WHO LOVES YOU?

For monkeys, close ties both with peers and with parents are crucial to an infant's emotional development

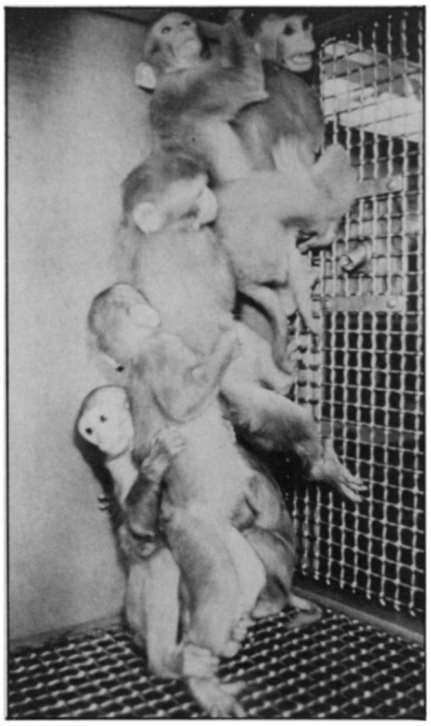
BY JOEL GREENBERG

It has long been established that baby monkeys need every bit as much love to develop normally as do human infants. And using Harry F. Harlow's 40 years of primate research as a base, some scientists believe that recent experimental results with monkeys might contribute to knowledge of the early psychological needs of children.

Harlow, now an emeritus professor of psychology for the University of Wisconsin, demonstrated—by isolating infant rhesus monkeys from contact with their mothers—that early separation from mothers can lead to emotional difficulties in the monkeys' later relationships. Totally isolated monkeys would later sit huddled and crying in the corner of a cage and refuse to associate with other animals. In addition, Harlow's use of cloth-covered wire figures as surrogate mothers revealed the importance of softness, warmth and contact comfort in the infant's attachment to its mother. It was previously believed that mother's milk was the dominant factor in the mother-infant relationship.

During the last few years, Harlow protégé Stephen J. Suomi has continued to experiment with rhesus monkeys at the University of Wisconsin Primate Laboratory. Suomi presented some of the latest findings recently at the Vermont Conference on the Primary Prevention of Psychopathology.

Though much of the current work confirms and refines Harlow's previous findings, there has emerged over the past two years additional knowledge about how various attachment factors influence a monkey's later adjustment. Suomi has found, for instance, that early, healthy interaction with peers is extremely important, in addition to the presence of the mother. "If deprived of interaction with peers, they [the monkeys] do not develop normal patterns of behavior,"



photos: U. of Wisconsin Primate Lab

These 1½-year-old monkeys, raised with no mother, display abnormal panic to fear.

Karen Schaar, APA Monitor

Suomi: The analogies to humans "are there."

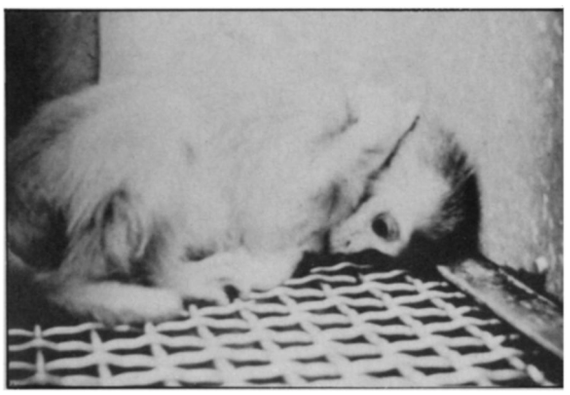
Suomi says. "Later on, they become contact-shy around other animals, and hyperaggressive as well."

After an initial five- to eight-week period of interaction almost exclusively with the mother, the young monkey ventures into relationships with its peers. From then on, he spends more time with playmates than with mother, reports Suomi. Play predominates the infant's social activity—he spends 70 to 75 percent of his first year of life swinging, running, chasing and wrestling with his mates. "This is where he develops competencies and proficiencies in certain physical areas," says Suomi.

