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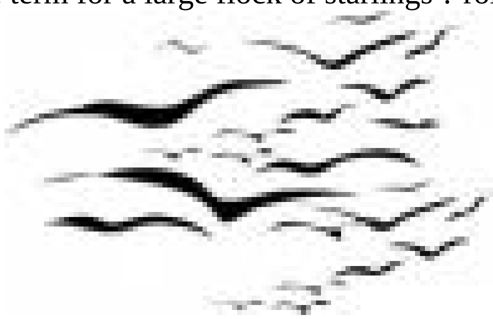
Flocks that turn on a dime -- one of nature's deep mysteries

Rich Heffern | Feb. 16, 2011 Eco Catholic

We?ve all seen this ? even if you live in a city. A flock of starlings consisting of maybe a few hundred or more individual birds turns on a dime all at once. It?s startling. It?s wonderful. How do they do that?

A murmuration ? that?s the term for a large flock of starlings ? rolls ?like a drunken fingerprint across the sky,? as the poet Richard Wilbur



wrote, ?smudging the dusk horizon with the quickness of a pulsating jellyfish.?

The ancient Romans believed that the gods hinted at their intentions in the way birds flew. Scientists of the last century groped for such mysterious concepts as ?natural telepathy? or a ?group soul.?

Many birds flock, of course, but only a few species really fly together, creating what University of Rhode Island biologist Frank Heppner proposed calling ?flight flocks? ? namely, highly organized lines or clusters. Pelicans, geese and other waterfowl form lines and Vs, to take advantage of aerodynamic factors that save energy. But the most impressive flockers are those that form large, irregularly shaped masses, such as starlings, shorebirds, and blackbirds. They often fly at speeds of 40 miles per hour while the space between them may be only a bit more than their body length. Yet they can make surprisingly sharp turns that appear to be conducted entirely in unison. ?Imagine doing unrehearsed evasive maneuvers in concert with all the other fast-moving drivers around you on an expressway, and you get an idea of the difficulty involved,? writes Peter Frierederici.

Through today?s technological innovations, from high-speed photography to computer simulations, biologists have been able to view and analyze bird flocks as they never could before. ?There?s a lot we don?t know,? said Heppner, ?but I think we?re actually going to know how and why birds fly in organized groups within five years.?

Self-interest explains the density of flocking. Individuals are safer from predators when they are in large groups. But there?s no way every member of a group can see a fast-flying falcon or hawk at the same time. How can they possibly know what direction to move in in order to avoid the predator?

Dmitri Radakov, a Russian scientist, who studied schools of fish in tanks devised a theory to explain their flocking behavior, which probably applies to birds as well. It runs out that only three simple rules are enough to form tightly cohesive groups. Each animal needs to avoid colliding with close neighbors, to be generally attracted to others of its kind,a nd to move in the same direction as the rest of the group. Plug these behaviors into a computer model and you can create ?virtual swarms? that change density, alter their shape, and turn on a dime ? just as bird flocks do.

In the real world, though, there are problems with this model. It does not adequately explain how flocks can move as quickly as they do. Wayne Potts, a biologist at the University of Utah, studied dunlin flocks on Puget Sound. He made movies which he analyzed frame by frame, showing how each individual moved. He was able to show that a turn ripples through a flock just as a wave can pass through sports fan at a football game. He called his theory the ?chorus line hypothesis? ? a dunlin watches a number of birds around it, not just its nearest neighbors, for cues. ?The wave propogates through the flock at least three times faster than could be explained if they were just watching their immediate neighbors,? says Potts.

Scientists who study the phenomenon all agree now that the explanation lies in both acoustic and visual observation, but that the exact way it works is still not known. Heppner speculates that there may be some fundamental math-based behavior going on ? the kind of thing that physicists call ?emergent property? in which the whole is greater than the sum of its parts. ?It?s entirely possible that you get unpredictable behavior out of predictable rules,? Heppner says.

It?s one of the deep mysteries of the natural world. As we continue to search for the explanation, we can still stand in awe and wonder watching it.
