COLOR PSYCHOLOGY OF DOGS WITH THEIR EYESIGHT

RESEARCH PAPER

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ABSTRACT

The colour vision of three domestic dogs was examined in a series of behavioural discrimination experiments. Measurements of increment-threshold spectral sensitivity functions and direct tests of colour matching indicate that the dog retina contains two classes of cone photopigment. These two pigments are computed to have spectral peaks of about 429 nm and 555 nm. The results of the colour vision tests are all consistent with the conclusion that dogs have dichromatic colour vision. (Jay Neitz,1989)

Aim: To explore the relationship between interior color selection and dog vision, in order to create environments that positively influence canine behavior, comfort, and psychological well-being through effective application of color psychology.

Keywords: Dogs, Canis familiaris, Comparative colour vision, Dichromacy, Cone Pigments.

INTRODUCTION

Although keen color vision has long been considered an important sensory capacity of primates, the summary has often been offered that members of other mammalian orders tend to lack color vision (Walls, 1942; Tansley, 1965; Ali & Klyne, 1985). According to Tansley (1965, p. 98), for instance, “On the whole mammals appear not to have color vision except for the primates.” Contrary to this assertion, there is in fact evidence to indicate that at least the presence of color vision can be established in quite a number of nonprimate mammalian species (Jacobs, 1981).

A major problem in deriving any generalizations about color vision in mammals is that appropriate tests have only been conducted on a relatively small number of mammalian species. Striking among the gaps in our knowledge is a lack of compelling information about color vision in any of the canids (Jacobs, 1981). This is particularly surprising in the case of the domestic dog (*Canis familiaris*) for two reasons. First, of course, the dog enjoys a unique status as a favored companion and able assistant to our species, the latter role often requiring the use of good vision. Second, dogs are subject to a variety of retinal degenerative diseases and in recent years this fate has made the species a frequent subject of ophthalmological studies (Aguirre et al., 1982; Schmidt & Aguirre, 1985; Schmidt et al., 1986).

The structure of the dog retina clearly suggests the possibility for color vision. In particular, there are abundant numbers of cones that comprise as many as 20% of all of the receptors in the central portion of the retina (Parry, 1953). In addition, there is both electrophysiological (Aguirre, 1978; Odom et al., 1983) and behavioral (Coile, 1982) evidence that these cones provide robust signals under classically defined, photopic test conditions. Despite these facts, behavioral studies have to date not yielded any consensus conclusion about dog color vision.

Twenty years ago, Rosengren (1969) reviewed the studies published up to that time. Of the 16 studies she found in the literature, roughly half had concluded that dogs had some color vision; the remaining studies had either yielded negative conclusions or were ambiguous in outcome. Rosengren (1969) ran several simple color vision tests on four cocker spaniels and concluded that they had the capacity to make some color discriminations. There do not appear to have been any subsequent studies of dog color vision. None of the studies in this early literature would be considered as very compelling relative to modern standards for investigations of color vision.

Color perception in dogs differs significantly from humans due to dog vision, which is limited to blue and yellow tones. This affects how dogs interpret their surroundings and respond emotionally to spaces. Understanding this is essential in interior design, as colors can influence a dog's comfort, stress levels, and behavior. Using appropriate hues and contrasts based on color psychology can help create calming and navigable environments. Designing with canine vision in mind ensures spaces that support their psychological well-being while maintaining functional and safe interiors.

Accordingly, we have reexamined this issue and here report results that establish the presence of color vision in the dog, characterize the nature of this capacity, and provide an estimate of the spectral properties of the cone pigments of this animal.(Jay Neitz,1989)

LITERATURE REVIEW

Introduction to Canine Vision

Dogs (*Canis familiaris*) have a visual system that differs significantly from humans, especially in terms of color perception. Early assumptions suggested that dogs lacked color vision; however, modern research has established that dogs possess **dichromatic vision**, meaning they can perceive a limited range of colors. (Gerald H. Jacobs,2009)

Their visual perception is influenced by the structure of the retina, which contains two types of cone photoreceptors instead of three (as in humans). This limitation directly impacts how dogs interpret colors and respond psychologically to their environment. (Gerald H. Jacobs,2009)

The study of color psychology in dogs is rooted in the broader scientific understanding of canine vision, particularly the physiological structure of the retina and its influence on perception and behavior. Early assumptions in visual science suggested that non-primate mammals lacked meaningful color vision; however, this view has been revised through experimental research in comparative vision science.A pivotal contribution was made by Jacobs (1981), who argued that several non-primate species demonstrate measurable color discrimination abilities, challenging earlier generalizations. Building upon this foundation, Neitz, Geist, and Jacobs (1989) provided one of the most definitive studies on canine color vision, demonstrating through behavioral discrimination experiments and spectral sensitivity analysis that dogs possess dichromatic vision. Their findings revealed two cone photopigments with peak sensitivities at approximately 429 nm and 555 nm, corresponding to blue and yellow-green wavelengths. This physiological limitation establishes the framework for understanding how dogs perceive and psychologically respond to color stimuli.

