

Editorial: A brief note on the background of the study of cognition and behavior of chimpanzees by Japanese researchers

Chimpanzees (*Pan troglodytes*) are the closest living relative to humans (*Homo sapiens*). One cannot understand the process of hominization, that is, the evolution of humans, without studying chimpanzees and other nonhuman primates. The comparative study of chimpanzees and humans is essential for understanding the evolution of cognition and behavior, because these functions are not kept in the fossil records as are skulls and bones. The purpose of this note is therefore to explain the historical background and the present situation of the study of chimpanzees in Japan, with reference to the study of their cognition and behavior.

The living nonhuman primates are distributed in Africa, Asia, Central and South America, but not in Europe and North America. Japan has an indigenous species (*Macaca fuscata*), known as the Japanese monkey or snow monkey. In Japan, the study of nonhuman primates began with the socio-ecological study of Japanese monkeys in their natural habitat. The late Dr. Kinji Imanishi (1902–1992) of Kyoto University and his colleagues (his school was called the “Kyoto school”) have promoted the long-term project of studying wild Japanese monkeys from a socio-ecological perspective since 1948 in Koshima, and then the Takasakiyama, Arashiyama, and other research sites.

In 1958, Imanishi and Itani went to Africa for the first time to start the socio-ecological study of African great apes. They thought that they had to begin studies of the great apes and living human hunter-gatherers in Africa to understand the process of hominization, especially the evolution of sociality. These two scholars reconnoitered Kenya, Tanganyika (now Tanzania), Uganda, Congo (now Zaïre), and Cameroon for three months. Then, Kawai and Mizuhara carried out the first survey of mountain gorillas in the Virunga Volcanos of Uganda in 1959. In 1960, Itani also carried out a field study of wild chimpanzees in Kibale and Budongo in Uganda, and then went down to Gombe in Tanganyika, where he met Jane Goodall, who had just started her long-term study of wild chimpanzees. Since then, primatologists of the Kyoto school have continued research on chimpanzees in several sites throughout the tropical rain forests and the savannah woodlands of Africa.

As part of this research effort, Nishida, a graduate student supervised by Itani at that time, started a long-term study in the Mahale Mountains of Tanzania in 1965, and succeeded in provisioning (i.e., feeding chimpanzees to habituate them to human observers for close observation and identification of each individual) in the next year (Nishida, 1990). Sugiyama studied the chimpanzees at Budongo, Uganda (Sugiyama, 1968), and then independently started his long-term research on chimpanzees at Bossou, Guinea, in 1976. These studies by Japanese researchers in the early stage brought new findings about wild chimpanzees: The finding of the “unit group” of chimpanzee society which was characterized by “fission-fusion” of the subgroups (Nishida, 1968, 1970), insect/meat eating and cannibalism, so-called “infanticide” (Suzuki, 1966, 1971), unique tool use (Sugiyama & Koman, 1979), and so on.

The socio-ecological study of African great apes originated by Imanishi and Itani was transformed into the studies of other African great apes in addition to the chimpanzees. There are several long-term studies, such as that of bonobos in Wamba, Zaïre, led by Kano since 1978 (Kano, 1992), of gorillas by Yamagiwa since 1978 (Yamagiwa, 1983), and of the sympatric gorilla and chimpanzees in Nuabale-Ndoki, Congo, by Kuroda, Mitani, and others since 1988 (Mitani, 1990).

In the shadow of socio-ecological study, the study of cognition and behavior of nonhuman primates by Japanese researchers has not been widely recognized (Matsuzawa, Kojima, &

Jitsumori, 1996). This has also been true of the study of chimpanzees in the laboratory. However, there had been some efforts by Japanese psychologists in the early days. The pioneers are Dr. T. Okano and Ms. M. Okano. They were stimulated by the work done by the Kellogs (a 9-month study in 1931 – Kellog & Kellog, 1933) and the Hayes (a 6½-year study from 1947 – Hayes, 1951), and raised an infant female chimpanzee named Sachiko at their house for 16 months from 1961. The Okanos showed the similarity of humans and the chimpanzee in their cognitive development (Okano, 1979).