"In play, the youngsters develop the precursors that will characterize them as adults," says the psychologist. The most critical developments occur in aggressive activity and sexual behavior. In normal, frequent play activity, the infant develops control of aggression, as well as the "normal" rear-mounting technique of intercourse, Suomi notes. But when deprived of peer interaction, later aggression becomes exaggerated, and sexual "deviances" develop. "Even if it is denied peer interaction for a relatively short time, there can be profound consequences," says Suomi.

When animals are separated from their cage mates, they often become depressed. An immediate increase in vocalization is followed by self-clutching and a drop in locomotion and sexual activity. Conversely, peer interaction can be used as a therapeutic tool. When isolates are thrown in with peers at a relatively early age—even if they had been isolated beyond the age when play would normally begin—they become more normally interactive, Suomi reports. (At the conclusion of experiments, monkeys are integrated as much as possible into normal socialization and play groups with monkeys that had undergone conventional upbringing.)

But Suomi's experiments also reiterate Harlow's results concerning the importance of the infant-mother link. "If an



Effects of total isolation from birth are evident in this five-month-old monkey.

individual does not have a good relationship with his mother, then the relationship with peers suffers," Suomi says. Monkeys reared by Suomi in isolation for the first six months of life would not interact when exposed to peers and showed only self-directed behavior. Later on in adulthood—rhesus monkeys mature, through adolescence, four to five times faster than human infants—the monkeys develop severe interpersonal problems. They frequently attack dominant adult males as well as their own bodies, Suomi says.

Infant monkeys reared exclusively with peers, rather than a mother, from birth, interact later with other monkeys "but not healthily," says Suomi. Such monkeys are abnormally fearful and "cling to each other most of the time," he reports.

Even brief maternal separations have lasting effects later in life, Suomi says. Monkeys removed from their mothers for just two hours a week during the first eight months of life demonstrate effects such as an unnatural fear of the environment for as long as two years later. Harlow demonstrated that female infants who are deprived of motherly love often grow up to abuse and batter their own children (SN: 12/27/75, p. 389). After giving birth, such mothers would either ignore their infants or strike them, sometimes fatally.

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viously occurred at a time of day when wind was thought unlikely to be shaking the lander; the wind sensor was off at the time, but winds had not been recorded on prior days at that hour. Over subsequent months, however, says Viking seismology team member Gary Latham of the University of Texas, similar seismic traces showed up at the same time and with the wind known to be blowing.

The Nov. 24 data have not been thus discounted. Furthermore, the sole tentative data point is one more than had existed throughout the previous centuries of Mars-watching, so the resulting map would thus appear worthwhile, at least as speculation. It also seems to be a reasonable result: thickest at Tharsis, thinnest at the floor of the deep Hellas basin. And, with future seismic events an unknown quantity and future Mars missions in a similar condition, it may have to suffice for a long time.

Given all the "ifs," the crust of Mars beneath the rock-strewn plain occupied by lander 2 is about 16 kilometers thick. The number comes from measuring the elapsed times between three successive peaks in the Nov. 24 data, assuming that the first peak represents a tremor traveling directly to the lander while the subsequent ones represent a longer path in which the signal is reflected from the crust-mantle boundary.

Seismology team leader Don Anderson of the California Institute of Technology passed on the one precious data point to Bruce G. Bills and Alfred J. Ferrari of Jet Propulsion Laboratory, who would produce the map itself—with another set of assumptions. Gravity data inferred from variations in the orbit of the 1971-72 Mariner 9 spacecraft (Viking's predecessor) were used to indicate the planet's overall mass distribution. Bills and Ferrari then adopted a "reasonable" number of 0.6 grams per cubic centimeter as the difference in density between the crustal material and the heavier mantle. The size of the difference affects how steeply the underside of the crust must dip up and down to help account for the gravity variations. This, in turn, was corrected for the visible ups and downs of the surface topography.