The dichromatic nature of canine vision implies that dogs interpret the visual world through a restricted chromatic range, analogous to red-green color blindness in humans. According to Miller and Murphy (1995), dogs are unable to distinguish between red and green hues effectively, often perceiving them as shades of gray or brown. This limitation significantly influences their interaction with the environment, as color differentiation is not as dominant a sensory cue as it is in humans. Instead, dogs rely more heavily on brightness contrast, motion detection, and spatial awareness. The dominance of rod photoreceptors in the canine retina, as discussed by Coile (2002), enhances their ability to detect movement and function in low-light conditions, further reducing reliance on color perception. Consequently, the psychological impact of color on dogs is less about emotional association, as seen in human color psychology, and more about visibility, clarity, and functional recognition.

Behavioral studies have reinforced the idea that dogs can learn to associate specific colors with outcomes, although their performance is strongly influenced by luminance contrast rather than hue alone. Kasparson et al. (2013), in their work published in Applied Animal Behaviour Science, demonstrated that dogs are capable of color discrimination when brightness cues are controlled, confirming that their responses are not solely dependent on intensity differences. Similarly, Rosengren (1969) conducted early experimental observations indicating that dogs could make simple color discriminations, although methodological limitations at the time led to inconsistent conclusions across studies. These variations highlight the complexity of isolating color perception from other visual cues in animal behavior research.

From a psychological perspective, the limited color spectrum perceived by dogs suggests that their responses to color are primarily functional rather than emotional. Research by Siniscalchi et al. (2017) indicates that dogs exhibit lateralized brain responses when exposed to different visual stimuli, including colors, suggesting that certain hues may influence attention and behavioral reactions. Blue and yellow, being the most distinguishable colors within their visual range, tend to elicit stronger engagement and recognition. In contrast, colors such as red and green do not produce the same level of response due to their perceptual ambiguity. This has direct implications for applied fields such as interior design, product design, and training environments, where color selection can influence canine behavior, comfort, and efficiency.

In the context of built environments, especially pet care centers, veterinary clinics, and boarding facilities, the application of canine color psychology must be informed by both perceptual science and behavioral outcomes. As suggested by Horwitz and Mills (2009) in their work on canine behavior, environmental enrichment plays a crucial role in reducing stress and promoting well-being in dogs. The use of visually accessible colors such as blue and yellow, combined with high-contrast spatial elements, can enhance wayfinding and reduce anxiety. Moreover, the integration of texture, lighting, and spatial organization becomes equally important, as dogs rely on multisensory input rather than color alone.

Dichromatic Color Vision in Dogs

A landmark study by Neitz, Geist, and Jacobs (1989) demonstrated that dogs have two cone photopigments with peak sensitivities around 429 nm (blue) and 555 nm (yellow-green).

This means:

- Dogs primarily perceive blue and yellow hues
- Colors like red and green appear dull (brown/gray)
- Their vision is comparable to red-green color blindness in humans
- Thus, dogs do not see a full spectrum but rather a simplified color environment. (Christina Fernandez, 2026)

Role of Cones and Rods in Dog Eyesight

The retina of dogs consists of:

- Cones : Responsible for color detection (limited in dogs)
- Rods : Highly developed, responsible for motion detection and night vision (Christina Fernandez, 2026)

Dogs have more rods than humans, which makes them:

- Better at detecting movement .
- More sensitive in low-light conditions.

Less dependent on color for environmental understanding. (Christina Fernandez, 2026)

Color Perception and Psychological Response

Color psychology in dogs is directly linked to what they can perceive visually. Since dogs mainly see blue and yellow: The ability to perceive color in mammals is contingent upon photoreceptors known as cones and rods. Cones are responsible for color detection, while rods facilitate motion perception and vision in low-light conditions. Humans possess three types of cones (trichromatic vision), whereas dogs have only two types, leading to dichromatic vision.

