New research finds people and pigeons see eye to eye

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Pigeons and humans use similar visual cues to identify objects, a finding that could have promising implications in the development of novel technologies, according to new research conducted by a University of New Hampshire professor.

Brett Gibson, an assistant professor of psychology who studies animal behavior, details his latest research in the journal article, "Non-accidental properties underlie shape recognition in mammalian and non-mammalian vision," published today in Current Biology. Gibson and his colleagues found that humans and pigeons, which have different visual systems, have evolved to use similar techniques and information to recognize objects.

"Understanding how avian visual systems solve problems that require considerable computational prowess may lead to future technological advances, such as small visual prosthetics for the visually impaired, in the same way that understanding visual processing in honeybees has led to the development of flying robots and unmanned helicopters," the researchers say.

So a software engineer who wants to design a program to help a robot recognize objects can get a leg up from evolution, which has been developing "programs" for object recognition in animals long before humans ever thought of doing such things, Gibson says. "To the extent that we can learn how different animals recognize objects and whether they are doing the same things or different things based on their environments may really help us in designing our own system of object recognition."

Gibson and his colleagues from the University of Iowa (Olga Lazareva and Edward Wasserman), the University of Montreal (Frédéric Gosselin), and the University of Glasgow (Philippe Schyns) found that pigeons, like humans, primarily rely on corners (coterminations) of an object in order to recognize it instead of relying on other features such as shading and color.

For example, a person could easily identify a AA battery from the side profile. But, let's say the person could see the same battery only from the bottom with the negative terminal. From this perspective, the only visible outline would be a circle; from the bottom, the corners of the battery now are not visible and information about the corners cannot be seen.

"The task of recognizing the object becomes much more difficult. For most people, it would take them a bit longer to recognize the image as a battery," Gibson says.

The researchers employed a new procedure, which Gosselin and Schyns developed, called Bubbles, to determine what features humans and pigeons were using to recognize objects. Three pigeons were trained to recognize four objects: an arch, a barrel, a brick, and a wedge. The researchers then partially revealed different parts of the object pictures. They then conducted the same experiment with six people.

Not only did both the pigeons and people recognize the four objects based mostly on corners, but they used these properties more than the shading information contained in the images. More notably, the pigeons and people used corner information more than a computer programmed to extract the most useful information for recognizing the object pictures, which suggests that the pigeons and people were using comparable information.

"When members of different species respond similarly to the same visual information, we gain confidence in the prominence of this information, irrespective of cultural or genetic influences. Birds represent an important group to compare with mammals, the other major class of warm-blooded, highly mobile, visually oriented animals," the researchers say.

"Because of the unique demands of flight, for the last 200 million years birds have been under strong evolutionary pressures to keep their overall size to a minimum. Although a very large portion of the avian central nervous system is devoted to visual processing, the bird brain is still just a fraction of the size of our own. It is this extraordinary mixture of visual competence and small size that makes the study of birds critical to our understanding of the general mechanisms of visual cognition," they say.

In addition to his research on vision, Gibson has done extensive research involving navigation and memory in birds. He is currently investigating how the Clark's nutcracker uses different types of spatial information to return to hidden stores of food during winter. More information: www.unh.edu/news/cj_nr/2006/october/lw10bird.cfm?type=n.

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