Color preferences in dogs: A replication study

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Abstract

Color plays a critical role in signaling important information for both approaching and avoiding items in the environment, which may result in animals having preferences for certain colors. Free-ranging dogs (*Canis familiaris*) in India have been shown to strongly prefer the color yellow over blue and grey (Roy et al. (2025). *Animal Cognition*, 28(1), 1–9). However, it is not clear if this finding is specific to free-ranging dogs in India or whether it generalizes to other dog populations. We conducted a replication of the Roy et al. study to assess whether pet dogs in the United States show similar preferences by measuring whether they approached yellow, blue, or grey bowls first. We conducted two experiments and found that pet dogs younger than seven years old first approached yellow bowls most often, replicating Roy et al.'s findings. To test if brightness rather than color accounted for this preference, we conducted a third preference experiment with light, medium, and dark grey bowls. The dogs did not prefer the light grey bowl, indicating that there was not an overall preference for brighter colors. Therefore, a preference for the color yellow could be a characteristic of dogs in general. Understanding dog color preferences is important for guiding the design of dog products and environments but also is critical for canine behavioral scientists who must make decisions about colors for experimental stimuli.

Keywords: brightness, *Canis familiaris*, color, dog, preference, replication

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Color can provide information about the fitness of potential mates, the ripeness of fruits, or the toxicity of prey (Cuthill et al., 2017). Therefore, animals may have preferences for some colors over others. However, different species have different color perception abilities. For instance, dogs (*Canis familiaris*) lack a medium-wave color photoreceptor that humans have, giving them a different visual color palette (Pongrácz et al., 2017; Byosiere et al., 2018). Recent work by Roy et al. (2025) suggests that Indian free-ranging dogs use color information to make decisions about potential sources of food. When offered food in three different colored bowls, Indian free-ranging dogs preferred a yellow bowl over a blue or grey bowl. However, it is not clear whether the experience of living as a free-ranging dog in India drives this preference or whether it is a property of dogs more generally. The present study replicates and expands on Roy et al. to determine whether pet dogs in the United States also demonstrate a preference for yellow.

Pet dogs live with humans and experience much of the colorful world that we surround ourselves with. However, looking at the same stimuli does not mean seeing the same colors. Compared to humans, dogs have more limited color vision capabilities with only two color photoreceptors (Rosengren, 1969; Neitz et al., 1989; Jacobs et al., 1993; Tanaka et al., 2000; Kasparson et al., 2013). The physiological and behavioral evidence suggests that dogs likely see the world in shades of blue, yellow, and grey (Pongrácz et al., 2017). This visual system is similar to humans who have deuteranopia (red-green color blindness) (Siniscalchi et al., 2017).

Visual discrimination tasks allow dogs to show us what they can distinguish in their environment. Color discrimination studies work by training dogs to select a specific colored stimulus (e.g. a yellow circle). Once the dog associates the yellow circle with a food reward, the researchers offer the dog a choice between the yellow circle and a different colored circle. If the dog can identify which circle is yellow, they will select the yellow circle to receive their reward. Using these (and similar) methods, discrimination studies demonstrate that dogs can discriminate between colors (Rosengren, 1969; Tanaka et al., 2000; Kasparson et al., 2013). But this ability to use color cues breaks down when the dog is asked to choose between red and green stimuli.

Color appearance, however, depends on a number of physical properties including hue, brightness, and colorfulness (Fairchild, 2013). Hue is characterized by the dominant wavelength of light perceived and how much it appears to be similar to one of the colors red, yellow, green, and blue. Brightness is the perception of how much light a source reflects. Colorfulness is the intensity of the hue. Discrimination work has informed our understanding of how dogs prioritize color/hue and brightness cues. Dogs appear to rely on color/hue cues over brightness cues when discriminating between physical stimuli (Kasparson et al., 2013). However, brightness becomes more relevant when stimuli are presented on computer screens. At certain brightness levels, dogs struggle to differentiate colored stimuli (Byosiere et al., 2019). We do not yet fully understand how color/hue and brightness cues combine to influence dog perception and behavior.