Experimental research (Neitz et al, 2009) has demonstrated that the canine retina contains two types of cone photopigments with peak sensitivities at approximately 429 nm and 555 nm, which correspond to blue and yellow wavelengths, respectively.

This biological constraint elucidates why dogs perceive a more limited spectrum of colors compared to humans and serves as the basis for their color psychology.

a. Preferred Colors

- Blue and Yellow : Highly visible and stimulating
- Used in toys, training tools, and environments
- Improve engagement and attention (Pauleen C. Bennett, 2019)

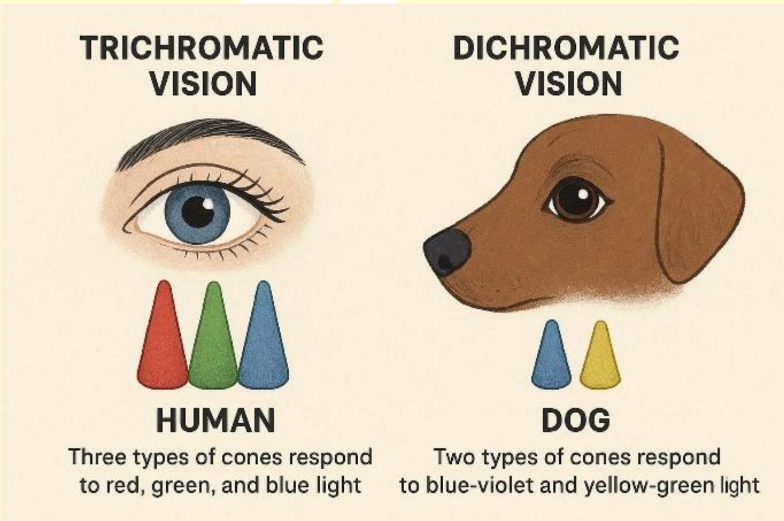

Figure 1 Trichromatic vision vs Dichromatic vision; Source : Pet Paws smd feathers

b. Less Effective Colors

- Red, Green, Orange : Appear muted or grayish
- Less effective for attracting attention or training cues (Pauleen C. Bennett,2019)

Figure 2. Human vs Dog eyesight ; Source : Pet Paws & Feathers

Behavioral Studies on Color Discrimination

Behavioral research has been extensively employed to investigate how dogs react to colors. These studies typically involve:

- Training dogs to associate colored objects with rewards
- Monitoring the accuracy of their responses to various color stimuli
- Results indicate that dogs exhibit a significant response to color differentiation, revealing insights into their perceptual capabilities.

Dog Vision vs Human Vision

Feature	**Dogs**	**Humans**
Cone types	2 (dichromatic)	3 (trichromatic)
Cone sensitivities	~429 nm (blue/violet) & ~555 nm (yellow-green)	Blue, green, red
Colour range	Blue–yellow spectrum	Full visible spectrum
Red-green distinction	Cannot distinguish	Yes
Visual acuity	4–8× worse than humans	Baseline
Low-light vision	Superior (more rods, tapetum lucidum)	Weaker

In conclusion, the literature consistently supports the understanding that dogs possess dichromatic vision, which fundamentally shapes their perception of color and its psychological impact. While color does not hold the same emotional or symbolic significance for dogs as it does for humans, it remains an important factor in visibility, behavioral response, and environmental interaction. The work of Jacobs (1981), Neitz et al. (1989), Kasparson et al. (2013), and Siniscalchi et al. (2017) collectively establishes a scientific basis for applying color psychology in canine-centered design, emphasizing functionality, contrast, and perceptual clarity over aesthetic diversity.

CASE STUDY

Experiment 1: (Source: Animal Cognition)

To identify any second preference, a two-choice test was done between blue and gray. The same blue and gray bowls as described earlier were used. The bowls were placed about 50 cm away from each other. Since presence of food did not affect the choice in the previous experiment, all trials in this experiment were the "with_food" condition only. See Online Resource 5 for video of the experiment. We success fully tested 102 dogs (52 females, 47 males, and 3 dogs of unknown sex) where blue was chosen 44 times and gray was chosen 58 times. There was no significant preference for any of these colors (goodness of fit $\chi 2 = 1.921$, $df = 1$, $p = 0.165$). A total of 21 dogs did not make a choice when presented with the setup, and 19 trials were discarded for not meeting all experimental criteria.

