanatory fictions—but there is no reason to believe that even the most complex human behavior cannot someday be accounted for with such facts.

In this chapter we examine a portion of the extensive experimental literature on the self-concept which has proliferated in recent years, and we offer what we hope is a constructive and parsimonious interpretation of major findings. We first offer some general comments on the very concept of a self-concept.

## THE SELF-CONCEPT

### Reification

The term "self-concept" is often treated as if it refers to a thing, which it does not. Philosophers have called this kind of error "reification" or "hypostatization" or "the substantialization of abstracta." A boy is observed to behave in certain ways—for example, he stares at a photograph of himself longer than at photographs of other children—and from that a psychologist infers that he possesses a "cognitive entity" called the "self-concept." The self or self-concept has been variously referred to as "an *object* to be known" (Wicklund, 1979), "*parts* of the phenomenal field" (Snygg & Combs, 1949), "an *object* of conscious inspection" (Gallup, 1979), "*regions* of our life" (Allport, 1955), and "an interpersonal *entity*" (Cooley, 1902). It has been said to have a "*structure*" and "*components*" (James, 1890) and, *like an embryo,* to "grow" (Lewis & Brooks-Gunn, 1979) (all italics added).

But the referent of "self-concept" is unclear. The referent, if there is one, is certainly less tangible than an arm or a brain; it has neither boundaries nor precise location.

### Property as Explanation

In his *Principia,* Newton warned against attributing the slow movement of a liquid to its viscosity. *Viscosity* is a description or property of the movement. We err in using a property of some phenomenon to explain that phenomenon. And yet, in spite of constant reminders from colleagues (e.g., Ebel, 1974), psychologists make this mistake frequently: A chimpanzee is observed to solve a problem in an insightful way. The explanation? The chimpanzee has "insight." A businessman works incessantly and garners many achievements in the corporate world. The explanation? He has a "need for achievement." A girl comes to be able to make accurate predictions about her own behavior. The explanation? She possesses an "accurate self-image." In each case, these so-called explanations are mere descriptions of the behavior observed. One might argue, as does Kagan (1981), that there is a point to such descriptions—that, for example, the "self-concept" can serve as a convenient summary of a great deal of behavior that children normally exhibit by about age 2—but "convenient summaries," "descriptions," and "properties" don't explain anything.

### Causes

Hypothetical constructs such as the self-concept, drives, and traits often obscure the search for more concrete determinants of behavior—for determinants that have physical dimensions, that are manipulable, that allow you to make predictions about or to change behavior. Researchers who appeal to the traditional constructs rarely stray beyond. Some even assert that a more objective analysis is impossible. Gallup (1977b), for example, concludes a paper on the self-concept as follows: "As far as the self-concept is concerned, it would appear that on the morning before God created the great apes [who, according to Gallup, possess self-concepts], maybe he . . . forgot to shave with Occam's razor" (p. 337). But objective accounts are often possible.

The behavior that comes under the rubric of *self* is troublesome because, like language, it is complex, distinctively human, acquired haphazardly over a period of years, and not easily traceable to biological factors or to any obvious instances of conditioning (Epstein, 1986). A wide variety of behavior is said to provide evidence for its existence: pointing to or naming one's picture, body- or mark-directed behavior in front of a mirror, looking at or smiling at one's picture longer than at another person's picture, imitating a videotape of oneself more than a videotape of someone else, and so on (Amsterdam, 1972; Gallup, 1970; Kagan, 1981; Lewis & Brooks-Gunn, 1979).

Presumably, the verbal behavior said to show "self-knowledge," of which Skinner (1945, 1963) has offered accounts, would also apply: describing one's feelings, states of mind, thoughts, aches and pains, actions, and so on.

What all behaviors said to show the existence of a self-concept have in common is that they are controlled in part either by one's own body or one's own behavior. By about age 2, most children respond differently to likenesses of their own faces than to likenesses of other faces. When asked, "Where does it hurt?", they report something about the states of their bodies. When asked, "What are you doing?", they describe their behavior.

### Anthropocentrism

Resistance to a factual, scientific analysis of behavior is rooted in part in anthropocentrism. Proponents of human uniqueness have sought to identify psychological or physical qualities, of which the self-concept is but one instance, which set humans apart from the rest of the animal kingdom. But anthropocentrists have suffered numerous setbacks during the past century as, one by one, apparently distinctive human qualities have been observed in other animals. The boundary between humans and non-humans (most notably but not exclusively the great apes) has become increasingly transparent (Beck, 1975; Chiarelli, 1973; Davenport, Rogers, & Russell, 1973; Fouts, 1974; Gardner & Gardner, 1969; King & Wilson, 1975; Mason, 1976; Menzel, 1973; Savage-Rumbaugh, Rumbaugh, & Boysen, 1978; Teleki, 1973; van Lawick-Goodall, 1970, 1971; Wilson & Sarich, 1969; Yeni-Komshian & Benson, 1976; Yunis & Prakash, 1982).

### "Bidirectionality" of Consciousness

Always an elusive entity for psychologists, consciousness has been characterized as "bidirectional," in the sense that we both "[have] an experience and [are] aware of having an experience" (Gallup, 1977b). In other words, we can direct our attention outward toward events in the world or inward toward ourselves, or, in still other terms, as we have already noted, behavior comes under the control both of stimuli outside the body *and of the body and behavior of the organism itself.*

To state the matter another way: *We can react not only to the world but to our reaction to the world, since every response is also a stimulus.* To say that an organism is capable of "self-directed consciousness" or "self-awareness" probably means nothing more than that the organism occasionally exhibits behavior that is controlled by its own body or behavior. This may be reductionism, but it also may be true.

