Module 3 : How Animals See the World/Animal Vision

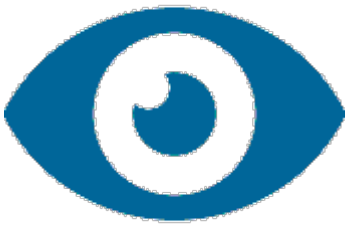
- Is all animal vision the same?
- Seeing colours
- Seeing by feeling
- Night vision

In this module we will explore animal vision, by learning about the following points.

- Is all animal vision the same?
- Seeing colours
- Seeing by feeling
- Night vision
- Researching animal vision

How Animals See the World/Animal Vision – 5m04s

3.1 Is all Animal Vision the Same?



Many animals use their eyes in the same way as us humans, but there are some differences.

Colour

You may have heard that many animals cannot see in colours, but this is not entirely accurate. Although some animals are able to see in colour, there is a limitation as to how much colour they can see. These animals just have poor colour vision and every species sees differently. The human eye is one of the most advanced for daylight, with the ability to see a full spectrum of colour.

Field of vision (Binocular)

Where the eyes are positioned also makes a difference to the field of vision. For instance, dogs and cats have eyes that are positioned wide apart on the head and therefore have better peripheral vision than humans. However, this decreases their depth perception.

Clarity of vision (Acuity)

While humans depend heavily on their normal 20/20 vision, other animals may not, relying on their other senses. For example, dogs will see clearly to 20 feet, as human do at 75 feet. Cats, however, have a more similar acuity vision to humans but also see better at close range.

Night vision

Compared to other animals, humans have limited night vision. While able to see in the dark, humans lack the sharpness that many other animals require in order to see effectively in the dark.

Humans also have farsightedness, near-sightedness and colour-blindness issues that can limit what is seen.

3.2 Seeing Colours

If animal vision varies between the different species, then which animals can see colours and what can they see?

Certain animals can see in colour, however, their ability is limited to blue-violet and yellows.

Animals that fit into this category are:

- Dogs
- Mice
- Cats
- Rabbits
- Rats

There are many myths associated with animals and sight. For example, in bullfighting, it is often thought that the bull is enraged by the colour red. However, it is usually a result of the movement of the cape that causes the animal to charge.

There are other animals that have better vision than dogs, mice, cats, rabbits and rats.
Animals with good colour vision are able to see a range of colours. They may not see as many colours as humans do, but still tends to be better than the typical house pet.

The list includes:

- Monkeys
- Birds
- Ground Squirrels
- Insects
- Fish

There are organisms with superior colour vision compared to that of others. This category includes bees and butterflies. These two insects have the ability to see a more elaborate spectrum of colours than humans; unseen to the human eye, the colour spectrum includes ultraviolet rays.

It is a pollination adaptation. A special ultraviolet pattern of pollination attracts these insects to the correct part of the flower. Without their superior vision, it would be difficult to get to the relevant part of the flower the insects feed off.

3.3 Seeing by Feeling

Why do some animals see such vibrant colours, while others none? Is there a species or breed of animal that cannot see at all?

Some animals do not need to see. Certain evolutionary adaptations have taken away the eyes of some organisms or have given an animal a special survival trait in lieu of colour vision.

Animals, such as the Mexican Cavefish, have evolved without having any eyes. This is due to a lack of food and oxygen in the dark water caves. When compared to their surface-dwelling cousins, it would seem that the Cavefish underwent a process of natural selection, where only those capable of surviving in the deep, dark waters would survive.

The pit viper is another animal that has an adaptation that makes eyes a secondary requirement for living and seeing. A pit viper sees by feeling. It is not the same type of feeling a fish does though. A fish has sensory organs along their mouth, to feel through the water and along the ground for prey. The pit viper takes this to a whole new level by feeling the heat of an object. Scientists call this thermal vision. The viper sees heat signatures in order to identify prey instead of colours.

3.4 Night Vision

Humans require night vision goggles to see fully in the dark, but many other animals have a superb natural ability to see and manoeuver in the dark.

The human eye can see in dim light, but its cone receptors are unable to function in the dark. Therefore, humans cannot see colour in the dark, but rather shades of grey. Poor colour vision among animals can often denote that they have superior night vision.

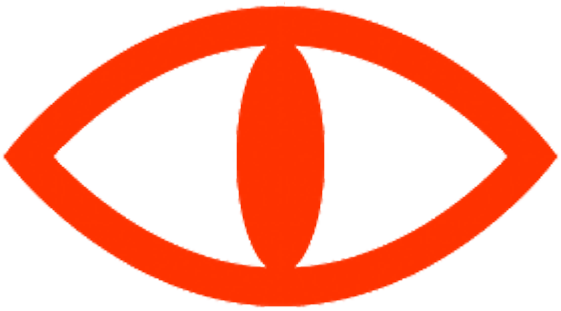
While a human may walk into a wall in the dark, a cat or dog can easily find its way without the need for light. It is argued that certain pets may find the challenge for their owners to walk in the dark, comical. This poses the question, are our pets playing in the dark or simply hoping to not be found?

Another question would be, why do cats prefer to be outside at night, rather than during the day? Like many nocturnal animals, daytime sounds can often be too loud for felines. Furthermore, many animals - cats included - often feel exposed to predators during the day and tend to prefer the shadows and calmness of the night.

