Mirror-image reinforcement in monkeys¹

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Using a successive discrimination task, 4 pigtailed monkeys, 1 Japanese macaque, and 1 rhesus monkey were given 54 separate 60-sec. opportunities to open an instrumental door on a random 50% schedule of mirror-image reinforcement. Although no evidence of discrimination learning was found, the reinforcing value of the mirror was demonstrated by measures of total duration of all responses on each trial and average duration of each response which showed significant differences in favor of trials accompanied by mirror exposure.

Numerous Es have sought to demonstrate the existence of different external sources of motivation. Various forms of visual stimulation, for example, have been shown to serve as effective reinforcers in primates (e.g., Butler, 1954, 1957, 1961). Since visual access to other monkeys has typically proved to be a more effective reinforcer than electric trains, food, dogs, etc. (Butler, 1954, 1958), one might also expect the opportunity to gain access to a mirror to possess reinforcing properties.

Previous studies involving mirror-image stimulation permit no assessment of the reinforcing value of a mirror (e.g., Brown, McDowell, & Robinson, 1965; MacLean, 1964; Tinkelpaugh, 1928) since the Ss were not instrumental in obtaining self-image stimulation, and no means of assessing the motivational properties of the mirror were employed. The purpose of the following study was to make exposure to a mirror contingent upon a simple door-opening response in monkeys.

Method

The Ss consisted of one male and three female pigtailed monkeys (*Macaca nemestrina*), one male Japanese macaque (*Macaca fuscata*), and one male rhesus monkey (*Macaca mulatta*). All Ss were prepubescent and experimentally naive. At the time of testing, the animals were housed in the Primate Research Center at Washington State University.

The apparatus consisted of a wooden box which could be secured over the door of a metal monkey cage. Inside the box were a guillotine door, an instrumental door attached to a low tension spring, a second guillotine door, and a 10-1/2 by 11-5/8 in. mirror, in that order. Each trial began with the raising of the first guillotine door which activated a timer and gave the S access to the instrumental door. When S opened the instrumental door to a 20-degree angle or more, this timer was stopped and a second timer was initiated. The second timer remained activated as long as the door was held open. Access to the instrumental door was terminated after 60 sec. by lowering the first guillotine door, and an intertrial interval of 270 sec. was employed. All Ss were run successively at the rate of one every 11 days.

Testing was begun following 23 hr. of adaptation to the new cage and room. After being exposed to the mirror for 30 sec. on Day 2, S was given two reinforced trials both of which were terminated after the door had been opened and closed only once. On Days 3-11 a response to the instrumental door permitted access to the mirror on a random 50% of the trials and to the second guillotine door on the other 50%. Opportunity for mirror exposure was made contingent upon the brightness of the first guillotine door (black or white randomized between Ss). Four trials were given on Day 3 and six trials on Days 4-11. Measures of latency, number of responses, and total duration of all responses were obtained for each trial.

Results and Discussion

Data for each of the dependent variables were analyzed by three-dimensional (trials by treatments by Ss) analyses of variance. Analysis of speed scores (1/latency) showed no evidence of discrimination learning between the two reinforcement conditions, with a mean of .50 for mirror-image trials and .44 for nonmirror-image trials. However, asymptotic levels of responding, in terms of speed scores, were achieved in only three trials. To circumvent the possibility that reinforcement arising from manipulation of the instrumental door might have partially obscured the reinforcing value of the mirror, a simultaneous discrimination between two instrumental doors would probably have been more appropriate for showing behavioral differences between the two conditions.

The mean number of responses was 1.70 for reinforced trials and 2.89 for nonreinforced trials, a difference which did not attain statistical significance. For measures of the total duration of responses over each trial the differences between the mirror versus non-mirror conditions proved to be significant at the .05 level ($F = 8.10$, $df = 1/4$), with a mean of 42.85 for reinforced trials and 29.22 for nonreinforced trials. A measure of average duration per response was contrived by dividing the total duration for each trial by the total number of responses for that trial for each S individually. The average duration per response also proved to be significant between reinforced and nonreinforced trials ($F = 12.13$, $df = 1/4$, $p < .05$) with means of 30.17 and 12.27 respectively. Thus mirror-image stimulation appeared to possess reinforcing properties over and above the inherent manipulatory components in this situation.

The opportunity for receiving self-image reinforcement would seem to fulfill most of the basic requirements of a good external incentive as formulated by Fiske & Maddi (1961). The element of stimulus change

is certainly implicit in a mirror situation. Moreover, a mirror is particularly unique in that not only are all responses instantly replicated or mimicked by the mirror image, but the S has control over and is instrumental in producing stimulus change having once been exposed to the mirror. In terms of assessing the relative contribution of stimulus change to the incentive value of various external sources of motivation, changes in a mirror image might be expected to reinforce responsiveness on the part of a monkey and thus maintain stimulus change at a high level.

No data, however, were obtained for the Japanese macaque. This S's response to the mirror condition was more one of avoidance than approach, and he tried persistently to *close* the instrumental door when it was opened by the E. It may be important to note that since shortly after birth this monkey had been raised only among pigtailed monkeys; therefore its own image in the mirror may not have been comparable with the images available to other Ss who had been raised among their own species. These results provide some interesting but certainly only suggestive implications for the Japanese macaque's "self concept," or for that matter the self concept of any monkey who is raised with a different species. In other words, social interaction among monkeys may play a role in the formation of

such a concept. For example, one could raise infant monkeys with a cage mate of the same or a different species and subsequently compare their differential responsiveness to a mirror situation.

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Note

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