Self-awareness has been said to be unique to humans (Ardrey, 1961; Buss, 1973; Kinget, 1975; Lorenz, 1971), and Slobodkin (1977), an evolutionary biologist, has even suggested that it has freed humans from the otherwise deterministic forces of evolution – surely the ultimate in uniqueness among species. The claim that self-directed consciousness is unique has always been limited by the lack of techniques for determining its existence in nonhumans. Klüver (1933) asserted that consciousness in animals was not amenable to study by objective methods, and, more recently, Gardiner (1974) has noted that "there is no way to interview animals to discover the exact point on the evolutionary scale at which [consciousness] emerges. Neither is there any way to determine when 'self' becomes an element within the subjective mass. . ." (p. 207). But if self-awareness in animals is not amenable to study, how can one be confident that it is unique to humans?

A recent line of investigation, notably that of Gallup and colleagues, has suggested that an objective analysis of self-awareness may be possible. Gallup (1970) suggested a test of self-awareness which, if valid, would repeal the prohibition on comparative scientific study of this phenomenon. This test makes use of *mirror-image stimulation* – stimulation that results from an organism's own reflection in a mirrored surface. The mirror image is, in many ways, unique among the vast array of stimuli used by psychologists.

## MIRROR IMAGE STIMULATION

### The Mirror as an Unconditional Stimulus

Unconditional responses (UCRs) to mirrors, especially aggressive displays, have been observed in a variety of species, including siamese fighting fish (Thompson & Sturm, 1965), sexually aroused male sticklebacks (Tinbergen, 1951), and the male towhee (Dickey, 1916). Ritter and Benson (1934) reported that wild male towhees, California linnits, Western mockingbirds, robins, cardinals, and blackbirds attack their reflections in mirrors and window panes. Smythe (1962) observed that chaffinches and hedge sparrows occasionally attack their reflections in the hub caps of stationary automobiles, sometimes to the point of exhaustion. Captive California sea lions have been observed to emit underwater clicking-type vocalizations to mirrors, to make rapid runs at mirrors, and to attempt to bite or slap their mirror images (Schusterman, Gentry, & Schmook, 1966). Thompson and Sturm (1965) demonstrated classical conditioning using a mirror as an unconditional stimulus: They brought the aggressive response of siamese fighting fish under the control of a light by pairing the light with mirror exposure.

Among primates, gibbons (Boutan, 1913), rhesus monkeys, and pigtailed and Japanese macaques (Gallup, 1968) respond aggressively to mirrors. MacLean (1964) described penile erection in the squirrel monkey in response to a mirror. Many primates (Yerkes & Yerkes, 1929), as well as cats (Kraus, 1949) and human infants (Dixon, 1957), reach toward or look behind a mirrored surface, as if to make contact with the reflected image. Orangutans (Schmidt, 1878) and chimpanzees (Köhler, 1925) are unusual in that the way they react to their mirror images changes over time: At first they are aggressive, then they appear to be "curious," and eventually they may become emotional if an attempt is made to remove the mirror. Gorillas behave similarly, except that they are aggressive only rarely (Yerkes, 1927).

### The Mirror as a Social Stimulus

Organisms do not ordinarily attack themselves. Thus, the aggressive response of an animal to its mirror image suggests that the animal perceives the image as a stranger, and the response may be interpreted as territorial defense (Lorenz, 1966).

It is frequently noted that animals vacillate between approach toward and withdrawal from a mirror. The vacillation would seem to follow from a simple observation by Tinbergen (1968): In general, one animal's approach induces another animal's withdrawal. Moreover, mirrors should enhance such an effect, because you converge with your mirror image twice as fast as you do with a still object.

Adult humans sometimes respond to their mirror images as images of other people. For example, Wolff (1943) noted that many people are startled when they see their own images reflected suddenly in an unexpected mirrored surface; they respond as if they are being confronted by a stranger. Similarly, certain drugs cause some people to report a feeling of strangeness or unfamiliarity with their mirror images (Kraus, 1949). Furthermore, congenitally blind individuals who have had their vision restored report unusual reactions to mirrors. For example, von Senden (1960) told of a man who had to remind himself constantly that a mirror was fastened to a wall in order to compensate for the fact that he "saw" the objects behind the wall.

Retarded humans, too, sometimes respond to their mirror images as if they are seeing another person. Shentoub, Soulairac, and Rustin (1954) exposed 15 retarded children, ages 4 to 19 years, to mirrors and found that many of them tried to escape from the reflection or refused to look at it. One girl, when offered candy before a mirror, offered some to her mirror image. Similar results have been obtained with retarded adults (Harris, 1977).

Schizophrenic humans have also been observed to respond inappropriately to likenesses of themselves. Schizophrenics who were shown photographs of themselves (Faure, 1956) or mirrors (Wittreich, 1959), interpreted these as distorted images of themselves, masks, a twin, or another person. Schizophrenics have also been observed to engage in prolonged mirror gazing (Abély, 1930), and it was even suggested that such behavior might be useful in diagnosis and prognosis (Ostancow, 1934).

Traub and Orbach (1964) developed a full-length mirror that could be adjusted along a continuum, from undistorted to extremely distorted. They presented psychotic humans with the distorted mirror and asked them to adjust it until their reflections appeared undistorted. One subject tried to escape from the distorted image and could not be tested. Many others were unable to look at their distorted reflections. Many subjects repeatedly looked at their bodies, or asked to see themselves in an undistorted mirror before proceeding, indicating they had forgotten what they looked like. Normal subjects given the same task (Orbach, Traub, & Olson, 1966) performed more accurately. As a control, all subjects were asked to adjust the distorted reflection of a door. Accuracy was high for both groups, and there were no significant differences between normals and psychotics.

