

Mirror Self-Image Reactions Before Age Two

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The behavior of 88 children between 3 and 24 months was observed before a mirror, using an objective technique to examine the child's awareness of the image as his own. The results indicate the following age-related sequence of behavior before the mirror: the first prolonged and repeated reaction of an infant to his mirror image is that of a sociable "playmate" from about 6 through 12 months of age. In the second year of life wariness and withdrawal appeared; self-admiring and embarrassed behavior accompanied those avoidance behaviors starting at 14 months, and was shown by 75% of the subjects after 20 months of age. During the last part of the second year of life, from 20 to 24 months of age, 65% of the subjects demonstrated recognition of their mirror images.

Until recently mirror self-recognition and the thereby implied self-concept were believed to be uniquely human. The "first experimental demonstration of a self-concept in a subhuman form" (Gallup, 1970)¹ has shown that chimpanzees are capable of self-recognition and that the use of the mirror does provide an objective technique for determining the presence of a self-concept. Previously, recognition of the mirror self-image has been reported to take place at a wide range of ages in human children: between 6-12 months by Dixon (1957), at 9 months by Darwin (1877), and at 14 months by Preyer (1893). The Merrill-Palmer Scale (Stutsman, 1931) standardization indicates that 67% of 2-year-old children identify themselves in the mirror. However, Gesell and Thompson (1934, p. 241), after studying over 500 children, doubted that any recognition occurred in early childhood. Verbal indications of a stable self-concept do not appear until about 2 years of age with the use of self-reference pronouns or the individual's name.

The purpose of the present study was to observe and compare in a standard situation the reactions of a large number of children to their mirror images during the first 2 years of life in order to determine the age at which the child shows recognition of his mirror image as his own using an objective nonverbal technique. In this technique a spot of rouge placed on the child's nose (on one side close to the cheek) served as a point of reference for evaluating self-recognition in the mirror. The spot

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helped to focus attention on the face, that part of the body which it was desired that the child examine and recognize. Self-recognition was assumed if the child touched the actual spot or used the mirror to examine his nose.

Method

Subjects

Children were solicited through the Well-Baby Clinic of a major urban hospital. All subjects were products of normal pregnancy and birth at the same hospital; the pediatric histories indicated normal development. A total of 88 white subjects between the ages of 3 and 24 months were observed, with 2 males and 2 females at each month of age. Two children were followed longitudinally from 12 through 24 months. Nine additional (nonhospital) subjects were studied to determine reliability. Another 18 children were excluded as subjects: 13 of them cried when put in the playpen; 2 fell out of the cloth chair; 3 were tired or hungry, e.g., one 6-month-old girl fell asleep while looking in the mirror.

The subjects represented a heterogeneous white socioeconomic population. Approximately 2/3 came from middle class backgrounds, and 1/3 from the lower class. Hospital charts of 64 subjects revealed that 30 fathers were employed in semi-skilled or skilled positions, 10 were in the arts or professions, and 2 were students. Another 11 were unskilled; 11 were unemployed.

Apparatus

The apparatus consisted of a playpen, with a mirror attached to one side, and (for children who could sit only with support) a cloth chair. The mirror was 28 cm X 118 cm, narrow enough for a year-old child to hold on to by both sides and high enough for the entire body to be visible.

Procedure

A 5-min preobservation interview allowed the child to become accustomed to the investigator and the strange room. Following this the mother was told that her child would be observed in front of the mirror, and she was asked to remove all his clothes except for his rubber pants or diaper. This enabled observations of all subjects in the same type of dress. Next, the mother was asked to put a spot of rouge on the side of the child's nose.

The observer then said, "I'm going to show you what I'd like you to do with your child." While walking around to the left side of the playpen, the observer continued, "In just a minute I'd like you to come around here with (child's name). When you are

next to the mirror, place him facing the mirror." While speaking the observer demonstrated what the mother was supposed to do. "Then point to his face in the mirror and say: 'See, see, see.'" The observer pointed in the mirror each time she said: "See." The observer continued: "Then point to his face again and ask him, 'Who's that?'" Next, the observer sat down on a small chair at the left corner of the playpen, to the rear of the mirror, and said: "Then you sit in this chair, and please do not pay much attention to him. You can look at him, and smile at him if he's smiling at you, but please don't draw his attention to you in any way." The observer was seated about 2 m behind and to the right of the child. Her image could be seen by the subject if he looked at the right side of the mirror. If the child turned around he could see the observer seated behind him.

