Social Life of Japanese Monkeys

Observation shows that nonuniformity is a fundamental characteristic of individuals and of troops.

Denzaburo Miyadi

Japanese monkeys have a more northerly range than any other nonhuman primate. They are about the size of the Gibraltar monkeys, found at the entrance to the Mediterranean Sea, and have beautifully bright faces and very short tails.

They forage in the forest in troops of from 30 to 200, collecting the leaves, fruits, and insects which are their principal foods. The number of species of plants in the diet of a troop may be as high as 200, and the troop's foraging area is estimated to cover about 3 to 5 square kilometers.

The wild Japanese monkeys are extremely shy, and it is very difficult to catch even a glimpse of them. Hardly any photographs had been taken of them in nature before the beginning of our study in 1958. But at our secret approach to a troop we were surprised at the variety of their voices coming from the depth of forest. Thus we came to regard vocalization as one of the most important clues to their natural history and undertook to list, in our field notebooks, every vocal sound heard. Other clues were the droppings, footprints, and fragments of food plants they left scattered about.

To study the vocalization more fully we needed to ascertain the situation of the troop before and after each cry and to identify the behavior of the monkey emitting a certain vocal sound as well as the influence of the sound on another monkey or the reaction of the troop as a whole. Thus it was necessary to lure the monkey troop to an open place to observe it more clearly at shorter distances.

For this purpose we tried setting out sweet potatoes and wheat grains on rocks in a deep, pathless forest of Koshima Island in Kyushu, where the monkeys were accustomed to pass. They ate the sweet potatoes, and by and by the troop's wanderings became influenced by the food we set out. Next, the number of these provisioning points was gradually reduced, finally to a single point: the sandy beach of the small island. On the rock of this beach, large quantities of sweet potatoes and wheat grains were set out. At first the monkeys were wary of a fisherman's cottage on the beach and were unwilling to come down to the food. The suspicion and fear they felt toward human beings, however, were no match for their greed. Once they realized that we would do them no harm, they gradually grew bolder, and soon, unobserved, we had a complete view of them.

After this success our first task was to distinguish the monkeys of the troop by giving each one a name. In this way we learned about the membership of the troop and also about the relationships among individuals and the social status of each individual, so that eventually we were able to grasp the social structure and the lineage of the troop as a whole.

Vocal Communication

Under these circumstances minute analysis of each vocalization became possible. While there may be doubt that every vocal sound has social meaning, most of the vocal sounds do have such meaning in nature. In a monkey society we often meet with so-called "solitaries" who have abandoned life within the troop and wander alone. One of the solitary males we observed on Koshima Island in 1950 made no vocal sounds at all. We also found solitaries in other troops. Even when we approached close to him, a solitary did not make any warning call.

Itani, who studied the vocalization of the Mt. Takasaki troop in Kyushu, distinguished more than 30 kinds of sounds. Some troops are noisier than others, and a larger troop usually has a larger vocabulary than a smaller one. We found, however, that a certain sound made by monkeys in a certain troop was not so unique that it could not be understood in other troops. Although there may have been some slight differences in the reaction to a given vocal sound in different troops, we are convinced that there are no "dialects" in the societies of Japanese monkeys.

The tones of monkey voices are very peculiar and hard to imitate, but some of our researchers were able to make certain calls which the troop at a distance answered, by voice or by behavior, just as if these cries were uttered by fellow monkeys.

The vocal sounds of Japanese monkeys may be classified in six groups according to their function in the troop and certain other criteria: (i) sounds which generally indicate emotional calms; (ii) defensive sounds; (iii) aggressive sounds; (iv) warning sounds; (v) sounds characteristic of estrous females; and (vi) sounds characteristic of babies.

In the first group belong about 15 vocal sounds. From the situation in which these sounds are emitted, as well as from the monkeys' behavior, it seems that they are not directed to any particular individual. Thus, their function is not one-to-one communication. Some of these sounds are very low and, like muttering, carry only a very short distance, but some, like human calls, are high and loud—loud enough to reach all the members of the troop. Even if the troop is in dense forest or bush, where the members cannot see each other, the monkeys can communicate by calling. These mutterings and calls are the means by which the monkeys become aware of the situation of fellow members of the troop. The calls may indicate departure, arrival at a feeding ground, and so on.