Mirrors have also been observed to have social facilitation effects. It has been shown that organisms behave differently in the presence of other organisms than they do in isolation (Zajonc, 1965), and mirrors seem to serve sometimes as substitutes for other organisms. For example, isolated pigeons do not normally lay eggs, but they will do so in the presence of mirror-image stimulation (Matthews, 1939). A similar effect has been noted in ring doves (Lott & Brody, 1966). Chickens eat more food in the presence of other chickens than in isolation, and this facilitation effect is also seen with mirrors (Tolman, 1965). Finally, college students who faced a mirror were observed to perform better on tests than students who did not face a mirror (Wicklund & Duval, 1971).

## The Mirror as a Reinforcer

Operant conditioning has been achieved using a mirror as a reinforcer. For example, Thompson (1963) conditioned siamese fighting fish to swim through a maze for contingent mirror exposure. Notably, this response extinguished more rapidly than comparable behavior that had been established using food as a reinforcer. Thompson (1964) also established a key-peck response in fighting cocks using mirror exposure as a reinforcer. Reinforcing effects of mirror exposure have also been demonstrated in baby chicks (Gallup, Montevecchi, & Swanson, 1972), paradise fish (Melvin & Anson, 1970), male squirrel monkeys (MacLean, 1964), pigtailed macaques, and rhesus monkeys (Gallup, 1966).

A mirror image may be reinforcing because it is novel (cf. Kish, 1966), or, possibly, simply because it is, in some ways, an ideal consequence. Mirror-image stimulation is unique, because only in front of a mirrored surface are one's movements instantly and perfectly mimicked. Moreover, an animal in front of the mirror has perfect control over the movement of the image, which is to say that the animal's behavior has continuous and virtually instantaneous consequences. Such a scenario would seem to be ideal for the establishment and maintenance of operant behavior.

The correlation between the behavior of the observer and the behavior of the observer's image also means, in effect, that the observer is in a position to control perfectly the behavior of "another organism." The prediction and control of natural phenomena, behavioral and otherwise, is a powerful reinforcer for scientists, gamblers, politicians, managers, teachers, and just about everyone else. Perhaps mirror-image stimulation in reinforcing because it provides the illusion of control over another organism.

Alternatively, Hogan (1967) suggests that the unconditional response (the aggressive display) elicited by mirror-image stimulation is what is reinforcing, not the mirror-image stimulation per se. It seems unproductive to speak of behavior itself as reinforcing, and we suggest that Hogan's statement means simply that mirrors are reinforcing because of the kinds of stimuli they produce, that is, views of aggressive conspecifics, which are, presumably, releasers of aggressive displays.

Moreover, it has been shown that, when given a choice between viewing mirror-image stimulation and viewing a live conspecific – both of which elicit the aggressive UCR – siamese fighting fish (Baenninger, 1966), goldfish (Gallup & Hess, 1971), weaver finches, and parakeets (Gallup & Capper, 1970) prefer mirror-image stimulation.

Some studies suggest that the UCRs elicited by mirror-image stimulation are of greater magnitude than the same UCRs elicited by conspecifics. In effect, then, mirror-image stimulation appears to be what ethologists call a "supernormal stimulus." This effect has been shown for aggressive responses in siamese fighting fish (Baenninger, Bergman, & Baenninger, 1966), adolescent chickens (Gallup et al., 1972), and patas monkeys (unpublished data by Gallup & McClure, cited in Gallup, 1975). It has also been found that distress vocalizations in very young chicks are reduced more by mirror-image stimulation than by a live companion (Gallup et al., 1972).

Although these findings suggest that mirror-image stimulation is a powerful reinforcer, a study by Schulman and Anderson (1972) has introduced a complicating variable. They varied the early social experience of chickens and turkeys and found (a) that group-reared fowl preferred viewing conspecifics, (b) that those raised with a mirror preferred mirror-image stimulation, and (c) that those raised in social isolation showed no preference. The results may be an artifact of a flaw in the procedure, however: A bird was given a choice between viewing its own image or *two* conspecifics.

Controlling for this possible confound, Gallup and McClure (1971) tested feral versus socially isolated, preadolescent rhesus monkeys and found that feral animals preferred a feral conspecific to mirror-image stimulation, whereas isolates preferred mirror-image stimulation over an isolate conspecific. One possible explanation for this finding is suggested by a study by Pratt and Sackett (1967), which showed that rhesus monkeys preferred to view comparably reared conspecifics over monkeys with different rearing histories. Thus, for a feral, socially experienced animal, mirror-image stimulation would present an extremely unfamiliar social situation, in that the image neither initiates an encounter nor reciprocates. The mirror-reflected behavior of an isolate, however, although unfamiliar, would at least be more predictable than a conspecific's behavior. The image would only mimic; it would not initiate behavior with which the subject is unfamiliar.

This explanation, however, contradicts the hypothesis that mirror images are reinforcing because they are novel. Thus, we submit that, at this point in time, there is still much to be learned about (a) what properties of mirror images make them reinforcing and (b) what environmental histories maximize their reinforcing effects.

## MIRRORS AND SELF-AWARENESS

Probably the most obvious fact about mirrors – for humans, anyway – is that they are a source of information about one's own body. The responses of nonhuman animals to mirror-image stimulation, as previously noted, appear to be other-directed rather than self-directed. According to Gallup (1977b), in order for "self-stimulation" to become "self-perception" (or "self-awareness" or "self-consciousness"), self-recognition must first occur.

### Stages of Self-Recognition

Darwin (1877) recorded the responses of a baby to its mirror image, and, in recent decades, more careful and systematic observations have been made. For example, Dixon (1957) noted a series of "stages" through which mirror-controlled behavior seems to pass during the first few years of life: At first, most infants are unresponsive. After a few months, babies react to their images as they would to other children – by vocalizing, reaching, smiling, and so on. By a child's second year, it usually engages in behaviors that suggest "testing" or "discovery." For example, Dixon (1957) observed "repetitive activity while observing the mirror image intently, e.g., alternately observing a hand or foot and its mirror image, opening and closing the mouth with deliberation, or rising up and down slowly while keeping [the] eyes fixed on the mirror image" (p. 253). Amsterdam (1972) describes a similar stage. Finally, toward the end of its second year, the child begins to behave appropriately towards its mirror image.

