ScienceWatch – Pigeons in Flight Follow the Leader

"It is the first study demonstrating hierarchal decision-making in a group of free-flying birds" – T. Vicsek

Anyone watching the coordinated flight of a flock of birds has probably marveled at their ability to rapidly change direction as one. How they manage to shift direction in synchrony has been a mystery until now. Writing in the April 8, 2010 issue of *Nature*, a team led by biophysicist, Tamás Vicsek, Eötvös University, Budapest, Hungary, shows that homing pigeons (*Columba livia*) do it by using a hierarchal "follow-the-leader" pattern.

The scientists outfitted 13 pigeons with tiny GPS data logger backpacks weighing just 16 grams (0.56 oz), which recorded each bird's flight path every 0.2 seconds. They then released up to 10 birds at a time either in "free flights" near the home loft or "homing flights" a distance of ~15km (~9 mi) from the loft. Using the GPS they could follow each bird in the flock and look for "leading events"—when a bird's direction of motion was copied by another bird but delayed in time.

They found that such follow-the-leader events occurred in a pair-wise fashion, i.e. each bird consistently tended to copy directional changes of another, resulting in a pecking order during flight. The hierarchical leadership pattern occurred during both free flights and homing flights and is different from other collective behavior, like that seen in schools of migrating fish, where control of the group's movements is distributed among its members.

The average time it took each bird to copy the directional change of its leader was 0.37 seconds, considerably longer than reflex responses, and probably was the time it took for the follower to decide that its leader had actually changed direction. Although, birds that were flock leaders tended to be somewhat better navigators when tested in solo flights, the team found that leadership of the flock was not set in stone. While the same bird was the leader in eight of the 15 observed flights, other birds took over during the remaining ones.

Vicsek believes this flexibility arises because the birds are familiar with each other's ability. "These birds know each other. They know which is the smartest. The fastest bird will even follow the slower one who knows the way home the best," he says. The same bird did not always lead during a particular flight, perhaps says Vicsek, because it got tired.

Although not always the first bird, the flock leader generally stayed in front, while followers tended to fly to the right of the leaders. According to the authors, this lateral bias stems from the fact that in pigeons the left eye (right brain) is better at recognizing individuals.

The scientists hope that this study will shed light on how leadership is determined in other animals. "We identified a clear hierarchical structure within the decision-making process," says team member Dora Biro, University of Oxford, Oxford, UK. "The degree of coordination that flocks achieve is really impressive". She says the next step is to find out "what airborne leaders are made of".

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