INSTRUMENTATION & TECHNIQUES

Nuclear family apparatus

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The nuclear family apparatus was designed to provide a living arrangement that included fathers as well as other family members. Accordingly, it required generous dimensions so as not to cramp the males and durable materials that could withstand their strength. The apparatus described in this paper is relatively large, strong, easy to keep clean, and safe in its construction. It provides quarters for four rhesus monkey families—the parents and their offspring. Parents are confined to living cages at the rear and ends, but their young may divide their time between living cages and large play areas equipped with motor apparatus.

A long series of basic social development studies of rhesus monkeys has been conducted at the University of Wisconsin, using two fundamental test situations, the playroom and the playpen, for the collection of observational data. The playroom, shown in Fig. 1, is an observation room designed primarily for the social testing of small groups of infant or adolescent monkeys for short periods of time during the day. The original playroom (Rosenblum, 1961) was 8 ft high with 46 sq ft of floor space. The size and shape of subsequent playrooms have varied, but all are spacious chambers equipped with ledges, climbing ramps and poles, flying rings, ladders, and other play equipment. Usually toys such as rubber balls or metal bowls are provided, either as transportable objects or as attachments to the permanent equipment.

The second situation, illustrated in Fig. 2, combines living and testing in a single apparatus called the playpen (Hansen, 1966). Here four living cages adjoin a large central play area which can be partitioned into two or four discrete units if desired. Each of four infants is reared with a viable monkey mother or a surrogate mother in a home cage. The infants are permitted access to the play area through openings in the cage walls small enough to restrain the mothers but large enough to allow free movement of infants. The apparatus is flexible enough to permit many different conditions of rearing or testing with minimal changes. For example, infants can be separated from their mothers by locking them into the play area or the mothers can be removed from the infants or the room. Opaque panels

between living cage and play area and between adjoining living cages can isolate a pair visually from other pairs. Plexiglas panels can separate mother and infant tactually but permit auditory and visual contact.

The nuclear family apparatus, illustrated in Fig. 3, is our most recent living-testing apparatus for the study of social behavior. It is basically a much enlarged and modified playpen for adults and their offspring. Each of four families lives in one of four large compartments bordering three sides of a play area equipped with apparatus designed to stimulate a maximum variety of motor and social play in the allotted space. There are three units of

four families each spaced 3¼ ft apart in a room 16 x 62 ft. To prevent establishment of territoriality and to equalize time spent in each cage and adjoining each other family, families are shifted weekly in cage assignments balanced over a 12-week period. Observers sit across from the unit, about 4 ft away, to record behavior.

The apparatus was designed to house adult rhesus monkeys and their offspring over a long period of time in sufficiently spacious quarters to prevent crowding and to provide the young with optimal opportunities for socialization not only within the family, but also with animals from other families. It controls the amount of interfamily contacts as well as provides for continuous intrafamily interaction. Daily coded observations supply a longitudinal record of the social behavior of each animal with its own family members and with each member of the other three families in its unit. It thus produces animals of known experience raised in a physically and socially enriched laboratory environment.

The walls and ceiling of the

Fig. 1. Playroom situation.

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PLAYPEN APPARATUS

Fig. 2. Playpen situation.

apparatus are constructed of heavy stainless steel woven wire mesh with 2-in. openings, permitting relatively unrestricted observation of the animals and causing minimal photographic interference. The large mesh is supplemented by small mesh or transparent Plexiglas strips at all junctions of the home cages to prevent finger, hand, and face injuries from monkeys in adjoining cages. Unprotected monkeys compulsively reach their hands through openings or press their faces to the mesh and thereby place themselves in jeopardy.

Tempered plate glass partitions are mounted between adjacent home cages at the rear of the apparatus so that adults can keep aware of activities in the neighboring cage and, especially, visually track their offspring throughout the apparatus. This actually is a modification of the original apparatus, which had sheet metal between the rear cages. Very soon it was found that these cages were extremely frustrating to the occupants because they could hear their neighbors but not see them. Adults spent much time trying to look under the partition and banging at the barrier. After the first infants arrived and became mobile, the parents became anxious whenever their offspring wandered into the invisible cage next to them or into the portion of the end cage obscured by the opaque panel. The glass replaced the stainless steel when the infants were very young and relieved the situation.

Fig. 3. Nuclear family living apparatus.

Fig. 4. Living cage.

Both safety of the animals and easy maintenance of their physical environment were considered in the choice of materials. The nuclear family apparatus is built entirely of materials which are readily cleaned, relatively indestructible, rustproof, and nontoxic.