Each observation was timed from the moment that the subject was placed in front of the mirror. After 2 1/2 min, the mother was asked to say "See," again 3 times, and ask, "Who's that?" This was repeated a third time after another 2 1/2 min elapsed. Each subject was given 3 trials before the mirror. If the subject cried for more than about 30 sec, his mother was asked to pick him up and hold him until it was time for the next trial when he was again placed before the mirror.

Recording Responses

The observer recorded the subject's responses to the mirror as they occurred. If the subject was smiling at, or became interested in the observer, the latter smiled pleasantly for a moment and looked away from the child to discourage further interest and interaction. After the subject left, following a brief interview, the mirror behavior checklist (see Table 1) was completed using the earlier recorded detailed observations.

Reliability

Reliability data were obtained on a total of 16 subjects. Seven of these were part of the original sample of 88 subjects studied at New York Hospital; 9 additional subjects were observed in their homes in the suburban Boston area. All were seen by the investigator and the second observer. Nine subjects were in the 5 to 11 month range and 7 subjects in the 16 to 21 month range.

Three different reliability calculations all yielded satisfactory scores. (1) Item agreement was 82% when calculated by the formula: number of agreements in categories scored/subject/number of items in categories scored/subject. In this formula a portion of the agreement on nonoccurrence of events was included, by using all agreements, whether positive (for occurrence) or negative (for nonoccurrence), in those categories applied at least once to each subject. (2) Item agreement was 71% when calculated by the formula: number of positive agreements/number of positive agreements and disagreements, i.e., when agreement on nonoccurrence was omitted. (3) A further reliability check was provided by calculating percentage of agreement for

Table 1. Number of Subjects (out of 88) Performing Items of the Mirror Behavior Checklist.

Category & Item	No.	Category & Item	No.
Little or No Interest	0	Searching Behavior	
does not look	0	reaches into mirror	12
glances briefly	1	looks behind mirror	20
stares blankly	1	looks and reaches	
focuses on mother	70	behind mirror	5
focuses on 0 or 0 image	58	Puzzled Behavior	
glances at mirror frame	0	puzzled or quizzical expression	7
Social Behavior		touches experimentally	13
smiles, laughs	67	Avoidance Reaction	
vocalized pleasantly	44	cries	31
kisses, etc.	19	hides or withdraws	46
playfully touches	41	Admires Image	
Comparison Behavior		struts vainly	2
focuses on) & 0 image	29	glances coyly	16
focuses on object & its image	1	blushes	0
Observes Own Manipulation		preens	1
observes own image as he moves body or part of it	46	appears to admire	7
Self-comparative Behavior		clowns	8
alternately looks at body part & its image	3	embarrassed (added)	12
alternately looks as he moves body part	0	Observes Nose	
		turns head	3
		touches dot	9
		Recognition	
		says name	3
		points to self	2

those items of behavior on the mirror behavior checklist displayed by 8 or more subjects. There were 8 such items. Agreement ranged from 70% to 100%.

Mirror Behavior Checklist

The mirror behavior checklist (see Table 1) was constructed on the basis of a pilot study and reports of other observers. It includes categories that were meant to be used as a tentative outline of the developmental phases of mirror behavior; the categories are arranged in the order of the expected chronological and sequential appearance of the particular behavior. Definitions of categories and items, hypotheses and related predictions regarding mirror behavior, plus detailed and longitudinal observations may be found in Amsterdam (1968).

Results

Specific types of mirror behavior vary with age during the first 2 years of life. The number of subjects displaying these behaviors varies greatly. Table 1 presents the

general form of the mirror behavior checklist and the number of subjects performing each item. This checklist outlines the main types of mirror behavior as they were expected to occur chronologically.

Table 2 presents comparisons between the most frequent types of behavior according to broad age divisions, with 12 subjects in each age group, except for the oldest group which has 16 subjects. Since these age divisions are arbitrary and there are still relatively few subjects at each age level, the results in this table are approximate indices for mirror behavior. Table 2 reveals that each category shows a maximum period of occurrence with the peak incidences at higher ages in the successive categories. The peak percentage of sociable "playmate" behavior is at 6 to 8 months, and it steadily declines after this period to no sociable behavior by 18 months.

Although observation of imaged movement started at 3 months, and was present in a majority of subjects earlier than sociable behavior, it did not reach its peak until 9 to 11 months, after which it too declined. The maximum percentage of subjects engaging in searching was at 12 to 14 months. Withdrawal from the mirror, the dominant second year behavior, was present in 100% of the subjects at 18 to 20 months. Self-admiring and embarrassed behavior reached a maximum in the oldest group of subjects (21-24 months). Recognition of the image also was at a maximum in the oldest group of subjects.

