

# Do You See What I See?

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As an optometrist with pets, I have often wondered what my companion animals really see. Although we cannot be sure, scientists are finding ways to measure Nature's secrets. Many animals, for instance, can see much better in dim illumination than we can. However, most animals do not see colors as well as we do but some see many colors we cannot.

There are two different types of cells responsible for vision—rods and cones. Rods detect motion and function well in reduced light; cones create central, detailed, color vision. We have cones for seeing tiny detail, called 20/20. Animals with larger percentages of rods have what we would consider legal blindness yet are well-suited to their darker environments.

The location of the eyes in the head distinguishes prey animals from predator. Prey animals have eyes in the sides of their heads to see a wide field of view. Predators' eyes are in the front of the head which merges information from both, creating stereopsis (depth perception) for pouncing. Animal eyes are almost always fixed in the skull limiting vision above and below.

Dog eyes have more rods than human eyes so they are able to detect small motions more easily. If one stands very still, dogs often look slightly confused because they "lose" you. Dogs depend on their sense of smell once they have detected the motion of their prey. With fewer cones they cannot see details as clearly as we do. Vision clarity is limited—we can see three times further than dogs. Color detection is probably limited to yellows and blues.

Unlike human eyes, cats have an extra layer in the eye called the tapetum. This is the layer which causes cat eyes to "glow" in the headlights. The tapetum reflects light back through the eye greatly increasing vision at night. The pupil allows light into the eye, adjusting in size depending on the light available. Human pupils are round, while cat pupils are vertical slits. Slits open more quickly and more fully, giving better night vision. Cats function well in as little as one sixth the light necessary for humans.

Clear vision is very important for birds so they have big eyes for their body size. Bird eyes have a much higher density of cones compared to humans, five times as many in the case of hawks. They also have two focus areas, one of which acts as a telescope for magnifying tiny prey miles below. Birds may see more colors than humans, including ultraviolet. Often their feathers will reflect ultraviolet light invisible to us, perhaps useful in mating or determining health status.

Parrots have a behavioral response to stimulation called "pinning"—the pupils dilate and constrict rapidly while the bird is thinking. This can be good or bad, depending on whether he is thinking about biting you or welcoming you! Owls have depth perception like humans which aids in pouncing on prey. Eagles have the sharpest vision of all animals. Pigeons are thought to have the best color detection of any animal on earth.

Horses have the largest eyes of all land animals. As prey animals, horse's eyes are on the side of their head. They have a wide, circular view of their environment but have limited binocular vision and a blind spot right in front of their nose. Night vision is limited for horses but their detail vision is similar to ours.

Fish have a keen sense of vision—their vision is on par with ours, many see colors, and some see well in dim light. Structurally different, they move their internal lens back and forth rather than stretching it to create focus. Reptiles' vision varies depending on their environment. Many snakes use infrared vision to detect the heat of their prey. Old world chameleons can actually rotate their eyes, one independently of the other.

We love our pets and we want to better understand their world. Vision is a significant part of that world, and impacts their lives much as it does our own. Healthy eyes and good vision are an important part of making their lives, and ours, fuller.

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