

Animal Vision System

Basic Facts About Animal Eyesight

by: Sarah Alharbi



How does the human eye work?

The human eye works as a camera to capture life around us as we see it. Light reflects or bounces off of subjects in view and enters the eye through the pupil. The pupil controls the amount of the light entering it by increasing or decreasing the physical size of the pupils opening.

When light reaches the retina at the back of eyeball, it creates an upside-down and back-wards image of the subject matter the eye sees. The images is created by using cones and rods in the retina, which are light sensitive cells, the image is converted into neural messages. These messages are then delivered to the brain through the optic nerve. After the brain reads them, it tells the human mind what is being looked at so the human can actually see the subject.

How does the animal vision system differ?

For many years, animal vision system was inscrutable. However, recently researches have shown similarities and differences between the human and animal vision. Animal eyes work for the same goal, which is to help observe the surrounding world. In most cases, animals have a very similar eye anatomy to the human, including components that help the animal to survive the environment. For example, some birds have a nictitating membrane, which is a transparent third eyelid, to protect and moisten the in eye while preserving visibility. Cats and dogs have the same eye orientation as a human being. This helps to create one image with both eyes that where one subject is created without having a gap in between. On the other hand, horses have a blind spot in front of their nose because of their peripheral vision.



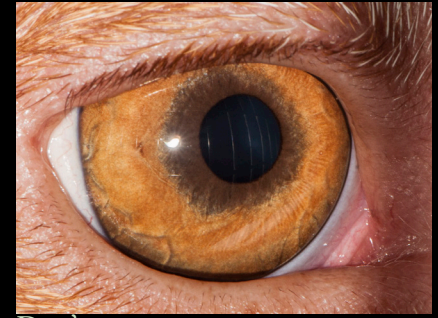
Human's eye



Nictitating Membrane layer



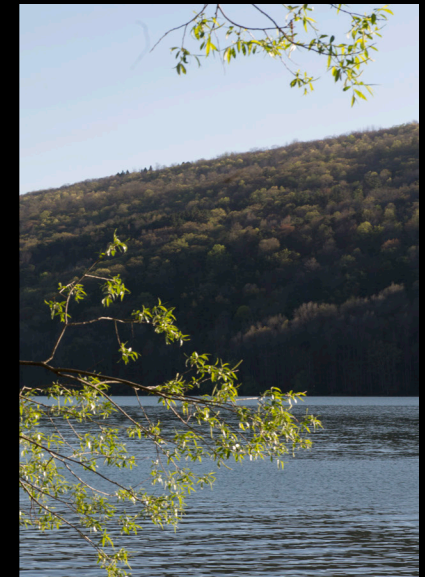
Cat's eye



Dog's eye



The result of the horse peropheral vision



Sensitivity to Light and color:

Cats and dogs depend on their ability to smell and hear voices to locate or target a subject since their vision system is not strong as human. However, they have a better night vision than humans, which makes them good hunters. Cats have elliptical pupil built in their eye, which requires a relatively bigger size eyeball than humans. This bigger size of the pupil allows more light waves to get to the back of the eyeball. The elliptical pupil is significantly faster when it opens and closes than the round pupil. Whenever a cat owner tries to take a picture with a flash, the cat's eye appears glowing and reflecting the flash. This reflection is a result of layer of tissue behind the retina, which is called Tapetum Lucidum. The reflective layer works as a mirror to bounce and reflect the light to go through the photoreceptors. When the light misses those photoreceptors, the Tapetum Lucidum bounces the light again and the eyes of the cat glow. This process works very well to help cats to see through the dark.

The birds vision system contains visual pigment rhodopsin, which helps birds have better visibility during the night. For this reason, birds are considered as color oriented animals. As study has been done on a specific type of parrots to test the color reception strength. Lights with different colors (Blue-Yellow- Red) have been placed in different areas. Near the yellow light, food was placed so whenever the parrot goes toward the blue or red light, it cannot find food. So the parrot directly goes the yellow light. The placement of the yellow light has been changed to observe if the parrot links between the distance and the food. Surprisingly, the parrot flies directly to the area where the yellow light is moved to find food.



Wide-open Elliptical Pupil
of a cat



Narrow opening of a cat
Elliptical Pupil



Emu

Eye Orientation:

Animals may have different eye orientation than humans, helping animals to dictate the range of what they see without the need to turn their head. Cats are similar to human front field of view, which is around 140° . Side ways, they can see more than what a human does. An even more fascinating truth is that a horse can see up to 360° which means they could see behind them according to their eye placement in the side of their heads. However, horses cannot see what is directly in front of their heads according to their peripheral vision. The field of view for a dog is 85° and for a human is 120° .

Gallery:



Horse's Eye



Goat's Eye



Emu's Eye



Cat's Eye

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Resources:

- <http://www.aaofoundation.org/what/heritage/Upload/Animal%20Eyes.pdf>
- <http://www.animaleyecare.com/animalvision.html>
- <http://webcoist.momtastic.com/2009/01/14/animal-vision-color-detection-and-color-blindness/>
- <http://www.mnn.com/earth-matters/animals/stories/how-animals-see-the-world-infographic>
- <http://www.livescience.com/40459-what-do-cats-see.html>