ORIGINAL ARTICLES

Why do some chelonians seem so silly?

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ABSTRACT. — The behaviour of chelonians is based on instinct rather than on learning. Nevertheless, casual observations suggest that some species are quite capable of association learning if not of insight.

WINNIE-THE-POOH may have been a 'Bear of Very Little Brain', but he was a genius compared with many tortoises. Give them a lettuce leaf, and they almost never try to eat it from the edge in a sensible way. On the contrary, they keep on and on biting at the middle of the leaf until by pure chance, the side falls towards them so that they can get their mouths round it. They are nearly as silly as the goldfish in the pond. These quickly learn to come to the surface when they see me but, when I throw a pinch of food to them, all too often they start to bite at floating leaves or flower petals, which are obviously far too large to get into their mouths. Only later do they begin to eat the food. Moreover, they prefer to eat 'goldfish pellets, floating type', rather than enjoy a healthy varied diet of chopped up worms, breadcrumbs, insects and the like.

Frogs and salamanders are almost as silly. Offer them a beetle or a woodlouse, and they will wait until it has moved beyond reach before they begin to show any response. Nine times out of ten, the prey will have departed long before they begin to show any response at all! Toads need to be stung many times before they learn not to eat honeybees (Cott, 1936, 1940). Surely, one would think, natural selection should have instilled a modicum of learning and common sense over the aeons that have passed since the Testudines or Chelonia first appeared in the fossil record at the end of the Permian period, some 250 million years ago. The ancestry of the Amphibia reaches back to the Carboniferous, nearly 100 million years earlier. Moreover, unlike tortoises, adult Urodela and Anura are carnivorous, and carnivores tend to be more intelligent than herbivores because they need to capture active prey. Perhaps the development of brain cells is more costly in terms of energy than one realises.

Amphibians such as frogs do not display any obvious evolutionary advance over fish, as far as the complexity of their fore-brains is concerned. A frog manages fairly well with its fore-brain removed though it is probably rather sluggish and unenterprising, according to Barnett (1967). Reptiles have substantially enlarged cerebral hemispheres relative to total size, but there is no cerebral cortex as there is in mammals. The cortex arises from the roof of the fore-brain, but it is the floor which is well-developed in reptiles. Thorpe (1956) reviewed learning and instinct in amphibians and reptiles. He cited Fischel (1934) who demonstrated trial-and-error learning in the Snapping Turtle (*Chelydra serpentina*), and added 'The learning curves also show characteristics suggesting insight when the animal is required to learn a modification of the original way of getting at the food — for instance, over instead of under a wire'. Although instinctive behaviour has been studied in depth among Testudines, little attention seems to have been paid towards learning. Doubtless instinctive responses have always sufficed the needs of these armoured herbivores. Moreover, tortoises probably seldom come across cut vegetables or loose green leaves under natural conditions. Consequently they are ill-adapted to deal with them.

Much of my own interest in tortoises stems from the days when I was conducting research on the physiology of thermoregulation in *Geochelone sulcata* (Cloudsley-Thompson, 1970), *Terrapene ornata* (Riedesel et al., 1971) and *Testudo graeca* (Cloudsley-Thompson, 1974) (reviewed in Cloudsley-Thompson, 1999). Adult *G. sulcata* never struck me as being particularly silly, but very probably size had something to do with it. As Jennings (1906) postulated, if an amoeba were the size of a dog, no-one would hesitate to credit it with intelligence. (A common Tripos examination at Cambridge in the 1940s was to comment on this statement.)

In 1969, my colleague Sir Marriot Nicholls (Professor of Anatomy, University of Khartoum) and his wife Mary witnessed a curious event in the tortoise enclosure at Khartoum Zoological Gardens. A large *G. sulcata* fell accidentally onto its back and was unable to right itself. Two other giant tortoises, however, saw what had happened. They hurried over from the opposite side of the enclosure and, with their shells, tipped their unfortunate comrade back onto its feet. This apparently altruistic behaviour has, I believe, also been recorded in other species of Testudines. If it is instinctive, however, how did it evolve? Is it group selection or kin selection? Wynne-Edwards (1962) never mentioned it.

Neither *Testudo graeca* nor *T. hermanni*, charming creatures through they are, ever struck me as being anything other than rather silly. *Terrapene ornata*, however, is another matter altogether. During the summer of 1969, in company with Bud Riedesel at the University of New Mexico, Albuquerque, my wife Anne and I carried out some experiments on thermoregulation in this species of box-turtle (Riedesel et al., 1971). The animals were by no means easy to handle. For no apparent reason they would close their shells with considerable force, pinching one's fingers quite painfully. To prevent this, it was necessary to wedge a cork at either end of the shell before insinuating thermistor probes into the mouth and cloaca. The terrapins evidently did not enjoy this and, surprisingly quickly, learned to close up as soon as the door of the laboratory opened. It soon became necessary to stalk them in their vivaria, catch them by surprise, and insert the corks before they realised what was happening! We were loath to anaesthetise them heavily because it took ages for chloroform or ether to take any effect, and we did not want to risk harming our involuntary guests before returning them to the wild.

These casual observations suggest that chelonians are quite capable of association learning, if not of insight, and by no means so silly as they may at first appear. Robert Bustard (2001) has revealed clear evidence that *Testudo hermanni* has a well-developed ability to learn and remember local topography, and his observations may suggest the possibility of insight!

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