

Researcher figures out how sharks manage to act like math geniuses

September 17 2014, by Bob Yirka



Great white shark at Isla Guadalupe, Mexico, August 2006. Credit: Terry Goss/Wikipedia

(Phys.org) —Bioresearcher Andy Reynolds with Rothamsted Research in the U.K., believes he has solved the mystery of how sharks act like math geniuses—they simply turn away from turbulence, he reports in his paper published in the journal *Proceedings of the Royal Society A: Mathematical, Physical and Engineering Sciences*. His research effort and

paper came in response to prior research that showed sharks trap prey using what's known as Lévy flight—a mathematical description of an optimal way of moving from one position to another using both long and short hops.

By most simple measures, sharks are not the smartest swimmers in the sea, yet, they have somehow managed to learn to use Lévy flight when chasing prey, optimizing energy use in the process. So, how do they do it? Reynolds claims its more reaction than thought and believes his computer simulations prove it. Normally responsible for investigating or developing models of insect movement patterns over terrain, Reynolds in this case, turned his attention to the way sharks and some other sea creatures move through their environment when chasing prey. After learning that many of them use Lévy flight, he sought to find out why.

[Lévy flight](#) actually makes sense for predators, he found, it's based on movements that can be used to gain the most amount of resources for the least amount of effort. Reynolds suspected [sharks](#) wind up using it due to [turbulence](#) in the water. Turbulence, he notes, is not conducive to efficient swimming. He turned to a part of turbulence theory which suggests that Lévy flights can arise naturally if a chaser (the shark) turns away from the direction of unusually strong turbulence. He took what he'd worked out with his math calculations and translated it to a computer model of shark movement. When run, the simulation showed the theories matched perfectly with real world observations. Sharks, it seems, are not great thinkers, instead, they merely appear to be so by simply avoiding messy turbulence.

Reynolds' results show that seemingly intelligent behavior in other animals may not be what it appears, and thus researchers and others observing such behaviors should consider the possibility that other factors may be at play.

More information: Lévy flight movement patterns in marine predators may derive from turbulence cues, *Proc. R. Soc. A* 8 November 2014 vol. 470 no. 2171 20140408, [DOI: 10.1098/rspa.2014.0408](https://doi.org/10.1098/rspa.2014.0408)

Abstract

The Lévy-flight foraging hypothesis states that because Lévy flights can optimize search efficiencies, natural selection should have led to adaptations for Lévy flight foraging. Some of the strongest evidence for this hypothesis has come from telemetry data for sharks, bony fish, sea turtles and penguins. Here, I show that the programming for these Lévy movement patterns does not need to be very sophisticated or clever on the predator's part, as these movement patterns would arise naturally if the predators change their direction of travel only after encountering patches of relatively strong turbulence (a seemingly natural response to buffeting). This is established with the aid of kinematic simulations of three-dimensional turbulence. Lévy flights movement patterns are predicted to arise in all but the most quiescent of oceanic waters.

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