Animals, like cats, including big cats such as lions and owls, like to hunt at night. Animal behaviour studies have shown that the vision and biology of these organisms tend to be very sharp vision in the dark.

Scientists only recently discovered that while certain animals can see colours in very poor lighting. Certain animals, like the gecko, are able to tell the colour blue from the colour grey, even in extremely dim light.

FACT



Cats have superb night vision — their oval-shaped pupils can widen and narrow very quickly to

control how much light comes into their eyes.

Source:allaboutvision.com

3.5 Researching Animal Vision

Much of what we know about animal vision has been studied in a lab under controlled conditions.

The study of animal behaviour allows researchers to determine what an animal sees and how it views the world. It is not possible for us to see through the animal's eye, yet. But it is possible to test what the animal likes under controlled conditions.
Scientists have made estimates on what certain animals see by using a technique called microspectrophotometry.

This process was used on fish to determine the visual pigments and photosensitivity of cells, which determined what colours and how well the organism could see.
Other tests and research conducted have included a vision colour test based on behavioural reaction, where an animal, such as a mouse, was shown colours. The mouse was then given a choice of three colours and received a reward at the end of the choice. The mouse had to decide which panel looked different in order to receive a reward. The theory was, if the mouse could see yellow, blue, or red, then a reward of soy milk would be given. The rodent would have to be able to see the light in order to see how to get the reward. Ultimately, the mouse could not see a difference between yellow and blue, so it chose red.

The interesting thing about this study is that scientists at John Hopkins and the University of California decided to genetically modify the colour vision of mice. A normal mouse cannot tell yellow from red, but their genetically altered mouse was able to find the red light with the reward.

The alteration to the mouse's vision was possible through the understanding of human vision.

Humans see in trichromatic colour meaning there are three cone cells in the human eyes. This allows for the ability to absorb green, blue and red light. Most other mammals have only two cone cells, thus the reduced vision. The study was not wholly about animal behaviour, but to determine the evolution of colour vision. It also focused on whether expanding the sensory input range of an animal would alter the animal's behaviour. This vision study has revealed certain humans have the ability to see more colours because they have four colour receptors. There are also colour blind humans who have a missing or improper third colour cell

Dog and Cat Eye Problems:

- Damaged Cornea: Dog's often suffer from punctured, injured or ulcerated cornea. For example, they often get injured when they run through tall grass.
- Dry Eye: Dogs' eyes produce fewer tears and this leads to dry eye syndrome.
- Conjunctivitis: This is an infection of the conjunctiva or the mucous membranes in the eye.
- Glaucoma: This is an increase in eye pressure. This may manifest as increased tear production or cloudiness in the eye.
- Entropion: This is when hair rubs on the cornea and causes damage. Some dogs are born with eyelids that turn inward and it's a congenital problem.

3.6 Vision, Stress and Injury

All animals have stressors that can change their behaviour.

For example, an animal that has suffered physical and verbal abuse can begin to change its behaviour.

The dog becomes extremely submissive, nervous, confused and fearful. If the same dog was given a good home it would display happy emotions and typical dog traits. This correlation can be applied to animal behaviour based on vision concepts with the introduction of stress and injury.
An injury acquired in an accident a pet is involved in that compromises the animal's vision would also affect their behaviour.

The stress level of the injured pet would increase. The pet may be less likely to want to leave the safety of home at all, or when it feels most vulnerable. The animal may also become lethargic because it is too stressed to move due to a decline in vision.

Animals can develop vision problems when they become older. They may not be able to see as well in

certain lighting conditions or have trouble finding their food and water. By understanding how animals see the world, you can assess their behaviour as they age. If a pet is able to heal from an injury affecting their vision, their behaviour may return to what it once was, but with more caution. On the other hand, this same pet may have adapted to their injury and developed new behaviour that aided them in seeing, and this behaviour may still be used.
Vision is just one part of an animal's senses. It should not be considered the most important of the five senses an animal has, which are smell, hearing, taste, touch and sight.

Humans rely heavily on their ability to see. Someone who loses their sight feels hugely disadvantaged, and touch then becomes an important sense when trying to manoeuver.

For most animals, their sense of smell, touch, hearing and taste is often more acute than their sense of sight.

It suggests that poor colour vision exists amongst animals because they do not need the added benefit of a full-colour range. Certainly some animals that eat during the day and eat varied coloured food need to see a better colour range; however, those that do not rely on other senses and have behaviour adapted to those needs of survival.

At home with your pets, you can do a few experiments to determine your animal's behaviour based on vision:

Watch what your pet does when you give them food. For example, put down two bowls, one from a can of 'older' food (opened a few days ago) and one newly opened. The food should be exactly the same, look the same. Your pet will smell the food and go to the newer food.

Now add more of the old food to the bowl and a smaller portion of newer food in the other, and what happens? Did your pet stay with the smaller portion of the newer food? The choice is often simple. Your pet wants the better food, so the portion size they see is irrelevant.

Assignment

Animal Behavioural Senses

Time: 30+ minutes

This task will get you to think about the different types of animal senses.

Download the worksheet below and complete.
Download Worksheet

Summary

In this module you have learned about the different types of colour vision.

You have learned about the evolution of these adaptations and why it is important for certain species to see better versus those that do not see at all.

You have learned that many of our pets are equipped with night vision.

While sight will always remain as the single most important sense to humans, animals often rely on touch, hearing, smell and taste to a much higher degree.

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