

Researcher prompted by summer swims probes unusual intelligence

October 21 2010, By Alvin Powell

If you were an octopus, would you view the world from eight different points of view? Nine?

The answer may depend on how many brains an [octopus](#) has, or, to say it another way, whether the robust bunches of [neurons](#) in its coiling, writhing, incredibly handy arms bestow on each of them something akin to a [brain](#). Is an octopus a creature ruled by a single consciousness centered in its large brain, or, by dint of its nerve-infused legs, a collaborative, cooperative, but distributed mind?

The idea of a distributed mind among animals is not new, according to Peter Godfrey-Smith, who focuses his efforts on the philosophy of science. Experiments indicate that when a bird learns a skill using only a single eye, and is later tested while being forced to use the other eye, the learning does not transfer well.

“This suggests that animal minds lack the cohesiveness that humans have,” said Godfrey-Smith, a philosophy professor at Harvard. “It may have something to do with consciousness. Maybe it acts as a unifying tool.”

Godfrey-Smith has been swimming with octopuses for years, diving in and around Sydney Harbour during summer breaks in his native Australia. It is only recently, however, that he noticed that supremely camouflaged octopuses were pretty common there.

“For years, I was swimming and diving in this area of Sydney Harbour. I had an idea they were there, but didn’t know what to look for,” Godfrey-Smith said.

Once he understood what to look for, he realized octopuses were all around. They’re so well-camouflaged, he said, it is best to look not for the animal, but for their dens. They often collect bits of marine debris — broken glass, tiles, and other hard substances — and put them out front.

“They’re watching us even if we’re not watching them,” Godfrey-Smith said.

Intrigued, he looked into the scientific literature and was struck by how little was known about octopuses. Octopuses and other cephalopods such as squids are thought to be the most intelligent invertebrates, but the nature of their [intelligence](#) is still a mystery.

Octopuses have large nervous systems, centered around relatively large brains. But more than half of their 500 million neurons are found in the arms themselves, Godfrey-Smith said. This raises the question of whether the arms have something like minds of their own. Though the question is controversial, there is some observational evidence indicating that it could be so, he said. When an octopus is in an unfamiliar tank with food in the middle, some arms seem to crowd into the corner seeking safety while others seem to pull the animal toward the food, Godfrey-Smith explained, as if the creature is literally of two minds about the situation.

There may be other explanations for the observations. But whatever the answer, it seems likely that octopus intelligence is quite different from that of humans and, as researchers ponder the broader meaning of intelligence, may be as different as is likely to be encountered, short of finding it on other planets.

That's because other creatures that are believed intelligent — such as dolphins, chimpanzees, some birds, elephants — are relatively closely related to humans. They're all on the vertebrate branch of the tree of life, so there's a chance the intelligence shares at least some characteristics. Octopuses, however, are invertebrates. Our last common ancestor reaches back to the dim depths of time, 500 million to 600 million years ago. That means octopus intelligence likely evolved entirely separately and could be very different from that of vertebrates.

“Octopuses let us ask which features of our minds can we expect to be universal whenever intelligence arises in the universe, and which are unique to us,” Godfrey-Smith said. “They really are an isolated outpost among invertebrates. ... From the point of view of the philosophy of the mind, they are a big deal.”

They're a big enough deal that Godfrey-Smith has begun collaborating with other scientists in both fieldwork and lab experiments. Though not trained as a biologist, he has participated in experiments with the Sydney Institute of Marine Science aimed at finding out how well an octopus can learn just by observing, which is a controversial question. Godfrey-Smith said the test subjects are the same gloomy octopuses he sees in the harbor, captured and then released after about a week when the tests are concluded. The first test, learning how to open a jar, is being completed, he said. Though there have been some “glimmers” of observational learning, the results are so far inconclusive. He is eager to repeat the tests next summer, modifying the problem the octopuses have to solve.

He also has explored the idea that octopuses — thought to be solitary creatures — may interact socially. During his dives, he has seen two octopuses living just two feet apart for more than a week in Sydney Harbour and has visited a diver down the coast who has found a group of octopuses living together and interacting.

His time in the water has turned up another scientific dividend, observations of the rarely seen process of the creatures mating. In a recent scientific paper, Godfrey-Smith described what he saw, identifying two strategies by the male octopus, one at close range and the second at a distance, where the male extends a sperm packet at the end of an arm. The second strategy seems to be employed when the male is smaller than the female.

Though the exact reason behind the two strategies remains unknown, Godfrey-Smith suspects it may be due to another major difference between humans and octopuses: Females, it seems, sometimes eat the males.

Provided by Harvard University

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