SCIENTIFIC AMERICAN

January 2011 ScientificAmerican.com

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Are creatures better than us at computation?

A number of recent news stories have had a similar kind of message: animals viscerally understand certain mathematical operations better than humans do. Such stories are always interesting in a Sunday-newspaper sort of way, but do the abilities of animals to calculate really exceed those of humans? It may help to examine some of these claims.

In the infamous Monty Hall Problem, named after the television game show, human subjects seem to pale next to pigeons in mathematical reasoning. A guest on the show has to choose among three doors, behind one of which is a prize. The guest states his choice, and the host opens one of the two remaining closed doors, always being careful that it is one behind which there is no prize. Should the guest switch to the remaining closed door? Most people choose to stay with their original choice, which is wrong—switching would increase their chance of winning from $1/3$ to $2/3$. (There is a $1/3$ chance that the guest's original pick was correct, and that does not change.) Even after playing the game many times, which would afford ample opportunity to observe that switching doubles the chances of winning, most people in a recent study switched only $2/3$ of the time. Pigeons did better. After a few tries, the birds learn to switch every time.

They learn, but do they calculate or understand? Not at all. Good empiricists, the pigeons simply follow the evidence. People, on the other hand, overanalyze and get confused.

Bees who seem to find the shortest path connecting many flowers in a meadow provide another example of what appears to be animal perspicacity. Even if the path they follow is optimal (and the only way to find out is to measure all possible paths), they cannot be said to have come up with a general algorithm, a task so complex that it belongs in a class of virtually unsolvable problems called NP-hard. Their path may often be a good approximation of the shortest path, but there is no good reason to think that they will always produce such an approximation, much less the optimal solution for all placements of an indefinite number of flowers.

Similar hyperbole arises in articles about dogs' alleged ability to do calculus and spiders' knowledge of geodesics (not to mention octopuses' knowledge of soccer). Alas, although all these results (except for the last) are of real scientific interest, they are almost always mischaracterized as instances of understanding. By insinuating that animals' innate instincts are superior to humans' feeble attempts to mathematize, some of the journalistic accounts betray an anti-intellectual bias. "What good are our dry algorithms, our probability, calculus and geometry," they seem to ask, "when pigeons, bees, dogs and spiders can do the math without thinking?" —*John Allen Paulos*

Paulos is a professor of mathematics at Temple University.

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