### A Test of Self-Awareness

Gallup (1970), using chimpanzeees, and Amsterdam (1968, 1972), using children, devised an objective test to determine whether an organism had achieved this last stage – the stage at which the daemon Self is said to spring to life, or at least to "mature" (cf. Lewis & Brooks-Gunn, 1979). In Amsterdam's study, a mother smeared rouge on her child's nose – where, supposedly, the rouge would be difficult to see directly – and then encouraged the child to gaze at its mirror image. If the child touched its nose, it was said to have achieved the final stage: The mirror now controlled reaching appropriately. Most children responded in this way by about age 2.

### Some Origins of the Appropriate Behavior

Before appropriate control can be established, an organism's social responses to its mirror image (Dixon's second stage) must be extinguished. Gallup (1968) suggested using very narrow mirrors for this purpose, so that only relatively small side-to-side movements by the observer would make the "other animal" disappear and reappear frequently. This seems, however, to be no different than housing two animals adjacent to each other with visual access limited to a small window; social responses of rhesus monkeys do not extinguish under such conditions. Furthermore, contrivances hardly seem necessary, because mirror-image stimulation is such atypical social stimulation: Mimicry is not a typical social response, so, if social responses are going to disappear, they should do so unaided, and, indeed, they often do (Gallup, 1968, 1970).

Mere extinction is not enough, however. An organism's behavior must actually come under the control of the mirror. How might this occur?

When the aggressive behavior has weakened, any arbitrary response—say, arm waving—would be strengthened somewhat by exposure to the organism's mirror image. A self-directed response, such as grooming, could therefore draw two sources of strength: the mirror image of the response, *and the natural consequences of grooming*. If, say, teeth-cleaning occurred by chance before the mirror, a chimpanzee would surely, at some point, gaze at its image and clean its teeth at the same time, in which case *the mirror image would begin to control the topography of the teeth-cleaning, because the image is a guide to more effective movements*. Moving this way or that, according to the image in the mirror, would allow the animal to dislodge bits of food with greater proficiency. The consequences of movements controlled in this way would be detected immediately—the animal would both *see* its hand shift and then *feel* the food in between its fingers (cf. Epstein, 1986).

Does mirror-controlled behavior actually develop in this fashion? Gallup (1968) described the development of self-oriented responses in a chimpanzee after mirror exposure. Initially, responding was aggressive, and then the chimpanzee repeatedly positioned its limbs in unusual positions and tried to inspect its new postures in the mirror. Several contorted facial expressions led to close visual inspection of the reflection. Finally, and most important, while in front of the mirror the animal came to groom parts of its body—for example, its forehead and eyebrows—not visible without the mirror, and it did so while gazing at its mirror image.

## "Self-Awareness" in the Chimpanzee

To confirm this observation experimentally, Gallup (1970) isolated four preadolescent chimpanzees in a room with a mirror for 80 hours over a 10-day period. Social behavior declined sharply on the third day, and there was a simultaneous increase in self-directed behavior (including grooming visually inaccessible body parts, picking the teeth or nose while watching the mirror image, making faces at the mirror, and so on). The animals were then anesthetized to unconsciousness with phencyclidine and atropine, and the upper eyebrow ridge and top of the ears were painted red with a dye that has no olfactory or tactile cues when dry.

After they had recovered fully, the chimpanzees were observed for 30 mins in the absence of a mirror, during which time an animal was seen to make a "mark-directed" response only once. A mirror was then reintroduced for 30 mins, whereupon from 4 to 10 "mark-directed" responses per animal were observed. Also, the total mirror-viewing time increased fourfold over the previous mirror sessions, and some of the animals inspected the fingers that had touched the dyed spots. As a control, two chimpanzees that had had no previous mirror exposure were anesthetized, marked, and tested, but they made no mark-directed responses. Critical discussion of this procedure can be found in Epstein (1985a).

## Other Primates

Gallup's (1970) finding has apparently been extended to orangutans, another member of the great apes family (Lethmate & Dücker, 1973). However, reports with other primate species have been negative. For example, Tinklepaugh (1928), exposed a female macaque to a mirror for several days and discovered that the animal learned to respond to objects in the environment using the mirror: ". . . if a human being thus viewed makes a threatening movement, she will turn directly from the mirror to the person, as though verifying her indirect picture of the situation" (p. 218). In spite of this proficiency, the monkey showed no sign of responding appropriately to her mirror image. Brown, McDowell, and Robinson (1965) also showed that monkeys could use mirrors to manipulate objects, but they, too, saw no indication that the monkeys responded appropriately to their own images.

Gallup (1970) also tested four adult stump-tailed macaques and two adult rhesus monkeys after 168 hours of mirror exposure. There was little decline in the occurrence of social behavior and no evidence of self-directed behavior during the exposure period. Moreover, no mark-directed responses were observed during testing. Similar results were obtained with four cynomolgus monkeys after 250 hours of exposure. Lethmate and Dücker (1973) tested for but saw no evidence of self-recognition in several primate species: spider monkeys, capuchins, macaques, mandrill and hamadryas baboons, and two species of gibbons. Pribram and Bertrand (cited in Gallup, 1977b) failed to find signs of self-recognition in gibbons and macaques. Benhar, Carlton, and Samuel (1975) gave baboons 250 hours of mirror exposure but, again, found that the baboons responded inappropriately to their mirror images.