"Kwaa" and "Vii" are the calls for departure. Two monkeys make these sounds. One of them calls "Kwaa" or

The author is professor of zoology at Kyoto University, Kyoto, Japan. This article is based on a paper presented before the Symposium on Japanese Science held at the Cleveland meeting of the AAAS. The full paper is to be published in the AAAS Symposium volume on Japanese science.

"Uwaa" and the other calls "Vii." After exchange of these calls, the troop will begin to move. "Howiaa" is the sign of arrival. A young male, or an old female, who arrives at the feeding place in advance of the others calls "Howiaa" to the members of the troop that follow, at the same time keeping watch on those who are already feeding.

It has been thought by some that the sounds made by monkeys are related too strongly to their emotions to have any objective meaning. The foregoing examples, however, seem to disprove this.

Vocalizations of group ii are accompanied by attitudes of defense or escape. They are expressions of violent emotion and belong with the so-called "shriek." "Gyaa Gyaa" is the cry of fear, and some differences in tone may be noticed, according to the age and sex of the monkey.

Vocalizations of group iii are aggressive sounds. They are associated with emotions of aggression and anger such as those which evoke the defensive calls of group ii. Some of them are, however, directed toward an individual or toward the troop as a whole, and they play very important roles in maintaining the social order of the troop. "Go Go Go" or "Ga Ga Ga" are the expressions of a threat or an intimidation, and these sounds are often accompanied by attack on other individuals, or by the shaking of a tree to arouse a kind of social tension in the troop.

Group iv includes warning sounds, among which the shrilling call "Kuan" has a particularly important social meaning. It is emitted always by the strongest monkey at a given spot; on hearing it the whole troop falls into complete silence, and all behaviors are switched to readiness for swift avoidance of the enemy coming from outside the troop. All the monkeys but one disappear from sight; this one remains at the top of a tree to observe the behavior of the enemy. These events in daily life are evidence of splendid teamwork among members of the troop.

Adjustment of Relationships

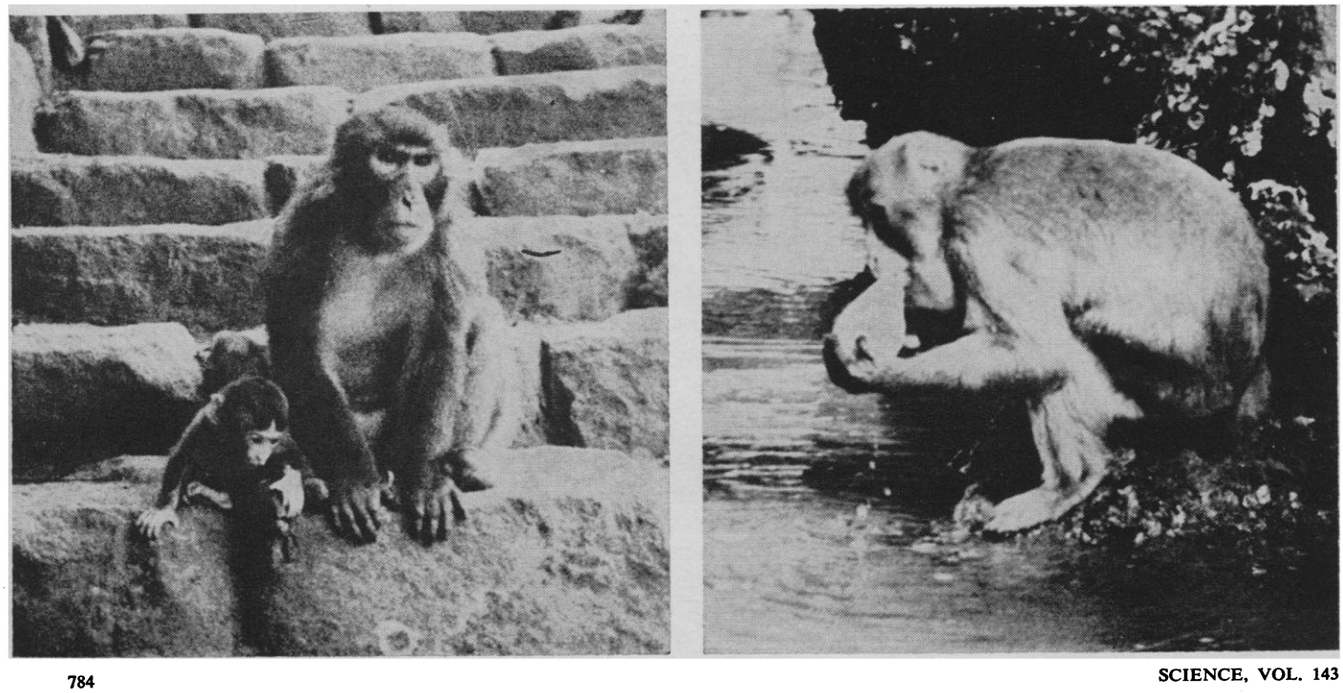
The six kinds of vocalization may be classified in two major groups, the calls and the crys. Many of the calls are made for communication between the individual and the group and are not accompanied by violent emotion. They help control the troop in its restless nomadic life, since in the dense forest or bush the monkeys must rely principally upon their ears rather than upon their eyes. Unlike the calls, the crys are usually accompanied by strong emotions—by anger or sorrow on social contact with other individuals—and their function is to adjust the social relationship.