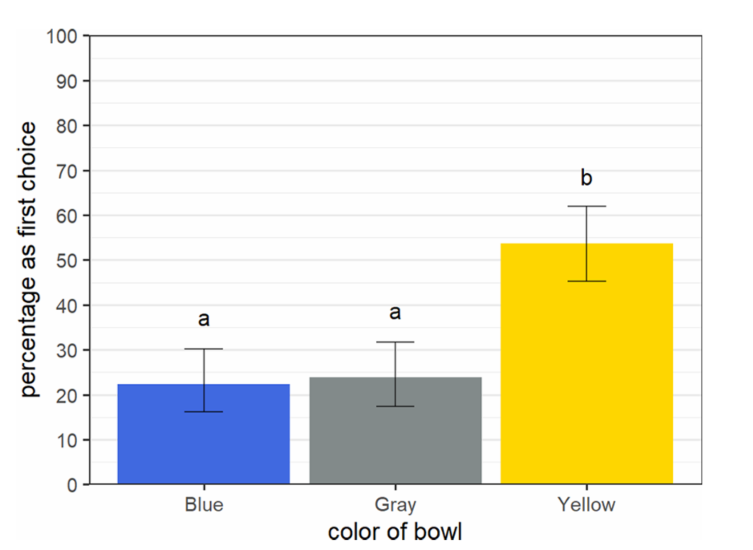

Figure 3. Source: Animal Cognition (2025)

Experiment 2A: Strength of preference control: with two yellow bowls, one of which has food

The strength of preference experiment was designed to assess dogs' attraction to yellow in comparison to their attraction to food associated with gray, a color they generally prefer less. The same bowls from previous experiments were utilized, but to maximize the visibility of the food, the bowls were turned upside down with the food placed on top (refer to Online Resources 7 & 8 for experiment videos). The bowls were positioned about 50 cm apart during the presentation.

The biscuits used in the experiments were small (approximately a quarter circle with a radius of about 3 cm) and while domestic dogs do consume carbohydrates, they have a preference for meat (Bhadra and Bhadra 2014; Bhadra et al. 2015; Sarkar et al. 2019). To ensure the experiment worked as planned, it was crucial that the dogs chose the biscuit over an empty bowl when both bowls were the same color. We selected yellow bowls since the brownish biscuit would blend into the yellow background; thus, if dogs could spot and select it there, they should easily do so against a contrasting gray bowl. Therefore, for the control trials, both bowls were yellow, with only one containing a biscuit. In total, we tested 54 dogs (20 females, 33 males, and 1 with an unknown sex). During the setup, 3 dogs did not make a selection, leading to the exclusion of 6 trials that failed to meet all experimental criteria. The bowls with biscuits were chosen 35 times, compared to 19 times for the empty bowls (goodness of fit $\chi 2$ = 4.740, df = 1, $p = 0.029$, Cramér's V = 0.296).

Experiment 2B: Strength of preference: "no_food" yellow bowl vs. "with_food" gray bowl

In this experiment, we placed food in a gray bowl similarly to the control setup, while leaving the yellow bowl empty, thus providing the dogs a choice between food and their preferred color. Two conditions were tested: (a) a piece of biscuit as food and (b) about 15 grams of raw chicken. Refer to Online Resources 7 and 8 for videos of the experiment. Different groups of dogs participated in Experiments 4a and 4b to prevent any learning bias.

We successfully tested 52 dogs (20 males, 32 females) using biscuits (see Fig. 4). The gray bowl containing food was chosen 11 times, whereas the empty yellow bowl was selected 41 times (goodness of fit $\chi 2$ = 17.308, df = 1, $p < 0.001$, Cramér's V = 0.576). In this trial, 8 dogs did not make a choice, and 6 trials were excluded for not fulfilling all experimental criteria. In the chicken condition, the empty yellow bowl was chosen 47 times out of 61 successful trials (28 males, 33 females, using different dogs than in the biscuit group), with the gray bowl selected only 14 times (goodness of fit $\chi 2$ = 17.852, df = 1, $p < 0.001$, Cramér's V = 0.540). Here, 7 dogs made no choice, and 10 trials were discarded for not meeting experimental standards.

There was no notable difference between the biscuit and chicken groups (contingency χ2 = 4.05*10^-6, df = 1, p = 0.99), but both groups showed significant differences from the control group (contingency χ2 tests; control vs. biscuit: χ2 = 18.819, df = 1, p < 0.001, Cramér's V = 0.421; control vs. chicken: χ2 = 18.852, df = 1, p < 0.001, Cramér's V = 0.404). After applying Bonferroni correction, the alpha level for these three tests was set at 0.017.