The floor of the living cages is removable for cleaning and is made of 1-in. mesh 1½ in. or more above the tile floor. The mesh is small enough to prevent the infants' hands or feet from being caught and large enough to allow most waste to drop through. The floor slopes slightly to sewers near or under each unit, facilitating continuous drainage of urine and drainage from the twice-daily hoseings of the apparatus and floor. The play area utilizes the tile floor of the room. During the first few weeks, the living cages also used the tile floor, but the accumulated waste in a very short interval made this unsatisfactory, and so the mesh floors were installed over the tile.

Scale drawings of one unit (Fig. 3), of one living cage (Fig. 4), and of the play area (Fig. 5) clarify a number of details of the apparatus. Some features merit special attention.

LIVING CAGE

The two front living cages are visible in Fig. 3 and the rear living cages are shown in outline. Details are in Fig. 4. Each of the four cages measures 4 x 4 x 6½ ft high and is fitted with shelves of two heights, three in two units and two in one unit. These provide flexibility in the monkeys' use of space in the cages. Food boxes, which are filled with dry food once a

Fig. 5. Play area with photographic front opened.

day, are also at two levels so that the less dominant animals have access to one box while the dominant animal eats from the other. Special foods, such as vitamin sandwiches and portions of fruit, are handed to each animal through the mesh to assure distribution. Additional dry food is scattered on the floor of the play area so that the young are assured an adequate amount. Water is available continuously through a small stainless steel watering nozzle extending through the mesh from above the cage. The transport cage entrance slide is at floor level on the outer side of the cage.

Attention is called to the small mesh tunnel extending into the home cage from the play area. This is superior to a simple opening because it lessens the possibility of small adults forcing themselves through the aperture into the play area. It also retards the neonate's initial excursions into the play area, increasing the likelihood that it will have sufficient motor skill, spatial orientation, and directional sense to return home easily when it does visit the play area. A small stainless steel door rotates over each opening from the play area and can be closed and locked to keep the infants in the home cage when desired.

PLAY AREA

Each nuclear family play area is 8 x 4 ft and the same height as the living cages—6½ ft. It contains a climbing apparatus formed by a variety of conjoined shelves and runged ladders set at appropriate angles. Hanging from the top flat mesh shelf of the climbing apparatus are an attached, revolving wheel and a rotating ladder. Several transportable

stainless steel toys are placed within each play area. The play equipment, drawn to scale in Fig. 5, was designed to aid in motor development and coordination of the infant monkey and to encourage manipulation and exploration. The horizontal mesh shelf in the climbing apparatus also provides additional living space in the play area for the young should they want or need it.

The revolving wheel is an aluminum circle 24 in. in diam with a concentric series of 7/8-in. holes spaced ¼ in. apart. The larger hole size was chosen to minimize the possibility of an animal's fingers or toes being pinched or caught while spinning on the wheel, and the holes were countersunk on both sides to eliminate sharp edges. The wheel shaft is mounted in four ¼-in. plates and secured with a locking nut and bolt to allow E to cant the wheel at any chosen angle. The angle of the wheel should be minimal while the Ss are young so that return to the climbing apparatus is slow.

The rotating ladder, 25¾ x 8 in., is constructed of ¼-in. rungs and ½-in. sides. One end is weighted to assure alignment in a vertical position when unoccupied, thus making it maximally available to very young infants that have ascended the climbing apparatus.

Both the wheel and ladder are mounted on stainless steel shafts which are adjustable from right to left on the horizontal shelf. The ladder is reversible on its shaft so it can be moved outward and away from the climbing apparatus as the animals grow.

The entire front of the play area is hinged on both sides so that it may be opened outward to permit human entrance or to expose the front of the

play area for photography. Cumbersome camera ports and interfering glass reflection problems are eliminated. During photography sessions, both doors can be opened and additional mesh hung to form the ceiling and walls of an extension of the play area.

The third unit was designed as a photographic unit and has plate glass fronts instead of mesh in the two forward living cages and the play area. This has not proven satisfactory for photography because the animals very quickly smudge the glass, even when it is washed down minutes before the session. Indeed, the moving in of people, cameras, and additional lights attracts the animals to the front and accelerates the time taken to obscure the glass. Moreover, there is some glare

even through clear glass, which reduces the quality of the pictures. Also, this unit has two shelves in the living cage instead of three, a modification designed to facilitate good photographic angles from the front.

In summary, the apparatus is a combined living and testing situation which has proven highly satisfactory for raising groups of animals heterogeneous in sex, age, and relationship, and enriched in their environment. The first unit has been continuously occupied by the same individuals and their offspring for almost 44 months at this writing, without injury or accident to any animal. Thus far, friction within and between families has been minimal. The other two units have been occupied for over 3 years by the same

basic families, although four adults from different families have died from disease, necessitating the introduction of two stepfathers and two stepmothers. As in the first unit, there has been minimal friction within and between families in these two units. Persons experienced in raising laboratory rhesus monkeys did not anticipate the peaceful adjustment of the animals to the nuclear family arrangement.

REFERENCES

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