



---

Social Recovery by Isolation-Reared Monkeys

Author(s): Harry F. Harlow and Stephen J. Suomi

Source: *Proceedings of the National Academy of Sciences of the United States of America*, Vol. 68, No. 7 (Jul., 1971), pp. 1534-1538

Published by: National Academy of Sciences

Stable URL: <http://www.jstor.org/stable/60735>

Accessed: 18/03/2010 20:44

---

Your use of the JSTOR archive indicates your acceptance of JSTOR's Terms and Conditions of Use, available at <http://www.jstor.org/page/info/about/policies/terms.jsp>. JSTOR's Terms and Conditions of Use provides, in part, that unless you have obtained prior permission, you may not download an entire issue of a journal or multiple copies of articles, and you may use content in the JSTOR archive only for your personal, non-commercial use.

Please contact the publisher regarding any further use of this work. Publisher contact information may be obtained at <http://www.jstor.org/action/showPublisher?publisherCode=nas>.

Each copy of any part of a JSTOR transmission must contain the same copyright notice that appears on the screen or printed page of such transmission.

JSTOR is a not-for-profit service that helps scholars, researchers, and students discover, use, and build upon a wide range of content in a trusted digital archive. We use information technology and tools to increase productivity and facilitate new forms of scholarship. For more information about JSTOR, please contact [support@jstor.org](mailto:support@jstor.org).



National Academy of Sciences is collaborating with JSTOR to digitize, preserve and extend access to *Proceedings of the National Academy of Sciences of the United States of America*.

<http://www.jstor.org>

## Social Recovery by Isolation-Reared Monkeys

HARRY F. HARLOW AND STEPHEN J. SUOMI

Primate Laboratory and Regional Primate Research Center, University of Wisconsin,  
Madison, Wis. 53706

Contributed by Harry F. Harlow, April 30, 1971

**ABSTRACT** Total social isolation of macaque monkeys for at least the first 6 months of life consistently produces severe deficits in virtually every aspect of social behavior. Experiments designed to rehabilitate monkeys reared in isolation are described. While young isolates exposed to equal-age normal peers achieved only limited recovery of simple social responses, some mothers reared in isolation eventually exhibited acceptable maternal behavior when forced to accept infant contact over a period of months, but showed no further recovery; isolate infants exposed to surrogates were able to develop crude interactive patterns among themselves. In contrast to the above results, 6-month-old social isolates exposed to 3-month-old normal monkeys achieved essentially complete social recovery for all situations tested. It is postulated that social stimulation that both permits subjects to achieve contact acceptability and provides an interactive medium conducive to gradual development of sophisticated social behaviors will result in almost complete recovery of social capabilities previously obliterated by rearing in isolation.

Social isolation has long been identified as a powerful precipitating agent in disruption of normal social development in human beings. While ethical considerations and practical constraints have obviously restricted controlled scientific study of isolation with human subjects, it has been possible to systematically investigate the effects of total social deprivation upon closely related, nonhuman, primate species. The unequivocal finding of numerous researches on macaque monkeys has been that total social isolation for at least the first 6 months of life enormously damages or destroys subsequent social and sexual behavioral capabilities (1-3). Monkeys so reared were grossly incompetent in interactions with socially normal age-mates. As infants and adolescents, they failed to initiate or reciprocate the play and grooming behaviors characteristic of their peers. As adults, these monkeys consistently exhibited abnormal sexual, aggressive, and maternal behaviors.

It is clear that early social deprivation is an enormously effective procedure for the production of psychopathological behavior patterns. Less well known is the degree to which social behaviors can be recovered after early social isolation. The data that follow indicate that social deprivation early in life does not necessarily produce irreversible behavioral deficits, and that rehabilitation of varying extent can be effected via judiciously chosen experimental procedures.

Several pairs of rhesus monkeys reared for the first 6 months of life in total social isolation chambers (4) were tested on a daily basis in a social playroom (4) with pairs of socially competent age-mates. In comparison to the normal stimulus animals, the isolates were clearly inferior on virtually every behavioral measure throughout the 8-month testing period.