Thinking that these failures might have been due to inadequate mirror exposure, Gallup (1977a) exposed a preadolescent crab-eating macaque to a mirror for 2,400 hours, but the subject was still unsuccessful in the test. Furthermore, according to Gallup (1979), Thompson and Radano provided 1 year and Bertrand provided 7 years of mirror exposure to pigtailed macaques, but appropriate responding did not emerge in either case.

Because monkeys are adept at recognizing each other, Gallup, Wallnau, and Suarez (1980) speculated that self-recognition would be facilitated if familiar cagemates were given access to a common mirror. Because each member of the pair would presumably be able to recognize the reflection of its companion, the identity of the remaining individual seen in the mirror would be obvious. In one experiment, a feral adult rhesus monkey and her 6-month-old infant were given over 1,000 hours of mirror exposure. Red dye was applied to the eyebrow and abdomen of both animals. Both the adult female and a control animal without prior mirror exposure touched their marked stomachs, and the infant repeatedly groomed the mark on its mother's eyebrow, but none of the monkeys made self-directed responses to their own marked eyebrows. The experiment was repeated with two 6-month-old rhesus monkeys who were separated from their mothers and maintained together in front of a mirror for 14 weeks. Both infants touched the marks on their cagemate's face upon testing, but neither responded to its own marks.

In contrast, as noted earlier, the behavior of most humans readily comes under the control of a mirror image, though estimates of when the control is normally established vary somewhat. Stone and Church (1968) contend that many children learn to recognize themselves in mirrors by 10 months of age, but earlier sources say that self-recognition is unlikely during the first year (Gesell & Thompson, 1934; Shirley, 1933).

Amsterdam's (1972) study, cited earlier, reported that appropriate control was apparent in 65% of the subjects tested who were between 20 and 24 months old. Unfortunately, the children were marked with a spot of rouge placed on the side of the nose—a visible body part—while fully conscious, and thus the children could detect the marks before they were given the test.

In summary, the results of most of the mirror studies to date suggest a discontinuity in the phylogenetic tree. It seems that the families Hominidae and Pongidae come, with adequate exposure, to respond appropriately to their mirror images; other species do not. It is unusual to find substantial qualitative differences between monkeys and the great apes in learning abilities or other psychological processes (Mason, 1976; cf. Rumbaugh, 1971; Rumbaugh & Gill, 1973).

If there is a discontinuity in the reaction of different species to mirrors, how might we interpret it?

## Discontinuity

Because Gallup attributes self-directed behavior in front of a mirror to the daemonic "self-concept," he has concluded that only humans and the great apes (chimpanzees, at least) possess this cognitive entity (e.g., Gallup, 1979). He mantains that his results "raise serious questions about recent claims (e.g., Griffin, 1976) concerning the evolutionary continuity of mental experience" (Gallup, 1977b, p. 335). His theorizing, furthermore, has become increasingly mentalistic. Writes Gallup:

> . . . most primates lack a cognitive category that is essential for processing mirrored information about themselves. . . (1979, p. 420)
>
> I do not think their sense of identity or self-concept in any way emerges out of experience with a mirror. A mirror simply represents a means of mapping what the chimpanzee already knows. (1977b, p. 335)
>
> . . . if you do not know who you are, how could you possibly know who it is you are seeing when you look at yourself in a mirror? (1979, p. 420)
>
> . . . therein may lie one basic difference between monkeys and the great apes . . . the absence of a sufficiently well-integrated self-concept. (1977b, p. 334)

Gallup has turned to what he calls the "Cooley–Mead" model of self to account for his results. According to Cooley's (1902) "looking glass" theory of self, our self-concept derives from interaction with others. Similarly, Mead (1934) proposed that, in order for the self-concept to emerge, one must see one's self from another point of view.

To evaluate the applicability of the Cooley–Mead model to chimpanzee behavior, Gallup, McClure, Hill, and Bundy (1971) compared the self-recognition responses of feral chimpanzees housed in group cages with those of chimpanzees who were born in the laboratory and reared in isolation. Each animal was exposed to a mirror for 9 days. During the exposure period, feral chimpanzees attended frequently to the mirror at first but paid less attention to it as the days passed. But the isolates attended frequently to the mirror for the entire period. When tested for self-recognition, the feral chimpanzees made 13.5 times as many mark-directed responses as the isolates. Hill, Bundy, Gallup, and McClure (1970) extended these findings with three additional isolation-reared chimpanzees, none of whom showed signs of self-recognition in the test. Two of these animals were then housed together for 3 months. Upon retesting, both animals showed signs of self-recognition, whereas the third chimp, who had remained isolated, did not.

These results were said to support the Cooley–Mead model, and two alternative explanations were summarily—and, in our view, prematurely—dismissed. One possible alternative is that social isolation leads to general deficits in learning ability. Gallup dismissed this possibility on the grounds that apparent learning deficits are complicated by heightened emotionality in novel situations (Harlow, Schlitz, & Harlow, 1968), but those are hardly adequate grounds for dismissal. Indeed, the heightened emotions of the social isolate—that is, the "anxiety"—should interfere with its ability to learn how mirrors work, just as the anxiety of Thorndike's cats made it difficult for them to learn a simple escape response (cf. Gluck & Harlow, 1971). Control by the mirror image would not easily be established if irrelevant emotional behavior were being elicited by the image.

It is also possible that isolates fail to distinguish the atypical behavior of the "other animal" in the mirror because they have not seen the typical behavior of other chimpanzees, and thus they have nothing with which to compare the mirror images. In other words, there were no opportunities for the appropriate discriminations to have been established. Gallup dismissed this possibility because the isolates' interest in the mirror remained high throughout the study, but that seems to be beside the point.