Discussion

The results of this study point to 3 distinct phases in the child's reaction to his mirror image. (1) The first prolonged and repeated reaction of an infant to his image is

Table 2. Number of Subjects Showing Behaviors between 3 and 24 Months

Age mos.	Sociable "playmate"	Observes Movement	Search for Image	Withdraws	Self-Admire/ Embarrassed	Recognition
3-5 (N = 12)	2 17%	7 58%	0 0%	0 0%	0 0%	0 0%
6-8 (N = 12)	11 92%	7 58%	3 25%	0 0%	0 0%	0 0%
9-11 (N = 12)	9 75%	8 66%	5 42%	2 17%	0 0%	0 0%
12-14 (N = 12)	7 58%	6 50%	10 83%	8 66%	1 8%	0 0%
15-17 (N = 12)	2 17%	3 25%	2 17%	9 75%	5 42%	0 0%
18-20 (N = 12)	0 0%	0 0%	0 0%	12 100%	7 58%	5 42%
21-24 (N = 16)	0 0%	0 0%	0 0%	15 94%	11 69%	10 63%

that of a sociable “playmate” when smiling and vocalizations are made with expressions of delight and enthusiasm with a playful approach to the “other child”. This occurred in over 85% of the subjects from 6 through 12 months of age. (2) In the second year of life children no longer respond to the mirror with naive joy, but they become wary and withdraw from it, although some still intermittently smile or vocalize at the image. Between 13 and 24 months of age 90% of the subjects withdrew from the mirror. Other ongoing behavior during this period included searching for the image, and some subjects displayed signs of embarrassment and self-admiration. 75% of the subjects displayed this behavior after 20 months. (3) Finally, between 20 and 24 months of age 65% of the subjects showed recognition of their images.

Dixon considers the infant’s observation of imaged movement as evidence that the subject is “attempting to relate the mirror image to himself” (1957, p. 253), and establishing the identity of the image. He labels this stage: “Who dat who do dat when I do dat?” This particular hypothesis seems untenable, since as Dixon shows, the child treats his image as a “playmate” throughout this period, and also during this time he engages in an intensive search for his image, indicating that he is perceiving it as another child. Dixon’s inference of self-recognition at this time may be due to the changing quality of observation of movement as the child acquires the ability for visually directed reaching which gives a new purposiveness to his behavior as shown by White, Castle, and Held (1964).

Curiosity about the nature of the image, which becomes the outstanding behavior at about 1 year when the child is no longer preoccupied with playing with his image, also contraindicates self-recognition. At this time the child interrupts his play to search behind the mirror, or attempts to climb through or over it, to find his image. Determined searching indicates that the child has become curious about either the nature of the mirror, or the presence of the image, or both, and can no longer accept the image naively as another child. This behavior is concentrated between 7 and 14 months, during the transition period when sociable behavior diminishes and is finally supplanted by avoidance and self-consciousness (i.e., embarrassed and coy behavior).

Apprehension and refusal to look in the mirror occur after the age at which subjects search for their images. (This pattern was evident in both subjects followed longitudinally.) While the subject is treating his image as a “playmate” he is not wary of the mirror. Withdrawal from the mirror was a consistent pattern in most subjects during the second year, beginning at 11 months, and present in over 2/3 of the subjects from 13 months on; this agrees with the findings of Dixon (1957) and also Preyer (1893) who did not have the additional noxious stimulus of a playpen. The transition from the first year’s predominant sociable response could be seen in the 12-14 month old child’s mixed pattern of sociable behavior, observation of movement, searching, and avoidance of the mirror. By 17 months every subject except one avoided looking in the mirror at some point, and this later avoidance was mostly associated with self-consciousness and/or recognition of the image. Although 31 of the 88 subjects cried or whimpered while in the playpen, only 3 cried in unmistakable fear

of the mirror. Four subjects under 11 months appeared to cry because of hunger or tiredness. Of the remaining 27 subjects, 14 were male and 13 female, and the situational context in which they cried revealed the following: (a) 4 subjects between 15 and 21 months of age reacted initially with crying but were retained in the study because they did not respond with initial crying on all three trials; (b) 2 subjects cried upon separation from their mothers; (c) 18 subjects, between 11 and 24 months, (with 15 of these subjects over 17 months) cried while trying to leave the playpen by attempting to climb over the side, or reaching out to be picked up by their mothers. This reaction usually occurred after the subject had been engaged in searching, or displaying self-consciousness or recognition, and their crying may have been related in some way to these other activities. However, these subjects may have only been reacting to the forced separation from their mother as seen in the studies by Morgan and Ricciuti (1969) and Rheingold (1969). In some cases the children seemed bored with the playpen and mirror after several minutes.