Unlike humans, however, monkeys cannot say to their companions such things as "This tastes good" or "You should try this." But patient study of the monkeys' language is of great importance for understanding the origin and evolution of our own language.

Monkeys have several other ways of communicating through their behavior. One type of symbolic behavior is "presenting"—a behavior in males which is identical with the behavior of the female during copulation. Before a superior, a male will proceed on all fours and present his buttocks, and the dominant individual will sometimes mount him. Though both are males, this is not a case of homosexual behavior but an affirmation by the two monkeys of the superior-inferior relationship existing between them. Suppose, for example, one male in a careless moment picks up, in front of a dominant male, an orange that has fallen in his way. The dominant male will immediately attack him. The attacked male will flee for a certain distance but will soon give up and present himself, buttocks foremost, to his attacker. The attacker mounts him in a leisurely fashion, as though to say, "You see, I'm the stronger," then everything is forgotten and the weaker is forgiven.

There is also "proposing." A male

Paternal care of babies is rare by leaders and subleaders, but one monkey troop showed this custom. Habit of washing sweet potatoes in sea water was invented by a female monkey and gradually copied by the rest of the troop.



advances toward an estrous female with a dancing gait, lips protruding and opening and closing rhythmically. Then, together, the two monkeys leave the troop for a short time. Such rhythmic lip movement is a sign of affection; it is also quite common among young females. The function of behavior and gestures of this kind is one-to-one communication, not unlike speech between individual human beings.

Some Cultural Habits and Their Propagation

Animal behaviors might be grouped in two classes, those innate to a species and those learned during the life of an individual. The latter are often acquired by trial and error and usually vanish with the death of the individual without being transferred to the offspring.

However, in a higher animal species whose social form is a permanent troop, behavior acquired by one individual may be imitated by other members to become a new habit of the troop, preserved there even when the individual dies. Such preserved behavior is accepted by newborn animals without hesitation and appears early in their development as if it were an innate habit. Thus, these behaviors are beyond the level of the individual and may be said to have been socialized or to have reached the cultural level. It is not always easy to decide whether a certain behavior which all individuals of a troop possess is innate in an individual or encultured in a group. For distinguishing the two, comparative study of the behaviors of different troops or of the process of new-habit formation may be useful.