They showed less object exploration, social approach, social contact initiation, social threatening, and play, while exhibiting high levels of disturbance activity and rigid and passive posturing (G. L. Rowland, unpublished doctoral dissertation, University of Wisconsin, 1964). Frequently, the isolates were targets of unprovoked aggression by the control peers. However, in terms of responses directed toward each other and not toward the control monkeys, the isolates showed limited recovery over the testing period.

From the fifth to the eighth month of testing, the frequency of play behavior between the isolate pairs usually increased from a zero-baseline to fairly respectable levels. Although this was clearly delayed and unsophisticated play by monkey standards, a little late-play is better than none. Inanimate object manipulation, which may be taken as a rough index of curiosity and exploratory tendencies, showed an even higher level of restitution (Fig. 1). Threat was another social response that developed between pairs of isolate monkeys, even though its exhibition was extremely delayed and limited. The threat response, which is a communicatory mechanism, was judiciously expressed toward other isolates but was not directed toward the normal controls. These data suggested that monkeys subjected to total social isolation for a half-year period possessed latent potential for limited social recovery immediately after incarceration, even in the presence of aggressive normal peers. Monkeys reared in total social isolation for the first year of life showed no such recovery when tested under similar conditions (G. L. Rowland, unpublished experiments).

Social recovery of a different form was exhibited by another group of monkeys subjected to early social isolation. These were females who had reached sexual maturity but were apathetic or adamantly uncooperative when confronted with breeding-stock males that were sexually eager and

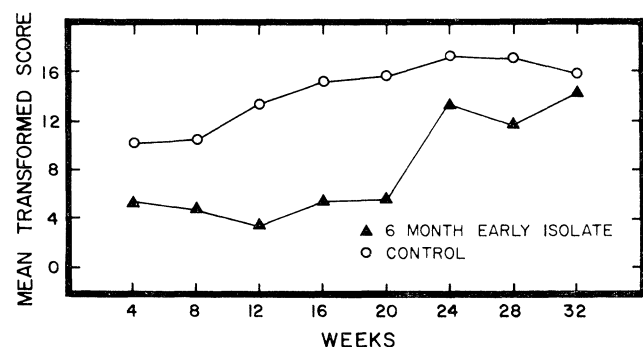


Fig. 1. Inanimate-object manipulation by 6-month isolates.



FIG. 2. Motherless mother abusing her infant.

adroit. By methods dark, dismal, and devious we impregnated several of these reluctant females over a period of years. We have called them "motherless mothers," since they never experienced mother love, nor any other kind of monkey affection, themselves. Most of the motherless mothers either completely ignored or abused their initial offspring (Fig. 2). However, unless the mothers actually killed their infants—and several did—the babies struggled for maternal contact day after day, week after week, month after month. The infants would cling to the mothers' backs, continually attempting to achieve ventral and breast contact despite efforts by the mothers to displace them. To our surprise, maternal brutality and indifference gradually decreased. From the fourth month onward, the persistent babies that were finally able to attain intimate physical contact with their mothers were actually punished less and permitted nipple contact more than offspring of normal mothers.

Many of the motherless mothers have had second and even third babies. Those whose maternal feelings were eventually released by the persistent and determined body contact and nursing efforts of their first infants proved to be adequate or good mothers to their subsequent babies. Most of the motherless mothers that had abused or ignored their first infants throughout a predetermined 6-month postpartum period continued to be inadequate, brutal, or lethal mothers to subsequent progeny.

