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TOOL MANUFACTURE BY A WILD BONNET MACAQUE, *MACACA RADIATA*

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Many wild and captive primates, belonging to virtually all families of nonhuman primates, except marmosets, tamarins and the primitive prosimians, are known to *use* tools – an example of a behavioural pattern among animals that has interesting implications for the evolution of material culture by human beings. Authentic examples of the *manufacture* of tools by primates, on the other hand, appear to be extremely rare, restricted primarily to chimpanzees and orangutans among the apes and capuchins among monkeys; the latter modify tools readily to obtain hidden foods, but only in captivity! Of the African and Asian monkeys, only lion-tailed macaques in captive social groups were observed to manufacture tools by detaching sticks from larger branches to extract food through narrow openings of enclosed containers. Such observations of primate tool use and modification – both in the wild and in the laboratory – have led to the view that tools are primarily used by primates to facilitate the acquisition and processing of food.

Some primates may, however, rarely use tools in very different contexts. In fact, the only example of elaborate tool manufacture by any monkey in the wild is that by a female bonnet macaque (*Macaca radiata*), approximately 15 years of age, that lived in a large troop of about 45 individuals in semi-arid scrublands on the outskirts of the city of Bangalore in southern India. She was observed to repeatedly insert a dry stick, stiff leaf or grass blade, or a leaf-midrib into her vagina and scratch vigorously, in response to some irritation that appeared to bother her persistently over months. During some 21 hours of intensive observation between March 1993 and September 1994, this female scratched her genitalia on at least 18 occasions. Her dependence on these objects is shown by the fact that on 15 of these occasions she used a tool a total of 34 times, while only on 3 occasions did she use her forefingers alone.

What was more remarkable, however, was that on 8 out of the 15 occasions on which she used objects, she actively manufactured or modified her tools. She did this by usually removing the leaf-blade of dry *Eucalyptus globosus* or *Acacia auriculiformis* leaves with her fingers or teeth, breaking the midrib into several pieces and using only a single short piece. Occasionally, she also detached short sticks from branched twigs, broke them into several pieces, and then used one of these shortened sticks.

The remarkable ability of this individual to use and appropriately modify different objects to achieve the same goal suggests that she could perhaps comprehend the function of detached objects in mediating changes in another out-of-reach object through systematic control. However, does her versatility reflect an insightful use of these tools? Did she have a mental model of a tool to which she could repeatedly refer? The use of different leaf midribs after removal of the blade strongly suggests that she could have indeed recognised a tool-like pattern (stick) within an apparently dissimilar object (leaf) through an appropriate mental representation of her ideal tool. If both these inferences are true, these cognitive mechanisms would correspond to the two highest levels of development in Piaget's series of (human) sensorimotor intelligence, a model that has been invoked in non-human primates as well.

Sophisticated tool-using abilities are believed to have evolved independently in different primate groups primarily as adaptation for the retrieval and processing of embedded foods. This example, however, clearly shows that some species may indeed possess the potential to use and make tools under very different contexts. This observation, coupled with the fact that all laboratory studies on primate tool use have so far used the paradigm of food acquisition, suggests that it is vitally important to document the occurrence of rare behavioural events and patterns, as also their contexts, in wild primate groups; similarly, alternative experimental protocols may have to be designed in order to conduct controlled studies of tool use technology under captive conditions.

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