In Conclusion, Our experiments demonstrate a clear preference for the color yellow over blue and gray in FRDs of India, at least in the context of foraging. This preference is so strong that it supersedes their attraction towards food, whether biscuit or chicken. This is the first time that we have observed FRDs ignore a clear food reward in a choice test. Further experi ments can help us understand the ecological advantages, if any, of this preference and the reasons behind it. Moreover, comparative studies with companion dogs and wolves can help to understand the evolutionary trajectory of this prefer ence for yellow. The impact of color cues and color prefer ence on training can be explored in the future.

INFERENCE

The study of canine vision clearly indicates that dogs perceive the world through a dichromatic visual system, limiting their color recognition primarily to blue and yellow wavelengths while rendering red and green tones as muted shades of grey or brown. This restricted color perception directly influences their behavioral responses and interaction with the environment, suggesting that color psychology in dogs is fundamentally based on visibility and contrast rather than emotional association, as seen in humans. Dogs rely more heavily on brightness differences, movement, and spatial cues, which makes high-contrast environments more effective for navigation and engagement.

From a design perspective, this implies that the use of blue and yellow hues can significantly enhance visual clarity and responsiveness in dogs, while colors like red and green should not be relied upon for functional elements such as wayfinding, toys, or activity zones. Additionally, since dogs possess superior low-light vision and heightened sensitivity to motion, the integration of balanced lighting, non-glossy surfaces, and clear spatial organization becomes essential in creating comfortable and stress-free environments.

Overall, the inference establishes that effective design for dogs should prioritize contrast, texture, and functional color application over aesthetic variety, ensuring that spaces are aligned with canine visual perception and psychological comfort.

ANALYSIS

Color psychology in dogs is closely linked to their visual capabilities, which differ significantly from those of humans. Dogs possess dichromatic vision, meaning they have only two types of cone photoreceptors in their eyes. As a result, they primarily perceive colors within the blue and yellow spectrum, while colors such as red and green appear dull, often as shades of grey or brown. This limited color perception plays a crucial role in shaping how dogs interact with their environment.

Unlike humans, who often associate colors with emotions and meanings, dogs respond to colors based on visibility and clarity. Their visual system is adapted to detect contrast, brightness, and movement rather than a wide range of colors. This is because dogs have a higher number of rod cells in their retina, which enhances their ability to see in low light and detect motion, but reduces their sensitivity to color variations. Therefore, objects that stand out due to high contrast are easier for dogs to recognize and respond to.

Behavioral observations support this understanding, showing that dogs are more likely to engage with objects that are visually distinct in their limited color range. For instance, a blue or yellow object is more easily identified than a red object placed on a green background. This highlights the importance of selecting appropriate colors in environments designed for dogs.

In conclusion, the analysis shows that canine color psychology is not based on emotional interpretation but on functional perception. Effective design for dogs should prioritize contrast, simplicity, and the use of visible colors to enhance comfort, navigation, and overall behavior.

CONCLUSION

Research into color psychology in dogs reveals that their visual perception significantly differs from that of humans, mainly because they possess dichromatic vision. Dogs can only see a limited spectrum of colors, particularly in the blue and yellow range, while colors like red and green appear indistinct. This biological characteristic impacts how dogs perceive their environment and react to visual cues.

The study indicates that, in contrast to humans, dogs do not link colors to emotional or symbolic meanings. Their reactions are primarily driven by visibility, contrast, and clarity. Their visual system is optimized for detecting brightness, movement, and spatial variations, thanks to a greater number of rod cells that improve low-light and motion perception. Consequently, environments with high contrast are more conducive to their navigation, recognition, and overall behavior.

Behavioral studies corroborate that while dogs can differentiate certain colors, their decisions are heavily influenced by luminance contrast rather than color alone. The preference for colors like yellow in experimental setups highlights the significance of visibility in engagement and interaction, occasionally surpassing other motivators such as food.

From an interior design viewpoint, this research underscores the need to create dog-centric spaces that cater to their visual capabilities. Incorporating blue and yellow shades, along with distinct contrasts, suitable lighting, and varied textures, can significantly enhance comfort, minimize stress, and enhance the functionality of areas like pet care centers, veterinary offices, and boarding facilities.

In summary, effectively applying canine color psychology necessitates a transition from human-centered design approaches to a focus on functional design, emphasizing visibility, contrast, and sensory balance. This ensures that environments are not only visually appealing to humans but also psychologically beneficial and functionally accommodating for dogs.

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