It seems that in the case of the adequate mothers, the babies inadvertently served as psychotherapists to their indifferent mothers and that these mothers spontaneously transferred maternal feelings induced by their first babies to their feelings for subsequent babies. The data on the rehabilitated mothers suggested that infants possess some

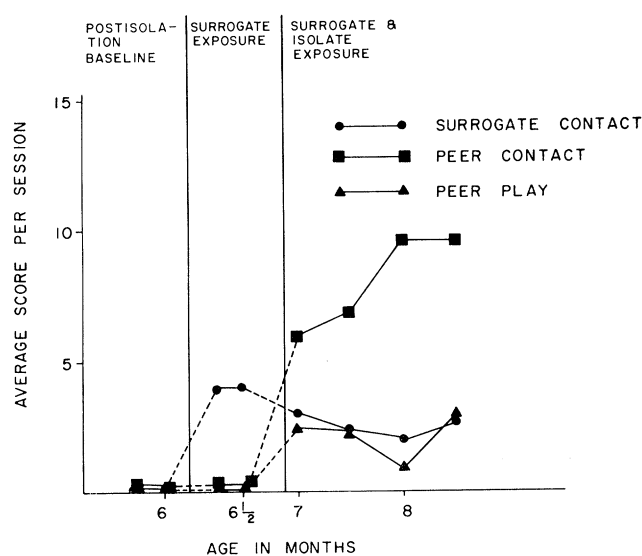


FIG. 3. Social behaviors of isolates housed with surrogates.

specific abilities as behavioral therapists for abnormal adult females. However, rehabilitation was limited to maternal behavior and, in particular, those mothers continued to exhibit inappropriate and ineffective sexual behavior.

The rehabilitative potential of social contact was further illustrated in a third study. Four 6-month isolate monkeys were individually housed for 2 weeks after removal from the isolation chambers. Heated cloth surrogates were then introduced into their home cages. Within a few days the isolates began to contact the surrogates with increasing frequency and

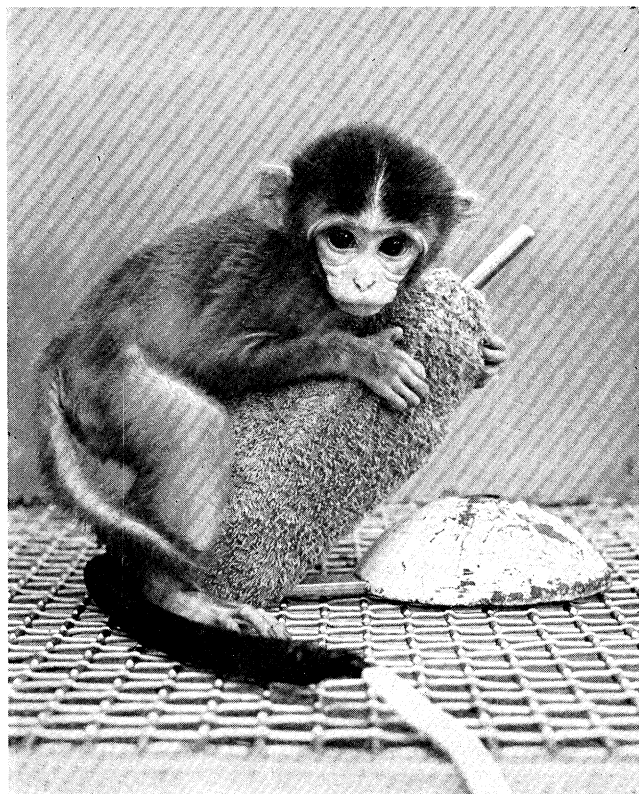
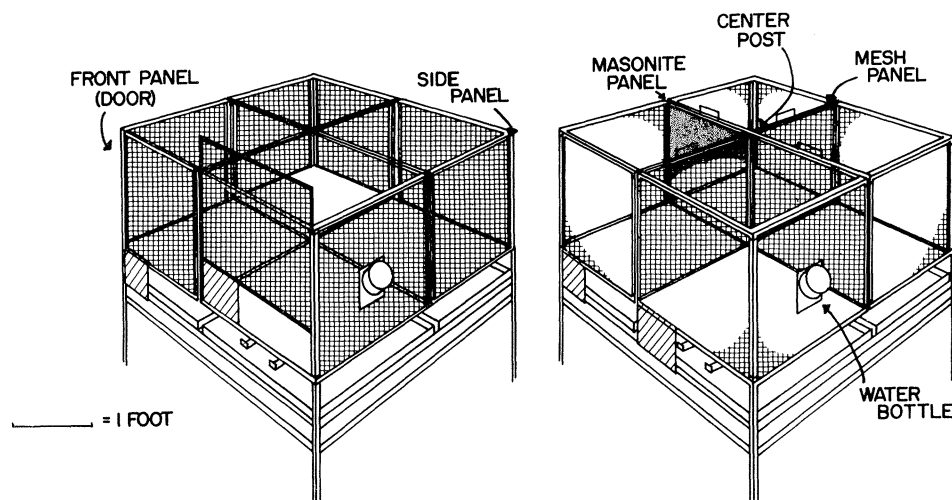


