

Dog Vision

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Dog **V****I****S****I****O****N**

This site was created to provide a **web based image processing tool** that can be used to demonstrate the differences in visual perception between humans and dogs. The Dog Vision tool can only show the differences that can be visualized on a static image:

The user can upload an image and then apply the modifications corresponding to any of the three perceptual differences above. The effect of each perceptual difference can be applied separately or in any combination. There are numerous other differences between the visual perception of humans and dogs. For an excellent review see the article from Miller & Murphy 1995^[1] or for a shorter summary Miller & Lights 2001^[2].

Below you'll find some information about the visual perception of dogs and technical details about how the image processing tool works. If you would like to use the tool right away [click here!](#)

Color Perception

Roses are gray, Violets are gray

More like: **Roses are yellow, Violets are blue!**

Dogs are not completely color blind since they have a dichromatic color perception. Unlike humans who have three different color sensitive cone cells in their retina (red, green and blue) dogs have only two (yellow and blue)^[3,4]. This does not mean that dogs can't see green or red objects! It only means that they can't distinguish green, yellow or red objects based on their color. However they can still distinguish a red ball from a green one if there is a difference in the perceived brightness of the two.

The color vision of dogs is similar to a person suffering from deuteranopia (red-green color blindness). **Red, yellow and green** are perceived as one hue. **Blue and purple** are perceived as a second hue. **Cyan and magenta** are perceived as a neutral hue (grey).

The image below shows a full RGB spectrum and how the same colorline would be perceived by a dog.

Human's view



Dog's view



Brightness discrimination

Brightness discrimination is the ability to differentiate between different shades. It is measured by determining the smallest discernible difference in brightness (ΔR) between two stimuli compared to the absolute brightness (R) of the brighter stimulus ($\Delta R/R =$ Weber fraction). The Weber fraction calculated for humans is 0.11^[5] whereas the Weber fraction for dogs is 0.22^[6]. Thus the brightness discrimination of dogs is about 2 times worse than that of humans. This means for example that certain shades of gray that humans perceive as different are perceived as the same shade by dogs. The image below illustrates this effect by showing a set of rectangles with differing brightness, and the same set with halved relative brightness.

Human's view



Dog's view



Visual acuity

Visual acuity is a measure of the spatial resolution of the visual system. It is often measured in cycles per degree (CPD), which measures how much an eye can differentiate one object from another in terms of visual angles. The maximum visual acuity of the human eye is around 50 CPD^[7] and 60 CPD^[8]. The measurements of dogs' visual acuity vary around 7.5-9 CPD^[9] and 11.6 CPD^[10]. According to these measurements dogs' visual acuity is 4 to 8 times worse than that of humans.

Choosing the amount by which the visual acuity should be decreased depends on many factors: the angle of view of the image, the resolution of the image, dpi ratio of the screen on which the image is viewed and the distance from which the screen is viewed. Under average conditions if the picture's resolution is equal to the resolution of the screen that it is viewed on then by reducing the visual acuity by a factor of 5 is a good approximation.

The image below shows a black and white grating with a bar width of 1 to 7 pixels. The effect of visual acuity reduced by a factor of 2 to 8 can be observed on the horizontal bands stacked above each other.

Original



Visual acuity reduced by a factor of 2



Visual acuity reduced by a factor of 3



Visual acuity reduced by a factor of 4



Visual acuity reduced by a factor of 5



Visual acuity reduced by a factor of 6



Visual acuity reduced by a factor of 7



Visual acuity reduced by a factor of 8

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Image with smiling dog taken from: <http://axon-axoff.tumblr.com/post/7340439912>

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