Researchers who were interested in the evolution of bipedal locomotion introduced an infant female chimpanzee, named Reiko, for the first time to the Primate Research Institute, Kyoto University, in 1968. Asano and Kumazaki (1975) carried out the first psychological experiment, that being the self-initiated regulation of the room light by the chimpanzee. Reiko had been kept in a room where the room light was controlled by an automatic timer, turning on at 6 a.m. and off at 6 p.m. During the experimental sessions, switching of the light was left to the care of the subject through a manual switch in the room. The time pattern of illumination generated by the chimpanzee showed a continuous 12-h dark period and 12-h active period. The authors did two probe tests. In one test, the light was turned on when the subject slept in the dark room. The chimpanzee spontaneously got up and turned off the light. In another test, the light was turned off when the subject was awake in the room. The chimpanzee turned the light back on. She also spontaneously turned on the light when she heard a noise outside the room. These results clearly showed the chimpanzee's switching behavior for turning on and off the room light was motivated by a sensory reward.

In 1977, Professor Kiyoko Murofushi of the Primate Research Institute organized a research team of psychologists on the acquisition of a language-like skill by chimpanzees. The original members of the project were K. Murofushi, T. Asano, and T. Matsuzawa. The project was supervised by K. Kubota (majoring in neurophysiology), M. Nagao (computer technology), and K. Kanbe (linguistics). S. Nagumo helped to build an experimental system from the beginning of the project. In America, the Gardners (Gardner & Gardner, 1969), the Premacks (Premack, 1971), and D. Rumbaugh and his colleagues (Rumbaugh, 1977; Rumbaugh, Gill, & von Glaserfeld, 1973) had already started the so-called ape-language studies. Murofushi and her colleagues obtained three infant chimpanzees, Ai, Akira, and Mari. They wanted to start a Japanese version of the ape-language study. The project started in April 1978. The Kyoto University team devised a computer-controlled system with unique visual symbols called Kyoto University lexigrams, which were taught to the three chimpanzees (Asano, Kojima, Matsuzawa, Kubota, & Murofushi, 1982). The main subject was a female chimpanzee named Ai, and she showed us various aspects of a language-like skill, such as productive and receptive use of visual symbols (Kojima, 1984), the concept of numbers (Matsuzawa, 1985a; Matsuzawa, Asano, Kubota, & Murofushi, 1986), color classification (Matsuzawa, 1985b), and so on. Later, two juvenile chimpanzees, Pendesa from the Japan Monkey Center and Chloe from the Paris Zoo, joined the project.

The project also introduced two more adult chimpanzees, Gon and Puchi, for reproductive purposes, in addition to Reiko, who was by then an adult. Through artificial insemination, the project got three infants, Popo in March 1982, Reo in May 1982, and Pan in December 1983. These subjects served in various kinds of psychological studies, which cannot be labeled simply "ape language" studies. Since the early 1980s, S. Kojima and other staff joined the project, which gradually started to study a wide range of cognition and behavior of chimpanzees: visual perception and cognition (Fujita, 1995, 1996; Fujita & Matsuzawa, 1986, 1990; Itakura, 1992b, 1994a; Matsuzawa, 1990a; Tomonaga, 1993b, 1993c, 1993d, 1995a, 1995b; Tomonaga, Itakura, & Matsuzawa, 1993; Tomonaga & Matsuzawa, 1992), auditory perception (Kojima, 1990, 1992; Kojima & Kiritani, 1989; Kojima, Tatsumi, Kiritani, & Hirose, 1989), language-like skills (Fushimi, 1994; Itakura, 1992a, 1992c, 1993, 1994b; Itakura & Matsuzawa, 1993; Matsuzawa, 1991a, 1996; Tomonaga, 1993a;

Tomonaga, Matsuzawa, Fujita, & Yamamoto, 1991; Yamamoto & Asano, 1995), sorting skills (Matsuzawa, 1989, 1990b, 1991b; Tanaka, 1995, 1996), and drawing skills (Iversen & Matsuzawa, 1996). The project continues after almost two decades. The approach to cognition in chimpanzees and other nonhuman primates can provide an evolutionary perspective on human cognition. This research area has recently grown to become a branch of the cognitive science called comparative cognitive science.

