



A DIFFERENT KIND OF VISION

Power of the Dog to See What We Can't

Dogs aren't known for their sharp eyesight, and for good reason: Scientists believe a dog's ability to focus on and clarify a given object (called "accommodation") is only one-fifteenth that of a human's. Yet even in the visual arena, dogs put up a good fight. Their ancestry as nocturnal predators gives dogs powers of vision that humans utterly lack: Dogs can see well in dim light, perceive moving objects from afar, and detect flickering lights.

Archaeologists have unearthed evidence that this unique sense of sight was the reason dogs were first welcomed into towns and cities. The very first civilizations were in the Middle East and Northern Africa. Etchings and rock paintings from this era repeatedly depict dog-like animals that are akin to modern sighthounds. The pictures show these dogs on a leash, being led into the hunt.

The dual dog ability to detect motion and see well in dim light was exactly what ancient humans needed. The earliest

POWER OF THE DOG

to See What We Can't

civilizations arose in a desert landscape, so the ability to detect motion over long distances would have been vital in hunting. Humans could shoot game from far off because they had bows and arrows, but they couldn't detect the game over open desert expanses. This is why hunting dogs were used. Humans also can't see well at night, so they were unable to defend their burgeoning cities from intruders. This is why watchdogs were introduced to civilization.

So while dogs have an amazing sense of smell, it was actually their vision that made them useful to ancient peoples. Scientists believe sighthounds were the first dog domesticates of Africa and Eurasia, making modern sighthounds some of the most ancient dog breeds. Ancient sighthounds were treated like gods, and even in modern times, sighthounds are revered in Middle Eastern and Northern African cultures. In both Bedouin and Egyptian languages, salukis (an ancient sight-hound breed) are called "the noble ones," and they are exempt from the Islamic law that asserts that dogs are unclean.

In 1875, a famous westerner witnessed first-hand the mysterious reverence with which sighthounds are treated. Lady Anne Blunt, Lord Bryon's granddaughter, was traveling through the deserts of Arabia, guided by nomadic Bedouin tribespeople. The Bedouin were very fond of a dog they called the saluki, which Lady Anne mistook for a greyhound. On three separate occasions, Bedouin guides gave Lady Anne a sighthound as a gift. They considered this the ultimate demonstration of hospitality.

As Lady Anne traversed the deserts of Jordan, her guide brought along his favorite dog, which he called Sayad, mean-

ing "hunter." Sayad was responsible for killing the desert hares, birds, and hyenas that sustained the humans during their long desert journey. Lady Anne reported in her journal that Sayad was a "very handsome greyhound...of the long-haired breed, which has a wonderful nose for game. His master declares he sees the birds, for the Arabs do not seem to understand the theory of scent."

Lady Anne was mistaken. While British biologists had already discovered the dog's unequaled sense of smell, sight-hounds don't use their noses when they perceive hares darting across a desert landscape, hundreds of feet away. They are taking advantage of their acute sensitivity to movement, which is made possible by the special architecture of the canine eye.

Dogs, like the wolves they evolved from, have eyes that enable them to hunt during the night. Dog pupils are large, to let in as much light as possible. Once an image has entered through the eye's pupil, it passes through the lens, which in turn focuses the image onto the retina, which is located along the back wall of the eyeball.

It is the anatomy of the retina that limits a dog's visual acuity, while simultaneously allowing the dog to detect movement in dim light. The retina is lined with cells that are light-sensitive, called photoreceptors. The eye of any mammal has two main types of photoreceptor cells: rods and cones. Rods are especially sensitive to light, and are also associated with perception of movement.

Cones, meanwhile, are the receptors of fine detail and visual acuity. Most mammals have both rods and cones in their retinas; dogs tend to have a higher proportion of rods. The

central area of the retina in the canine eye contains about 20 percent cones, while humans have an area called the fovea that consists of 100 percent cones.

To make their night vision even better, dogs have an extra layer of cells called the "tapetum lucidum," located directly behind the rods and cones of the retina. When light that gets past these rods and cones hits these cells, they reflect the light almost straight back out. This means a dog has two chances to perceive light: When the light is reflected, it has a second chance to be absorbed by the photoreceptors. The tapetum lucidum is responsible for that shiny look in dogs' eyes when you shine a light in them at night.

Once again, these forces that improve a dog's night vision also lower visual acuity. Paul Miller, a research professor of comparative ophthalmology at University of Wisconsin, Madison, says that "although the tapetum improves vision in dim light, it also scatters some light, degrading the dog's vision from the 20:20 that you and I normally see to about 20:80."

So while our canine cousins excel in night vision and perception of movement, they have poor acuity. From a dog's-eye view, there is little need to perceive the details of nearby, stationary objects. Dogs are evolved from canids (a family that includes wolves, foxes, jackals, and coyotes), which hunted over large tracts of land. For them, the ability to detect movement over distance was more important than seeing nearby objects. A dog has its sense of smell for this type of fine distinction. Humans evolved from rainforest primates who never saw over open distances (there were too many trees in the way), yet they needed to use detailed visual cues (mostly

color) to determine which of the rainforest's many fruits, vegetables, and nuts were poisonous or not.

Dogs are not good at seeing details. Many owners have realized that their own dog is not good at recognizing them until they speak out loud. Dog breeder Caroline Coile recounts with amusement her dogs' apparent inability to recognize her by sight: "The dogs sniff the air, crane their necks, stare, and begin to pace and bark nervously. It is apparent they're not sure who I am.... I finally speak, and the relief is palpable as they swamp me with enthusiastic greetings. The scary part is, these are salukis—sighthounds!"

The propensity of rods in a dog's eyes has another curious side effect—dogs are extremely sensitive to flickering light. The light frequency at which flickering lights appear to fuse into a constant image is called "flicker fusion," and it differs from one species to the next. Dogs have high flicker fusion. The benefit of this is unknown, but it does cause trouble for those dogs that spend hours barking at the tantalizing play of light and shadow on the wall. This also means dogs probably don't enjoy watching television, as to them the image is rapidly flickering, rather than the smooth image that humans perceive.

Dogs, then, wouldn't have the visual acuity to pass even the most forgiving driver's license test, and they don't recognize details of an object held in front of their very eyes, unless they can smell it. But this apparent blindness is not too much of a price to pay for the other powers of vision that a dog boasts—the ones that allow dogs to stand guard, peering out into the night, ready to alert their master to the slightest of movements.