FIG. 4. Monkey clinging to simplified surrogate.



COMBINED LIVING EXPERIMENTAL  
CAGE

FIG. 5. The quad cage apparatus.

duration. Correspondingly, the incidence of disturbance behavior exhibited by the isolates showed a significant decrease from presurrogate levels. After 2 weeks of individual surrogate exposure, the isolates were housed in pairs. In this situation they almost spontaneously exhibited social play, infantile sex, locomotion, and exploratory behavior (Fig. 3), but the social behavior was clumsy and the isolates continued to display sporadic disturbance activity. After 6 months they had shown no marked improvement.

We have long emphasized that the mother figure is a basic socializing agent, since it gives to its own infant social contact acceptability, essential to any subsequent social interaction—and basic security and trust. In this case surrogate mothers appeared to provide a certain degree of contact acceptability and security and trust sufficient for the isolates to suppress

existing self-directed disturbance activity and to initiate crude social interactions with other isolates. However, since the inanimate surrogates could provide no further social stimulation, recovery failed to progress beyond the above stage.

The above researches all used social agents as a means for rehabilitation, and to a limited extent recovery of some form was achieved. Experiments designed to rehabilitate isolates via nonsocial means, e.g., exposure to slides during isolation (C. L. Pratt, unpublished doctoral dissertation, University of Wisconsin, 1969), gradual introduction into the postisolation test environment (5), or aversive conditioning procedures (6) have been less successful. It is intuitively compelling to argue that the strategy most likely to succeed in rehabilitation of monkeys exhibiting social deficits should occur after stimulation of a social, rather than nonsocial, form. It may also be argued that the social stimulation utilized in the above studies was far less than optimal.

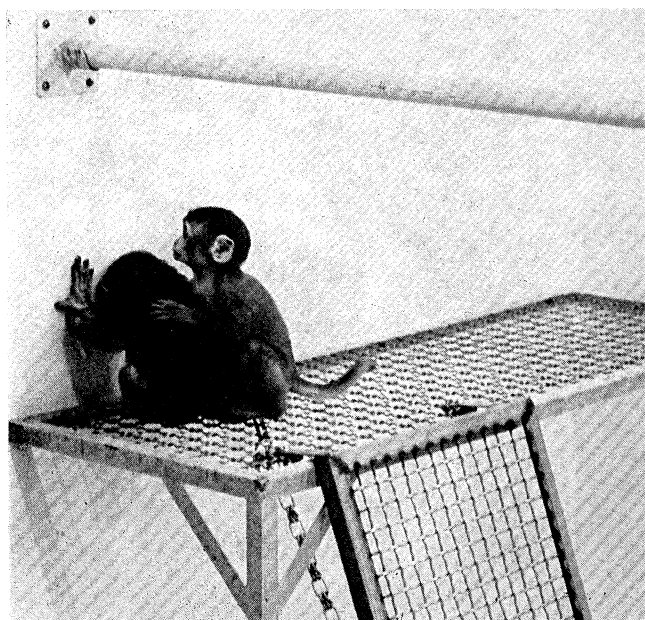


FIG. 6. Therapist clinging to huddling isolate.