The study of cognition and behavior in chimpanzees by the researchers in the Primate Research Institute has facilitated the other studies on chimpanzees: locomotion and posture (Kimura, 1987, 1991, 1996), physical development (Kimura & Hamada, 1996), paternity testing based on DNA typing (Takenaka, Takasaki, Kawamoto, Arakawa, & Takenaka, 1993), and the relationship between immunology and dominance (Masataka et al., 1990). It also facilitated studies in other facilities, such as zoos, in Japan. They have provided a rare opportunity to study cognition and behavior in chimpanzees: tool use (Kitahara-Frith & Norikoshi, 1982; Sumita, Kitahara-Frith, & Norikoshi, 1985), object manipulation (Torigoe, 1985), hand preference (Tonooka & Matsuzawa, 1995), facial gesture imitation by a neonate (Myowa, 1996), joint visual attention (Itakura, 1996), and so on. Moreover, the study of captive chimpanzees in foreign countries has also started (Takeshita & van Hooff, 1996; Takeshita & Walraven, 1996).

A unique study in the wild also started in the late 1980s, that is a "field experiment" of chimpanzee intelligence in their natural habitat. In 1986, Matsuzawa joined the field study of chimpanzees at Bossou, Guinea. The unique tool-use behavior of the Bossou community, such as cracking oil-palm nuts with two stones as hammer and anvil, has been studied in this outdoor laboratory, where the stones and nuts were provided by the experimenters (Fushimi et al., 1991, Inoue-Nakamura & Matsuzawa, 1997; Matsuzawa, 1994, 1996; Sakura & Matsuzawa, 1991; Sugiyama, Fushimi, Sakura, & Matsuzawa, 1993). The study of chimpanzees in the Nimba Mountains, the neighboring community of Bossou, also started, and has brought us new information about the cultural differences of wild chimpanzees in different communities and the propagation of cultural behavior between communities and across generations (Matsuzawa & Yamakoshi, 1996).

In 1995, the ape research annex was built in the Primate Research Institute of Kyoto University. The 11 chimpanzees kept at the Institute now formed a new community in Inuyama. They are living in a quite large outdoor compound with trees, flowers, and a stream. The compound has attached residential rooms and laboratories. An outdoor booth for experiments was built in the compound. The booth was connected by an underground tunnel to the adjacent building. The traditional experimental setting has thus been reversed. The experimenter was kept inside the booth while the subjects were free outside. It means that the cognition and behavior of chimpanzees can be studied in a social context, in addition to the traditional way of studying a single subject kept in a test room. A new series of experiments tried to clarify social interactions among chimpanzees, like deception and cooperation, communication, imitation, teaching, and so forth.

This special issue does not cover all contemporary research, but each paper helps us to understand important aspects of cognition and behavior in chimpanzees. In this brief note, we decided to cite English publications only, as this journal aims to communicate scientific achievements to psychologists all over the world. However, we have cited two of the pioneer works done by Japanese researchers, although they were reported in Japanese. We hope this brief editorial note on the historical background of the study of cognition and behavior in chimpanzees will have helped to start you on your way to understanding contemporary research in Japan. We also hope that future research in this important field will be inspired by this special issue and the previous one published in 1996 (Special Issue: Cognition and behavior of nonhuman primates, *Japanese Psychological Research*, Vol. 38, No. 3).

In closing, we want to mention the present situation of chimpanzees. The chimpanzees in Africa are endangered. The same is true of bonobos and gorillas in Africa and orang-utans in Southeast

Asia. At the turn of the century, there were hundreds of thousands of chimpanzees living in what are now 25 African nations. However, forests and woodlands are disappearing as a result of commercial logging and the ever-increasing growth of human populations. Chimpanzees have already become extinct in four of the nations where they once lived, and their numbers have shrunk alarmingly elsewhere (Goodall, 1996).

In Japan, there are 395 chimpanzees in total as of December 1995. They are kept in 58 facilities throughout the country: one research institute, three medical research facilities, 50 zoos, two circuses, and two commercial enterprises. Twenty-one out of 58 facilities (more than a third of the facilities) possess only one or two chimpanzees, who are isolated from conspecifics. A total of 139 chimpanzees (a third of the total population in Japan) possessed by the three medical research facilities have not yet been utilized for invasive medical studies as far as we know, but no one knows their future. We need to develop an action plan for providing the good care of captive chimpanzees in Japan as well as one for protecting wild populations and the forests they live in in Africa. No scientific study can now be approved without efforts being taken for environmental enrichment and animal welfare, or for wildlife conservation.

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