

How Dogs See

By Carmen J Thompson

On a recent snowy winter morning, the wind was blowing loudly from the North. Dressed in my warmest clothes, I headed into the wind to check on my dogs and goats. As I approached my livestock, which were huddled about 50 feet away, my two Anatolian Shepherds noticed me. They quickly rose to their feet and started barking loudly and advancing towards me. They covered 30 feet rapidly and were about 20 feet away when their demeanor changed. The barking ceased, and their whole bodies wriggled with pleasure at seeing me.

To better understand how our dogs see the world, we need to understand the differences between human vision and dog vision. Dogs have less visual acuity than humans and must therefore get closer to an object to see it. Even then, they do not see it as clearly as humans. Humans with 20/20 vision can distinguish objects from a distance of 20 feet. A typical dog has a visual acuity of 20/75, which means that he must be 20 feet from an object to see it as well as a human standing 75 feet away. Essentially, we would consider dogs to be farsighted.

Researchers have found that visual acuity varies among different breeds and bloodlines of dogs. While recent studies indicate that most dogs are farsighted, one study found that more than half of the German Shepherds, Rottweilers and Schnauzers were myopic or nearsighted. In all of these breeds, the nearsightedness tended to occur within the same families. In comparing a group of German Shepherd guide dogs with nonguide German Shepherds, it was found that 34% of the guide dogs had myopia¹. The findings seem to indicate that refractive state may have a hereditary component¹. It is not surprising that vision is hereditary. Sighthounds have been selectively bred for thousands of years to chase prey, while retrievers must visually track objects which fall from the sky.

Another factor in canine vision that varies by breed is peripheral vision. Eye set determines peripheral vision. Prey animals have wide-set eyes to allow them to see approaching predators. Humans and dogs have eyes set closer together. Human's eyes are set straight forward, but dogs, depending on the breed, are usually set at a 20 degree angle⁵. The angle of the dog's eye set increases its peripheral vision. Two studies have indicated that the field of view in dogs is approximately 60-70 degrees greater than that of humans⁴. This increased peripheral vision enables the dog to see more of what is going on around him.

It is also important to understand the differences in animal's vision regarding color and contrast. Cones provide color perception while rods detect motion and provide better vision in low light. Dogs only possess 10% of the cones that humans have. Because their retinas are rod dominated, dogs see better in the dark than humans and have motion-oriented vision⁵. This ability to see well in dim light has historically helped the species survive by finding food at night. Humans are believed to possess three types of cones which gives us trichromatic vision. Dogs, and most other animals, have dichromatic vision; they see two colors. Studies suggest that what the average dog sees is like a human who is red-green colorblind. The dog's world consists of yellows, blues, and grays. "When a human perceives a red object, it appears as yellow to the dog, while a green object appears as white"². Dogs are unable to differentiate between what we see as green, orange or red. It is believed that dogs see yellow the best. Yellow is the high-contrast color for almost all animals.

If you have participated in agility, you may have observed that the sections on obstacles where the dog is required to touch are often painted yellow. The high contrast is supposed to catch the dog's attention and encourage him to walk on that area of the obstacle. On the obstacles at the agility club where I used to take my dog, the see-saw was painted blue in the middle and yellow at the ends. The presumption is that the dog can see the obstacle in his color spectrum with the yellow end providing a contrast highlighting that part of the obstacle. In applying this research to your daily life, Grandin notes the importance of being aware of how a typical animal may see the color yellow. "Anything yellow will really pop out at them, so you have to be careful about yellow raincoats, boots, and machinery"^{3,44}. Dog's limited color and low light vision intensifies the contrasts between light and dark. Dogs use a tapetum lucidum which is the reflective

layer that shines when a bright light is shone on the dog's eye in the dark. It is thought that this reflective layer functions by reflecting light back through the retina—essentially giving the photoreceptors a second chance to react⁴. It has also been shown that the tapetum lucidum also enhances contrast.

Understanding that animals see objects in sharper contrasts can help us to figure out how they are seeing their environment. For example, slowly rotating fan blades are a high-contrast stimulus because they create a flicker which is perceived by the animal much like we perceive a police light. In her work with the meat packing industry, Grandin uses black and white photography to understand which objects or shadows seemed to startle the cattle. One example Grandin cites, which emphasizes the importance of contrast, is when her friend's lab was panicked by her son's Halloween costume. It was the "scream" costume which has a black and white face. This high contrast exacerbated the dog's reaction. It did not matter that the boy sounded and smelled the same; the dog could not overcome the change in appearance. Just because we do not see what is startling the animal, the threat may be **glaring** to the animal.

What are the practical implications of understanding how our dogs see the world? If we can better understand how our dog literally sees his environment, then we can get a better idea of what he may be thinking. The visual information a dog receives directly affects his reaction to the visual stimulus. Understanding a dog's reaction allows us the opportunity to correct unwanted behavior and predict future behavior. We can also get a better grasp on our dog's capabilities and limitations. Don't expect your Anatolians to visually recognize you across the field. Your dog will recognize you by your walk, your voice, or your smell before he is able to clearly identify your face.

Works Cited

¹ Coile, D. Caroline Ph.D. "Bringing Dog Vision into Focus."

² Davis, Jennifer. "Color and Acuity Differences Between Dogs and Humans." 1998

³ Grandin, Temple. *Animals in Translation*. New York: Simon And Schuster, 2005.

⁴ Miller, Paul E., DVM, and Christopher J. Murphy, DVM. "Vision in Dogs." *Journal of the Veterinary Medical Association (JAVMA)*, vol. 207, no. 12, pp. 1623-1634, Dec. 15, 1995).

⁵ Probst, Sarah. "Through the Eyes of Your Canine." *University of Illinois, College of Veterinary Medicine*. June 15, 1998.