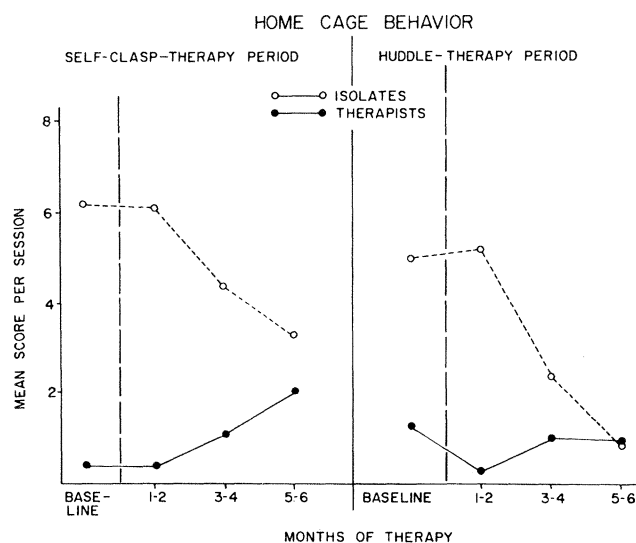


FIG. 7. Self-clasping and huddling behaviors: therapy period.

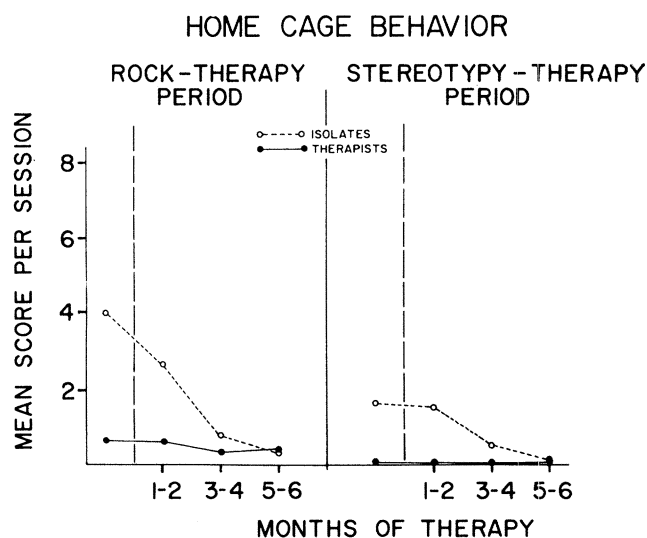


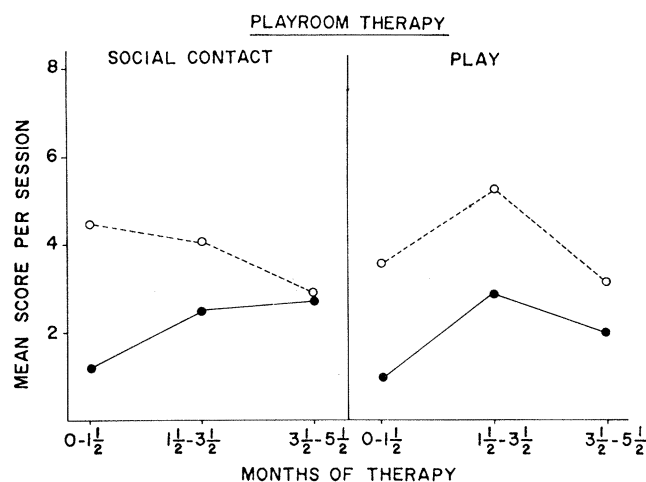
FIG. 8. Rock and stereotypy behaviors: therapy period.

In the first experiments, normal age-mates may well have provided the isolate subjects with complex social stimulation, but they certainly did not provide social contact acceptability. Rather, they aggressed against the isolates, and not surprisingly, isolate recovery in this context was limited at best. In the case of the motherless mothers and their persistent infants, the babies provided their mothers with contact acceptability but little else. Here, although relatively normal maternal behavior was recovered, other aspects of monkey social activity were not. Likewise, surrogates provided isolates with contact acceptability, but for further social stimulation the isolates had only each other. They exhibited recovery of only the most unsophisticated social responses.