Reports of admiring the self-image by various investigators indicate overlapping ages. Self-consciousness was observed by Dixon (1957) from 12 through 18 months when he ended his study, Preyer (1893) noted it at 69 weeks and the present investigator first saw it at 14 months, but only after 20 months did it become apparent in 2/3 of the subjects. Self-consciousness is used here to denote those behaviors showing embarrassment or some form of self-admiration (see *Admires Image* category, Table 1).

Self-admiring behavior tended to be brief, like an adult's, suggesting that the child was using the mirror to observe and admire himself in the style of adults, implying that recognition is present with this type of behavior. Nevertheless, there are 2 main objections against using self-conscious behavior as evidence that the child is aware that he is looking at himself. These objections are: (a) the child may be imitating the admiring behavior which he has observed in others, or (b) he may be responding self-consciously to the presence of others, i.e., the image which he believes to be another child, or the adults in the room. Another major complicating factor in the present study with children in the second year of life is the presence of the observer, and possibly also the mother. In order to eliminate the complicating and potentially inhibiting effects of others on the child's behavior, the subjects should be observed from behind a one-way vision screen. The main difficulty would be the fear aroused by leaving a child alone at this age as shown in the work of Rheingold (1969).

Recognition of one's own presence in the mirror is established between 20-24 months according to the technique used in the present study. However, there is considerable controversy regarding what behavior indicates self-recognition. Dixon (1957) infers self-recognition between 6 and 12 months if the child looks at both his mirror image and corresponding body part, and appears either perplexed or delighted while deliberately controlling the movements. Darwin (1877) believed that his son associated his own name with the image before 9 months of age because when called by name the child turned to the mirror and exclaimed "Ah." Preyer (1893) concluded

that his son could distinguish his own image at 14 months because he could recognize his mother's image. The Merrill-Palmer Scale relies on the child's verbal ability or chance nonverbal behavior to recognize his image at 2 years of age. Gesell and Thompson (1934) doubted that the child recognized his image during the first 2 years of life. In the present study, unlike previous ones with human subjects, an empirical method is utilized to determine the age of self-recognition. The subject is presented with a unique problem, which it is unlikely he has previously encountered, testing his reaction to an alteration of his image. Two subjects at 14 months of age seemed to have some awareness of the dot on their nose; one subject fingered his nose, but on the side opposite the dot; the other touched her face. It seemed that these 2 subjects had some concern about their faces, but they did not clearly show self-recognition by locating the rouge spot as did the older subjects. A total of 13 subjects (54%) showed recognition of their mirror images between 18 and 24 months. This included only one 18- and one 19-month-old child. After 20 months, recognition was a well established behavior in two-thirds of the subjects.

The above conclusions rest on (1) the assumption that the child's ability to locate a red spot on the face shows that he associates his own face with the face in the mirror, and (2) the inference that this behavior indicates self-recognition. This need not necessarily be the case. The only established fact is that the child in some way associates his own face with the face in the mirror after 18 months. It is possible, but highly unlikely, that he may behave similarly if another child who also had a red spot on his nose appeared before him, or if placed before the mirror without a red spot on his nose. Gallup's (1970) controlled observations of chimpanzees before and after red dye was put on their faces disproves this criticism.

In support of the hypothesis that the child has some awareness that he is looking at his own image is the evidence provided by the embarrassed self-consciousness and avoidance behaviors associated with locating the red spot and the verbal self-recognition response. Every subject who showed recognition behavior also manifested either avoidance or self-consciousness, or all three. Recognition inevitably appears as one element in a complex pattern of behavior which starts in the second year when some subjects begin avoiding the mirror after their search for the image results in failure. Possibly, the repetition of such disappointing and frightening experiences explains why children avoid mirrors. However, this would not explain why they become self-admiring, and/or embarrassed when placed in front of the mirror after 14 months, and continue to show this behavior after they become interested in using the image to examine their faces after 18 months.

Notes

¹ The current study was not derived from Dr. Gallup's work, but was done prior to or during the same period. The data reported here were collected between 1963 and 1966 in the Department of Pediatrics, Cornell Medical College-New York Hospital when the author was assistant clinical psychologist.

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