Although conservative explanations for the kinds of data Gallup has gathered do not seem to be in short supply, Gallup persists in attributing successful performances to mental daemons. His speculations have ranged widely. For example, Gallup (1979) has suggested that humans are not unique in their ability to contemplate their own deaths. He has speculated that chimpanzees are aware of, or can be made aware of, their inevitable ends, and Premack (1976), too, has expressed concern over this possibility. Such speculation have given rise to what can only be called *pongidocentrism*.

## Continuity

The case for discontinuity is by no means clearcut. Chimpanzees do not always respond appropriately to their mirror images (Gallup et al., 1971; Hill et al., 1970; Russell, 1978), and neither do humans (Harris, 1977; Kraus, 1949; Shentoub et al., 1954; Traub & Orbach, 1964; von Senden, 1960; Wittreich, 1959; Wolff, 1943). And the learning histories of those organisms who can respond appropriately make a difference (Gallup, 1970; Hill et al., 1970).

At best, the self-concept – whatever and wherever it may be – and the behaviors from which it is inferred, are *collateral products* of an organism's genetic endowment and environmental histories. Gallup and his colleagues have helped to discover some of the determinants of the behavior – for example, both chimpanzees and children need extensive exposure to a mirror before control is established. Without the behavior, the daemon would not be invoked. Thus, these determinants are determining both the behavior *and* the "self-concept" (granting, for the sake of argument, that the self-concept is worth talking about). But it makes no sense to attribute the behavior to the daemon – *that is, to attribute one of the products to the other.*

As we noted earlier, daemons are sometimes troublesome because they call attention away from the actual behaviors in question, as well as from the determinants of that behavior. If appropriate behavior with respect to one's mirror image has specific origins in one's learning history, we should be able to find those origins. If particular neural structures are involved, we should be able to find them.

And, finally, once we have identified determinants of the behavior, we should be able to establish such behavior in an organism that does not normally exhibit it.

## "Self-Awareness" in the Pigeon

Epstein, Lanza, and Skinner (1981) did so with pigeons. They reported that a normal adult pigeon whose history was supplemented with some simple training could successfully pass the mirror test; that is, it could successfully use a mirror to locate a spot on its body which it could not see directly, *even though it had not been explicitly trained to do so.*

Each of three pigeons was given two types of training over a 10-day period. First, with no mirror present, blue stick-on dots were placed one at a time on parts of the pigeon's body which it could see. Pecking the dots was shaped and maintained on a rich variable ratio schedule of food reinforcement. When the training was complete, each pigeon would readily scan its body, locate a dot, and peck it. The pigeon was thus provided with a repertoire of pecking itself, something a pigeon doesn't ordinarily do.

Second, the pigeon was taught to use a mirror. A mirror was added to the pigeon's chamber and pecks at blue dots placed on the walls and floor were reinforced. Then the dots were flashed only briefly, and pecks at the spot where a dot had been were reinforced. Finally, a dot was flashed only when the pigeon was facing the mirror. It received food when it turned and pecked the position where a blue dot had been flashed. The pigeons were exposed to the mirror for a total of less than 15 hours during the entire training period.

The pigeon was now like some of the chimpanzees and children who have been confronted with the mirror test in recent years. It had a strong tendency to "groom" itself (for blue dots, anyway), which means that, like the chimpanzee or child, it would now try to touch spots that appeared to be on its body. And it had learned – albeit in a more efficient and structured manner than the chimpanzees and children had – how a mirror works.

In some ways the pigeon was now at a disadvantage. For one thing, it had had relatively little mirror exposure. Moreover, it had had little or perhaps even no experience using a mirror to locate an object on its own body. It had learned to use the mirror only to locate spots on the walls and floor of its chamber. It had never seen a spot on its body while the mirror was available. In contrast, chimpanzees and children who are successful in the mirror test have apparently already learned to use mirrors to locate both objects in real space and objects on their own bodies (Gallup, 1968, 1970; Lewis & Brooks-Gunn, 1979).

The following test was conducted: A blue stick-on dot was placed on the pigeon's breast and a white bib placed around its neck so that the pigeon, standing fully upright, could just see the dot in the mirror. Because the bib would drop if the pigeon lowered its head, the pigeon could not see the dot directly. To be certain that the pigeons could not detect the dot either visually or tactually, each pigeon was observed first for 3 mins in the absence of the mirror. Three independent observers scored videotapes for what they judged to be dot-directed responses. None of the birds was observed to peck the dot during this period.

When the mirror was then uncovered, each pigeon approached it and, within a few seconds, began to bob and peck toward the position on the bib that corresponded to the position of the concealed dot. None of the birds pecked the positions on the floor and walls where dots had previously been presented. The three birds were judged by the independent observers to have emitted a total of 29 dot-directed responses within 3 mins of seeing the mirror, though food was not presented. This rate of responding is more than 10 times that reported by Gallup (1970) with chimpanzees.

To control for the possibility that the pigeons were responding simply because the mirror had been uncovered, one bird was tested wearing a bib but with no dot on its breast. The mirror was covered for 5 mins and then uncovered for 5 mins, and no dot-directed responses were observed during either period.

Thus, even though the pigeons had had very limited mirror exposure, and even though they had never been trained to use a mirror to locate spots on their bodies, they successfully used a mirror to do so. Does this mean pigeons have a self-concept?

## Implications

The Epstein et al. (1981) study may be interpreted in different ways.

*Training.* First, it might be said that because the pigeons had had *training* before the mirror test, the results are not applicable to chimpanzees and children, who, it seems, have had no "training" before the test.

But the word "training" is misleading. The chimpanzees and children who have been successful in the mirror test have had far richer learning histories than our pigeons. Organisms learn constantly, even without teachers! (Some would say especially without teachers!)

*Explanation.* However the chimpanzee or child acquired the relevant behaviors—we return to this point later—there is ample evidence that both chimpanzees and children have acquired each of them before they pass the test: They readily touch spots on their bodies, and they have each learned how mirrors work. The pigeon study suggests that successful performances in the mirror test are the outcome of the acquisition of these two repertoires.