A better monkey "therapist" would be one that could provide contact acceptability without aggression, as well as more sophisticated social capabilities. Years of research in which we investigated the normal social development of rhesus monkeys has indicated that a normally developing infant of 3-4 months of age fits these requirements almost perfectly. Therefore, we designed a study employing this type of monkey therapist.

Our therapists were four female rhesus infants that had been separated from their mothers at birth, but were raised in our nursery for 30 days and then housed with simplified surrogates (Fig. 4) in quad cage quadrants (Fig. 5). Furthermore, the therapist monkeys interacted 2 hr a day in groups of two and four, in either a double quad cage quadrant or in the standard playroom. Such rearing permitted relatively normal social development (7) (L. A. Rosenblum, unpublished doctoral dissertation, University of Wisconsin, 1961).

When four subjects raised from birth in total social isolation were 6 months of age and the therapists were 3 months of age, all eight monkeys were housed in individual quadrants of two quad cages. After a 2-week baseline period, each isolate was allowed to interact with its neighboring therapist in the quad cage 2 hr a day, 3 days per week, for a period of 1 month. The therapist monkeys also continued playroom interaction as a group of four. Subsequently, pairs of isolates were allowed to interact with pairs of therapists in the playroom. During the next 20 weeks, the number of quad cage social

FIG. 9. Social contact and play behaviors: therapy period isolates ( $n = 4$ ),  $\bullet$ ; therapists ( $n = 4$ ),  $\circ$ .

sessions was decreased and the number of playroom sessions involving two therapists and two isolates was progressively increased.

The isolates' initial responses to the therapy sessions were to huddle in a corner, and the therapists' first responses were to approach and cling to the isolates (Fig. 6). Within a week in the quad cages and a month in the playroom, the isolates were reciprocating the clinging. Concurrently, the therapists were developing play patterns of increasing sophistication among themselves and attempting to initiate such patterns with the isolates. Within 2 weeks in the quad cages and a month in the playroom, the isolates were reciprocating these behaviors.

By 1 year of age, the isolates were scarcely distinguishable from the normal therapists in terms of frequencies of exploratory, locomotive, and play behaviors, an unprecedented reversal of the isolation syndrome. The decline of self-clasping and huddling, illustrated in Fig. 7, demonstrated a dramatic cumulative recovery from these infantile or depressed be-

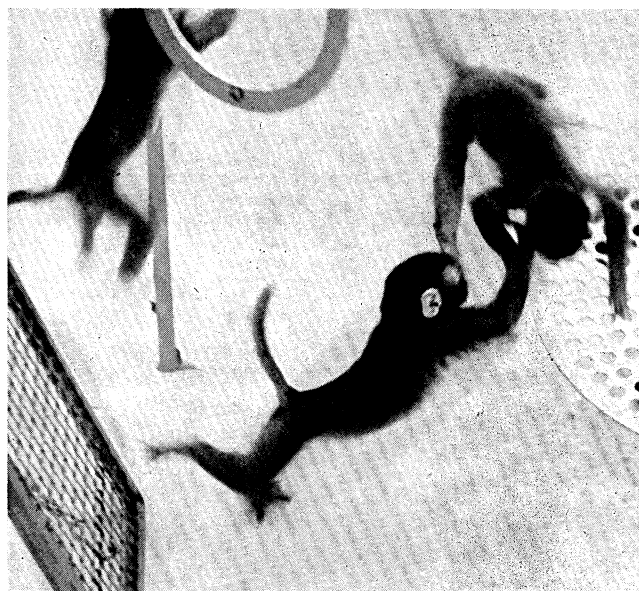


FIG. 10. Mutual interactive play by isolates and therapists.

haviors throughout the therapy period and a return to normal or near-normal levels by the end of 6 months. An interesting fact is that the therapists showed a modest increase in the self-clasp response, possibly learned from the isolates, even though their basic social behaviors did not deteriorate.