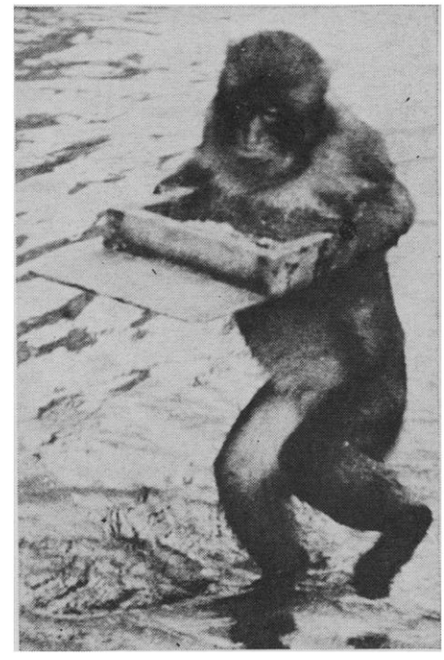
Members of the Primate Research Group at Kyoto University as well as members of the Japan Monkey Center have found some differences in the habits of Japanese monkeys belonging to different troops. While the monkeys of the Mt. Arasiyama troop have an egg-eating culture, those of the Syodosima troop in the Inland Sea do not. The monkeys of the Mt. Atago troop near Tokyo are indifferent to unhulled grains of the rice plant and to soya beans even when they pass along footpaths between the fields where these are cultivated, in contrast to monkeys of many other troops who do considerable damage to these plants. In most troops the mounting of a female by a male is "taboo" except in the breeding season, but this is not so in some exceptional troops. Paternal care of babies by leader and subleader males in the delivery season is seldom seen in Japanese monkeys except among those of the Mt. Takasaki troop. These differences in habits according to troop can hardly be assumed to be innate.

When we lured monkey troops to artificial feeding places, at first the monkeys ignored new foods, such as candies and boiled rice, but they became gradually accustomed to them and established new food habits. Newborn monkey babies do not distinguish between artificial and natural foods, and the infants were quick to start eating the new foods, although the mother interfered with this adventure. After a while, however, the mother imitated her children and the behavior spread to others, until the whole troop had acquired a new habit. The speed of acquisition differed considerably with age, and elderly individuals proved the most conservative. There were also some personal differences. While the first male of the Mt. Takasaki troop was reluctant to try a new kind of food, that of the Mt. Minoo troop near Osaka was quick in learning, and he was imitated by other members of his troop very quickly. Established habits are handed down quickly from mothers to babies or from older monkeys to younger ones, but along the reverse route new habits are acquired very slowly.

In the troop of Ko-jima Island we discovered another kind of new habit: the washing of sweet potatoes in sea water before eating them. This hygienic habit was initiated in 1953 by a 1½-year-old female, and it was imitated by other monkeys. It was first learned by the mother and playfellow, then by sisters and brothers. At present, almost all monkeys except the old males have this behavior, which seems to have been established as a new cultural habit of this troop. These new habits may spread to other troops through solitary males who happen to move from one troop to another.

The benefits of troop formation to both the individual and the species are manifold. Among them may be counted the acquisition of new habits as part of the culture of the troop. Such acquisition may be significant in the social evolution of higher animals.

The social life of the Japanese monkey has been studied for about 12 years through observation of more than 20 natural troops fed at various points throughout the country. However, no



One monkey troop adopted habit of using trays to wash food in the sea.

sign of a troop division was noticed until 1958 and 1959, when division took place in two troops in completely different ways. So far as we know, there is no other record of the multiplication of a natural troop.

In Japanese monkey society, two distinct parts may be distinguished, the central and the peripheral. The central part consists of one or several leader males, all the females (both mature and immature), and babies and infants less than 2 years old. At the periphery are the subleader males and young males, who have a different status from the leaders and are not allowed to enter or eat in the central part. While the males must leave the central part as they grow up, the females remain around the leader males throughout life, except in the breeding season when they consort with peripheral males.

One of the troop divisions occurred when the population of the Mt. Takasaki troop swelled to about 500 (when we started to feed this troop in 1952 it had about 200 members and six leaders). Perhaps because of the widening area covered by the troop, some adult females accompanied by their babies and infants came out of the central part to join the young males at the periphery. The first sign of division came when part of the troop left the feeding ground for the troop sleeping place more than an hour later than other members. Later the branching

troop sometimes passed the night near the feeding ground while the rest of the troop went to its usual sleeping place at some distance. Division was complete when the branching troop chose its own sleeping place, distant from that of the main troop and from the feeding ground. Both the leader and the subleaders of the original group remained with the main troop, contrary to our expectation that some of the subleaders might take the initiative in division. Six young males played important roles in the branching, and one of these became the leader.

