

Stone Handling by Japanese Macaques (*Macaca fuscata*): Implications for Tool Use of Stone

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ABSTRACT. Stone-play, a newly innovated cultural behavior, has been observed among the free-ranging Arashiyama B troop Japanese macaques near Kyoto, Japan since 1979. Conditions in which the non-purposeful handling of stones might possibly give rise to tool behavior are discussed. The progression of this behavior is traced through three phases: transmission, tradition, and transformation. During the first two phases, through social learning, the behavior was established within the group as a regular item of their behavioral repertoire and was most frequently observed after eating provisioned grain. In the third phase, observations suggest a "faddish" shift in the practice of certain behavioral sub-types between 1984 and 1985. During this period young individuals increasingly began to carry stones away from the feeding station, mixing stone manipulation with forage-feeding activities in the forest. Observations suggest under such conditions, stone handling is likely to lead to the occasional use of stone as a tool. This conclusion probably can be applied to species other than *Macaca fuscata*. Consideration of the eco-setting and social learning correlates of stone handling suggests how the instrumental use of stone might emerge from a tradition of non-instrumental manipulation.

Key Words: Japanese macaque; Play; Diet and behavior; Tool behavior evolution; Cultural transmission.

INTRODUCTION

BENJAMIN B. BECK has suggested that "the most important set of determinants in the origin of learned tool use... (may be) associative experience with objects in free play or non-problem settings" (BECK, 1980). Prior familiarity with the material properties and relations of objects in an animal's environment could increase the likelihood of their employment in a problem setting; and, on a more basic level of likelihood, fortuitous reward of some pattern of object manipulation requires at least that that pattern occur.

Experience with objects gained early in development may be essential to later proficient instrumental manipulation (RUMBAUGH, 1970, cited by BECK, 1980). MENZEL, on the basis of experimental data drawn from comparisons of wild-born and lab-born chimpanzees, has suggested that full realization of developmental potential for tool behavior depends on "early experience of a very general sort" (MENZEL et al., 1970; see also GOODALL, 1968). However, "...Tool using ability does not lie in the hands alone, in the central nervous system alone, or in the environment alone...but in some lucky interaction and isomorphic fit between them..." (MENZEL et al., 1970). As BECK has made clear (BECK, 1980), the relations between experience, setting, learning and evolution of tool behavior are complex and interesting. The case of Japanese macaque stone handling provides a nice opportunity to examine some of those relations.

Collection and manipulation of small stones by provisioned Japanese macaques was first reported at Takagoyama by HIRAIWA (1975). Stone handling was observed at Arashiyama and Takasakiyama in 1979, and its popularity at those two sites increased through 1984. Stone handling can be characterized, following CANDLAND's terminology, as a form of object play (CANDLAND et al., 1978), with inventive variations transmitted in a context of social facilitation and observational learning, individual repertoires influenced in part by matriline and other associations (HUFFMAN, 1984). HUFFMAN compared the cultural transmission of stone handling with that of feeding innovations well documented for Japanese macaques, e.g., sweet potato washing and wheat washing (KAWAI, 1965; HUFFMAN, 1984). Those behaviors are directly contingent on provisioning and presumably are directly reinforced by food rewards—food which washing makes more palatable or easier to ingest. Stone play, however, appears to be self-rewarding, with no apparent instrumental function, at least in its manifestation to date.

Stone play differs, too, from sweet potato washing and wheat washing in the manner of its early diffusion. Once introduced, sweet potato washing and wheat washing were acquired by older relatives of the innovator (in each case the same young female) as well as by age-mates. Stone play, on the other hand, was first transmitted solely among peer playmates aged 3–5 (HUFFMAN, 1984). At Arashiyama and Takasakiyama, where stone play continues to be observed, the original players have grown to adulthood. Stone handling now is acquired ordinarily a few months after birth by infants whose mothers handle stones. The behavior is widely diffused at both sites, but so far there has been no evidence for its adoption by adults. This tends to support our notion of it as a kind of play. However, since we are not in this paper concerned with the question of what constitutes play, or how play *per se* may contribute to the transmission and evolution of behavior, we will keep to a more neutral terminology: hence *stone handling*.

The behavior at issue involves repetitive manipulation of stone in a variety of ways (HUFFMAN distinguished eight subcategories in his 1984 paper, and we discuss changes in distribution of these, by age, in a later section). Stone handling is readily distinguishable in form and activity context from the occasional pick up, examination, and discard of a stone or other object by a monkey or ape engaged in exploration. Stone handling is essentially a solitary activity; although young monkeys may compete for stones and steal them from one another, stones are not the focus of social play—as when possession of an unusual found object triggers reciprocal chase-and-seizure games—nor is the manipulation of stones incorporated into social displays. In those features which involve collecting, scattering, and regrouping of stones, stone handling resembles the collection of inedible fruits, twigs, or leaves which is infrequently described as behavior idiosyncratic to one or a few related individuals in a group (OOTA, pers. comm. cited by HUFFMAN, 1984; QUIATT, unpub. data on *Macaca mulatta*, Cayo Santiago). What is perhaps most striking about stone handling by Japanese macaques, at Arashiyama and Takasakiyama, is the time and energy which individuals devote to it and its steady increase in popularity.

MATERIALS AND METHODS

This study was conducted on the Arashiyama B troop at the Iwatayama Natural Park, Arashiyama, Japan, over three periods (by one or both of the authors); July 1979–September 1980 (M.A.H.), November 1983–June 1984 (M.A.H.; D.Q. in January), September 1984–