All these factors add up to emerge from a computer as variations around some mean crustal thickness. Then it's just a matter of trying different mean thicknesses to find one that yields a 16-kilometer thickness at the lander 2 site. According to the resulting map, the mean thickness of the Martian crust is 40 kilometers, rising to 77 km at the highest point on Tharsis and thinning out to only 8 km where some huge, ancient meteorite punched the hole that is Hellas basin.

One ready conclusion from the map is that, compared with the earth, the Martian crust is thick indeed. Earth's average crustal thickness, says Anderson, is about 33 km, and it covers a planet with nearly twice the radius of Mars. Earth's crust, then, amounts to about 0.5 percent of its radius, against 1.2 percent for the same comparison on Mars—and 4 percent for earth's moon, a still smaller body.

Mars, says Anderson, thus seems to be considerably more differentiated than the earth. There are several possible reasons, he suggests: Perhaps Mars formed with a greater percentage of lightweight materials than did the earth. Or, Mars may have had more water when it formed (consistent with its greater distance from the sun), which would have lowered the melting point of "crustal-type materials." A third source of greater differentiation could have been a greater concentration of heat-producing radioactive elements. This last case seems unlikely, Anderson says, at least for the heavy radionuclides that would have contributed the most heat, although Viking reported a high ratio of argon 40 to argon 39 suggestive of considerable outgassing of the decay products of potassium 40.

Furthermore, recent studies have concluded that the moon, with the relatively thickest crust of all three bodies, has a smaller excess of radionuclides relative to the earth than had previously been supposed. Perhaps the thin-skinned earth, rather than the crustier moon and Mars, is the anomaly. Earth is closer to the sun than is Mars, of course, which could account for some of the lack of lightweight, low-melting-point crustal material, but then what about the moon? Is this support for the theory that the moon was formed farther out in the solar system?

Even as a first start, the Martian crustal map seems to have a place in comparative planetology. For correlations with individual, localized features, however, it may be less useful, says Ferrari; this is particularly true for the northern hemisphere, since Mariner 9, which provided the gravity data, was closest to the planet in the south.

Still, it is tempting to look. The only other place on the map, for example, where the crust seems to be almost as thin as in the floor of Hellas is a spot centered at about 63°N and 38°W. The Viking orbiters have shown that spot to be relatively undistinguished (at least there are no gigantic basins), but it does exhibit the lowest general topography of any point at that latitude. Broadly speaking, in fact, that whole latitude seems to exhibit some of the thinnest crust on Mars. Perhaps the map is showing that a spinning planet, besides becoming fatter overall near the equator, concentrates its crustal material at lower latitudes after differentiation has taken place.

The map is only a first step. It will be improved with the addition of Viking's gravity data to make up for Mariner 9's southern inclination, and additional seismometers from some future mission could make a major difference. But it sure gets a lot of mileage out of one data point. □

. . . . Monkeys

There are other apparent parallels between monkey and human behavior. In separating monkeys from their mothers, Harlow demonstrated that the infant monkeys react in ways very similar to those of human children. In both cases, vocalization or crying increases and depression sets in. Other researchers have shown that in the absence of other relationships, including one with the mother, infant monkeys can develop strong attachments for adult males, who become sort of a "big brother" to them.

There has been considerable debate over to what degree animal findings can be applied to humans (SN: 4/27/74, p. 274). Suomi, for one, believes that "in terms of patterns and developmental trends and how different social relationships form," there are "analogies with humans."

Many of his own results over the last two years correlate with similar studies performed with human infants living either in group situations or with their parents, Suomi says. A sign of the growing closeness of human and primate research was a recent meeting, hosted by Suomi and the Wisconsin lab, where researchers from both areas met to discuss standardizing testing mechanisms in the two disciplines. "The analogies and similarities," says Suomi, "are there." □