Even more dramatic was the precipitous decline in the more mature abnormal responses of rock and stereotypy (Fig. 8). By the fourth month of therapy, rock and stereotypy were at near-normal levels, and by the sixth month there were no differences—at least no differences between the deprived and therapist monkeys in absolute frequencies of these responses.

No doubt the most critical and valid measures of social recovery were those of social contact and play. Essentially complete recovery of both of these behavior patterns was attained by the isolates when they were tested with the therapist monkeys in the quad cage. In the larger and stranger playroom area there was eventually complete recovery of social contact and very satisfactory recovery of social play, as shown in Fig. 9. Mutual interactive play by isolate and therapist monkeys is illustrated in Fig. 10.

Because of limited animal availability, it was not possible to sex-balance both groups. All of the isolate monkeys were male and all of the therapist monkeys were female. We have long known that male and female monkeys play in fundamentally different patterns (8). Male play is typically rough-and-tumble in form, where the monkeys wrestle, roll, and sham-bite but seldom injure one another. Females are much more likely to engage in noncontact, approach-withdrawal play, which involves chasing back and forth with frequent role reversal and a minimum of bodily contact. Since our female therapist monkeys played only female games, they could not have trained the socially deprived males in the ecstasies and elegancies of masculine play. However, in the final playroom sessions, the males clearly exhibited a predominance of age-appropriate masculine play. Thus, the isolate males could not have developed their play patterns on the basis of imitation of the female therapist monkeys alone. Rather, it appears that the psychiatric sessions gradually imparted to the males the full grandiose gifts of masculinity, which the males in turn expressed in their play bouts.

The earlier data presented in this paper made it obvious that monkeys socially damaged by isolation early in life

may attain very limited recovery of behavioral functions if they are allowed to interact for long periods of time with a group of equally socially blighted monkey subjects. The data also strongly indicate that the most elementary social behaviors are the easiest to elicit in the recovery process, while exhibition of more complex behaviors by social isolates requires longer and more delicate procedures.

The present data suggest that therapist monkeys must be selected in such a manner as to present no threat to abnormal monkeys and that socialization is probably achieved in large part, but not entirely, through imitative learning as the younger animals enter and pass through subsequent socialization stages. Obviously many problems are left unresolved by the present study, such as the maximal age at which the isolates can be rehabilitated and the depths of depression that are minimal to socialization. Likewise, the maximal effectiveness of different therapeutic conditions is left unspecified. For example, should therapy begin with the formation or re-formation of maternal bonds antecedent to peer associations, or should this be preceded by environmental adaptation? The present research has indicated that social rehabilitation of isolate-reared monkeys *can* be attained. It is the task of further research to disclose better means to achieve this end.

This research was supported by USPHS grants MH-11894 and RR-00167 from the National Institutes of Health to the University of Wisconsin Primate Laboratory and Regional Primate Research Center, respectively.

1. Harlow, H. F., G. L. Rowland, and G. A. Griffin, *Psychiat. Res. Rep.*, **19**, 116 (1964).
2. Harlow, H. F., R. O. Dodsworth, and M. K. Harlow, *Proc. Nat. Acad. Sci. USA*, **54**, 90 (1965).
3. Mitchell, G. D., E. J. Raymond, G. C. Ruppenthal, and H. F. Harlow, *Psychol. Rep.*, **18**, 567 (1966).
4. Harlow, H. F., and M. K. Harlow, *Bull. Menninger Clin.*, **26**, 213 (1962).
5. Mitchell, G. D., and D. L. Clark, *J. Genet. Psychol.*, **113**, 117 (1968).
6. Sackett, G. P., in *The Role of Learning in Psychotherapy*, ed. R. Porter (J. A. Churchill, Ltd., London, 1968), pp. 3–25.
7. Hansen, E. W., *Behaviour*, **27**, 107 (1966).
8. Harlow, H. F., and M. K. Harlow, in *Behavior of Nonhuman Primates*, ed. A. M. Schrier, H. F. Harlow, and F. Stollnitz (Academic Press, New York, 1965), Vol. 2, pp. 287–334.