If other organisms that are provided with these repertoires prove able to pass the test, the explanation will become more credible. If a chimpanzee or child who lacks one these repertoires proves able to pass the test, the explanation will become less credible (cf. Epstein, 1984a).

*Self-Concept.* The results of the Epstein et al. (1981) study will suggest to no one that pigeons have a self-concept. Why not? For one thing, pigeons do not look like people. It is awkward to anthropomorphize with a 12-inch high, armless, feathered creature; it is easier with chimpanzees.

More important, the pigeons acquired only one telltale sign of self-awareness. The self-daemons are typically invoked only after a variety of self-controlled behaviors have been established.

*Bad Test.* The Epstein et al. (1981) study could also be said to cast doubt upon the usefulness or informativeness of the mirror test. After all, if an organism that has no self-concept can pass it, what good is the test? The mirror test shows what the mirror test shows—namely, that an organism's behavior is controlled appropriately or inappropriately by a mirror image. That may be worth knowing, but it also may not be a critical sign of self-awareness, as was supposed.

*Bad Concept.* Epstein (1986) and Epstein et al. (1981) suggest that the study is significant mainly in calling attention away from self-awareness. Rather, the behavior from which self-awareness is often inferred is brought into focus, along with the learning history that is responsible for the behavior.

## Replication

Gallup (1984) cites what he calls a "failure to replicate" the Epstein et al. (1981) study—a convention talk by Gelhard, Wohlman, and Thompson (1982). But these investigators reported having great difficulties in training their two pigeons in preparation for the mirror test. They gave up on one bird after nearly a year. This suggests that they were using inadequate training procedures, not that pigeons cannot pass the mirror test. One of the authors of that study, Roger Thompson (personal communication, December, 1983) stated that he had "no doubt" that Epstein et al. (1981) achieved the result they reported.

Moreover, Cheney (1984) has completed a systematic replication of the Epstein et al. (1981) study, and he has achieved positive results with each of the four pigeons he tested. According to Cheney, "Given the relatively modest level of sophistication and experience of the trainers in this study, the results indicate a rather robust phenomenon" (p. 6).

### Contingencies and Species Differences

Under most circumstances, moving toward an object brings it closer and ultimately produces contact with it. However, one must move in a special way to touch an object that is reflected in a mirror. A mirror thus provides a new set of relationships between one's movements and their consequences—a new set of "contingencies."

A pigeon would not normally come under the control of such contingencies, and, therefore, Epstein et al. (1981) supplemented them with the conspicuous and systematically changing contingencies one sometimes calls "training." Epstein (1986) offers further analysis:

> Attending to an object in the mirror and then finding it in real space not only produced the natural consequence—contact with the object—it also produced food, a powerful, effective reinforcer for a hungry pigeon. The food only supplemented the natural contingency; it did not obliterate or override it. The pigeon's behavior had to be under the control of the correspondence between mirrored and real space in order for food to be delivered. . . .
>
> The period of "testing" or "discovery" that Dixon (1957) described is undoubtedly the period during which a child's behavior comes under the control of the contingencies of reinforcement which govern mirror use. The child slowly learns the correspondence between the locations of parts of its body (and, presumably, of other objects) in real and mirrored space. (p. 104)

The only impressive thing about chimpanzees and children is that they can—*after many hours of activity in front of mirrors*—come under the control of mirror-use contingencies without explicit training. According to the present view, this control is established for the simple reason that chimpanzees and children are extremely sensitive to the consequences of their behavior. Earlier in the chapter we suggested some of the events that might lead to appropriate control. The fact that the mirror image is reinforcing is important, because that means it creates opportunities for further learning. The extinction of UCRs (such as aggressive displays) and of inappropriate reaching (such as reaching toward the image) is also important. Because chimpanzees and children learn quickly, the extinction of these behaviors should occur rapidly—again creating the opportunities for appropriate control to be established.

With inappropriate behaviors eliminated, a chimpanzee gazing at its mirror image should quickly come under discriminative control of that image, because, loosely speaking, *the mirror is a guide to effective action*. We described one possible scenario earlier: While gazing at its image, the animal happens to move its hand toward an irritant on its face or in its teeth which it cannot see directly. The sight of the reflected hand removing the irritant is the occasion upon which the hand successfully removes the irritant, and thus the image should come to control similar movements in the future. It is a "discriminative stimulus," a stimulus that sets the occasion for reinforcement, a stimulus that helps the organism to be effective.

A careful analysis of videotapes of a chimpanzee's interactions with mirrors should show interactions of this sort. We predict that careful study of these interactions will take the mystery out of the acquisition process.

### Other Species

Why do so many species—especially other primates—fail the mirror test? Epstein et al. (1981) suggested that monkeys fail because they tend to move so much faster than chimpanzees and children. The contingencies of reinforcement which govern mirror use are more likely to take hold if an organism gazes at its mirror image while it is moving slowly.

But other factors also seem important. If aggressive displays and other UCRs are elicited by the image, appropriate control cannot be established until these have abated. With some species and some individuals, this extinction may not occur. Moreover, inappropriate operant behavior, such as reaching toward the image, must also disappear. With children and chimpanzees, this extinction occurs fairly rapidly, but it may occur slowly or not at all with other species.

Species vary dramatically in the speed with which behavior is acquired or eliminated, and there is significant variation among individuals within a species. In other words, some organisms learn faster than others, and learning ability should make a big difference in the acquisition of mirror-use behavior.

As stated earlier, training that compensates for an organism's deficiencies should also make a difference. With appropriate training, many organisms that would not normally come under the control of their mirror images should do so. Because organisms differ, we should expect that the necessary training should differ for different organisms.