The other observed case of troop division did not proceed in this peaceful way. It seemed to be the result of a decline in rank of the troop's third leader, whom we had named Saburo. Saburo was initially surpassed in rank by the fourth leader, Siro, who later became the first leader. A few months after Saburo had been mounted by a young male named Take, there was a report of unusually severe fighting. The next day Saburo and one-fourth of the troop did not appear at the feeding ground. A search on the mountain revealed the new troop foraging in the forest, and it never again appeared at the feeding ground. The detached troop has two leaders: Saburo, the former declining leader, and Kuro, promoted from subleader status. After the division, the new troop observed the forms of social etiquette and manners according to rank, such as the down-motion of the tail in the presence of a superior male, more strictly than the original group. It is not clear how the 50 monkeys chose the separate troop. Was there a secret plot among them?

While change in social ranking among leaders is common, the declining leader does not always desert the troop to become a solitary, or try to establish a new troop. In one of the troops we observed there was a retired leader, very old, who still posted himself in the central part, although he was not much concerned with the management of the troop.

The Japan Monkey Center has also succeeded in organizing a new troop with monkeys collected from different natural troops. When a newcomer was added to the artificial group, he or she was recognized at once and warmly accepted by individuals who had come from the same natural troop several months before. The monkey troop is undoubtedly a society of mutual acquaintance; each monkey knows every other monkey—its rank, status, mother-child relationship, and so on. Some of the infants, for example, are ranked high because they are the children of influential mothers. In these senses, each monkey troop has its own troop peculiarity and cultural trend, and each member of the troop differs from the other members in personality and life history.

Thus, nonuniformity is a fundamental characteristic of individuals as well as of troops of the Japanese monkey, and case-by-case observation, with identification and naming of individuals and comparison of troops, is essential in primatological research.

News and Comment

Scientific Migration: Britain Agitated Anew by Research Team's Decision to Move to United States

London. The emigration of scientists across the Atlantic is again a public issue in Britain. In the uneasy lull before the general election, the phenomenon inevitably has political implications. The circumstances of each departure are being examined meticulously, to see whether they support the Labour Party's contention that a succession of Conservative Governments has scandalously neglected science, or the Government's view that the migration of scientists is as natural as that of swallows.

What the newspapers call the "brain drain" has re-emerged with the decision of Ian Bush and eight of his colleagues to move from Birmingham University to the Worcester Foundation for Experimental Biology, Shrewsbury, Massachusetts. In 6 years, Bush, who has specialized in steroid metabolism, has created an outstanding unit for research into the chemical basis of mental disease. His group was one of the most promising of the many small research units financed by the Medical Research Council but located at a university. It is not yet clear whether the work of the unit will survive the departure of its senior members.

This bulk emigration has drawn attention to others. M. H. L. Pryce of Bristol, a distinguished theoretical physicist, is off to Southern California in the summer. John Pople, another theoretical physicist, and the head, at the tender age of 38, of one of the divisions of the National Physical Laboratory, will go to the Carnegie Laboratory at Pittsburgh. E. B. Paul, of Manchester, a Canadian by birth, will be the second professor of experimental nuclear physics in 5 years to have left Rutherford's old laboratory for the United States when he joins the Rice Institute in August. In the last few weeks many less-senior scientists have announced their departure, and there has been a stern grumble from Fred Hoyle that he will pack up for good if he does not quickly get better facilities for his theoretical work on the constitution of stars.

This is the season when appointments are traditionally arranged for the next academic year, and the number now emigrating is not much larger than what the country has recently come to expect. The seniority of the emigrants, however, has come as a shock, as has the chorus of declarations that the United States promises better opportunities for scientific research than do the British universities. The complaint is especially galling when the country is about to embark on a gigantic program of higher education based on the assumption that there is nothing wrong with the universities that expansion will not cure.

The difficulty of getting money for research projects is one of the most common complaints. Funds for most research come not from the general budget of the universities but from bodies such as the Medical Research Council, a non-governmental commit-