

Calculating corgi knows best

Fetch: A professor's playful dog inspires a look at natural intelligence.

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Can dogs do calculus? Or has evolution simply equipped their brains to calculate the fastest route to their prey?

Those questions occurred to Tim Pennings, an assistant math professor at Hope College, in Holland, Mich., as he watched his corgi, Elvis, race repeatedly down the beach and into Lake Michigan to retrieve a ball.

Pennings recognized the problem, a common one in calculus texts about figuring the "optimal" — in this case the fastest — route from Point A to Point B through two different mediums at two different speeds.

Elvis could jump into the water and start swimming toward the ball immediately. Or, he could race down the beach until he'd minimized his swimming distance to the ball. But the fastest path lay somewhere in between — run partway down the beach, then launch into the water and swim to the ball.

So, Pennings calculated Elvis' speed on land and in the water, and worked out a mathematical model of his ideal path. Then he began tossing the tennis ball

$$T(y) = \frac{z-y}{r} + \frac{\sqrt{x^2+y^2}}{s}$$

Oooo



PHOTO BY TIM PENNING; SUN ILLUSTRATION

Professor Tim Pennings found that Elvis naturally tended to use the "ideal path" when retrieving tennis balls thrown into a lake.

into the lake to test how close Elvis came to the ideal.

For three hours, Pennings hurled the ball out into the lake. And 35 times, Elvis ran down the sand and, at some point leapt into the water and swam out to the ball. Pennings measured each trial and plotted the results on a graph.

"It seems clear that in most cases [31 of the 35 trials] Elvis chose a path that agreed remarkably closely with the ideal path," Pennings wrote in the May issue of *The College Math-*

ematics Journal. Given such complications as wind, waves and fatigue, he said, "it is possible that Elvis chose paths that were actually better than the calculated ideal path."

"Elvis' behavior is an example of the uncanny way in which nature ... often finds optimal solutions," Pennings wrote. "It could be a consequence of natural selection, which gives a slight but consequential advantage to those animals that exhibit better judgment."