### Other Behaviors

Other behaviors said to show the existence of a self-concept demand their own analyses. For example, a child's reply to the question "How do you feel?" has different origins than the child's behavior in front of a mirror. The reply "I feel fine" is the result of years of exposure to speakers and to the contingencies of reinforcement supported by a verbal community; its successful occurrence might also depend on the maturation of language-specific neural structures. It is not reasonable to expect, as some developmentalists seem to hold, that the entire set of behaviors from which the existence of a self-concept is inferred will emerge full-blown if any one member of the set emerges. The behaviors may have little relationship to each other and may have very different origins.

The fact that many self-controlled behaviors appear within a few months of each other during the second year of life (Kagan, 1981) is not surprising, because that is a period of mobility and rapid learning. While the child is acquiring a wide variety of behaviors that are controlled by its own body and behavior, it is also acquiring many other complex behaviors—verbal and other social behaviors, problem solving behaviors, complex motor skills, and so on. The roughly concurrent appearance of many self-controlled behaviors should not in itself be taken as evidence for the validity of the concept of a self-concept.

## A WORD ABOUT SIMULATIONS

The Epstein et al. (1981) study is one of a number of so-called "Columban [from the taxonomic name for pigeon] simulations" (Baxley, 1982; Epstein, 1981, 1984a)—simulations of complex human behavior with pigeons.

### Rationale

The rationale for these simulations may be briefly stated as follows:

> *If you have reason to believe, based on principles of behavior established in the laboratory and information about a person's past, that certain experiences were responsible for the emergence of some mysterious behavior, you provide support for this conjecture if, after providing an animal that does not normally exhibit such behavior with these experiences, the animal exhibits similar behavior.* (Epstein, 1984a, p. 46)

### Outcomes

There have been four outcomes of this research program to date. First, pigeons have been shown to be capable of engaging in a variety of complex behaviors—not just successful mirror-use behavior. For example, with appropriate training histories, pigeons successfully solved the box-and-banana problem, one of Köhler's classic insight problems (Epstein, Kirshnit, Lanza, & Rubin, 1984), as well as a variation on the rake problem (Epstein & Medalie, 1983).

Second, by systematically varying the training histories of different animals, investigators have been able to assess the contributions that different experiences make in the emergence of novel performances (e.g., Epstein et al., 1984).

Third, a set of principles has emerged which allows for the successful prediction of novel performances in the laboratory environment. What Epstein (e.g., 1986) calls "the interconnection of repertoires" has proved to be especially important in understanding how novel performances are generated. The interconnection of three repertoires in a pigeon has generated a solution to the box-and-banana problem in just under 1 min (Epstein, 1985b), and, more recently, the interconnection of four repertoires has generated a solution to an even more complex problem in under 4 mins (Epstein, 1985c).

And finally, Epstein (1984b, in press) has offered equations and a computer model, derived from the pigeon studies, which have proved reasonably successful in predicting complex, novel performances in human subjects.

### Limitations

Epstein (1984a) has commented at length on the limitations of the simulation research. First, as is true of all simulations, the Columban simulations do not *prove* hypotheses; they don't necessarily shed light on either human or chimpanzee behavior. It would be folly to assert that a history that is responsible for pigeon behavior is necessarily responsible for comparable behavior in chimpanzees or children. Rather, simulations provide "plausibility proofs." They show merely that some conjecture is *plausible*.

Second, not all of the simulations are equally adequate—that is, they do not all meet all of the criteria that good simulations should meet. The "symbolic communication" study (Epstein, Lanza, & Skinner, 1980), for example, was more a demonstration than a simulation. But the "self-awareness" study (Epstein et al., 1981) lives up to most of the criteria that Epstein (1984a) discusses: The behavioral processes it makes use of are applicable to chimpanzees, the pigeon's behavior in front of the mirror has the right topography and function, and chimpanzees who pass the mirror test have acquired the relevant repertoires before they are given the test (see Epstein, 1984a, pp. 46-47, for further discussion of these points).

## SOME FINAL REFLECTIONS

The behavior that gives life to the daemonic self has a life of its own. Behavior that is controlled by an organism's own body or behavior seems to be orderly and not fundamentally different from behavior that is controlled in other ways. The origins of such behavior—for example, of appropriate responses to one's mirror image—lie in the genetic and environmental histories of the organisms.

The sharp discontinuity said to exist between the higher primates and other animals has not been conclusively shown, and the concept of a self-concept does not shed light on the differences that have been shown. What differences there are among species and individuals can be accounted for in terms of ontogenic histories, sensitivity to environmental events, and species-specific behaviors elicited by specific stimuli. Further investigations will strengthen such accounts. One may wish to conjure up daemons from the behavior an organism engages in before a mirror, but that won't change the facts, and the facts are worth noting.

A daemon, according to the *Oxford English Dictionary*, is "an attendant, ministering, or indwelling spirit . . . an inward monitor or oracle." Some have been unabashed in their promotion of daemonology in this sense. Freud (1905/1961), for example, spoke of "those half-tamed daemons that inhabit the human breast," and his tripartite mind has been justly characterized as "a dark cellar in which a maiden aunt and a sex-crazed monkey are locked in mortal combat, the affair being refereed by a rather nervous bank clerk" (Bannister, 1966, p. 363). An introductory text on information processing (Lindsay & Norman, 1977) has colorful drawings of "feature daemons"—bright-eyed little men who live in one's head, pool their knowledge, and eventually figure out what one is seeing. (Who lives in *their* little heads and makes sense of what *they* are seeing is not specified.) Others have promoted concepts—such as the self-concept—which are less obviously daemonic, in the sense that they lack arms and legs, but which are just as imaginary and troublesome.

As we learn more about how heredity and the environment determine behavior and about how behavior is mediated by the body, we will naturally abandon the myths. Unfortunately, where the daemons rule, the facts may turn up more slowly.

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