While discrimination studies ask whether dogs are capable of perceiving differences between stimuli, preference studies ask whether dogs prefer some stimuli over others. Roy et al. (2025) investigated whether Indian free-ranging dogs preferred to eat out of blue, yellow, or grey bowls. They offered each dog all three colored bowls at the same time and recorded the bowl that the dogs investigated first as their choice. In one condition, each bowl contained a treat, whereas in another condition, no bowls contained treats. Each dog only completed a single trial so that the food reward (if present) would not influence future choices. Across 134 dogs, Roy et al. observed a strong preference for the yellow bowl independent of the presence of food. But it is not clear whether this preference for yellow is a common property of dogs or whether it is based on the experience of being a free-ranging dogs in India. Moreover, it is unclear whether the preference is for the hue of yellow or whether it could be driven by brightness, as the brightness for the yellow option appears to be higher than the other two colors.

In this study, we expand on the work by Roy et al. (2025) by asking whether pet dogs in the United States demonstrate a color preference. First, we replicate Roy et al.'s methods to determine whether dogs choose a yellow bowl over a blue or grey bowl when presented with the three colors. After observing preliminary evidence for differing choices between younger and older dogs, we hypothesize that younger dogs will choose a yellow bowl over a blue or grey bowl. Following Roy et al., we also hypothesize that the presence of food, dog sex, and bowl position will not affect the color preference. Lastly, we investigate the potential role of brightness in dog color preference by presenting dogs with three grey bowls of varying brightness levels: light, medium, and dark grey. We hypothesize that younger dogs will choose the brightest bowl over either of the two darker bowls. Combined, these studies will assess the generalizability of the Roy et al. findings and investigate whether brightness instead of color/hue may drive the effects.

Method

Experiment 1

This study was conducted at multiple outdoor locations: four dog parks, one city park, and one dog bar with a fenced in lawn. At each testing location, experimenters identified a grassy area with minimal potential distractors and no direct shade from trees, buildings, etc. We used the same experimental setup across all testing locations. The study ran during daylight hours (09:00-20:00 h) from May 2025 to June 2025.

Participants

We collected data from 95 dogs with 48.4% being female, 90.4% being neutered/spayed, and a mean (±standard deviation) age of 3.9±3.1 years. We excluded 19 dogs due to failing to complete the warm-up for the experiment, failing to choose in the experimental trial, or if the owner wanted to discontinue for any reason, resulting in 76 dogs with complete data. To follow our pre-registration and match the sample size in the food condition of Roy et al. (2025), we only analyzed data from the first 75 dogs that we tested.

Materials

We used three terracotta bowls (diameter 12.5 cm, height 5.7 cm) painted with Apple Barrel Gloss non-toxic acrylic paint. We painted each bowl either Golden Yellow (21395E), Real Blue (20660E), or Dark Gray (20366E). We used a Shimadzu UV-2501 spectrophotometer with an integrating sphere for specular reflectance (Model ISR-2200) to measure color absorbance and percent reflectivity (Figure 1). We used $BaSO_4$ as a background for both measurements. Yellow showed peak absorbance at 450 nm and peak reflectivity at 612 nm. Blue showed peak absorbance at 569 nm and peak reflectivity at 800 nm. Grey (shown as medium grey in Figure 1) showed peak absorbance at 401 nm and peak reflectivity at 537 nm.

We attached the bowls with Velcro to a 70 × 17 cm wooden board spaced about 15 cm apart with a circle drawn 2 cm out from each bowl (Figure 2a). The bowls were located closer to one of the long edges of the board than the other. We refer to the long edge of the board that is further from the bowl locations as the "dog side" of the board and the edge closer to the bowl locations as the "experimenter side". An opaque black plastic occluder (121 × 46 cm) blocked the dog's line of sight during experimental setup. We used Pet Botanics Soft & Chewy Beef Flavor Training Rewards treats. We recorded sessions with a GoPro HERO9 Black camera on a Sunpak 7001 D tripod placed 2 m behind the "experimenter side" of the board.

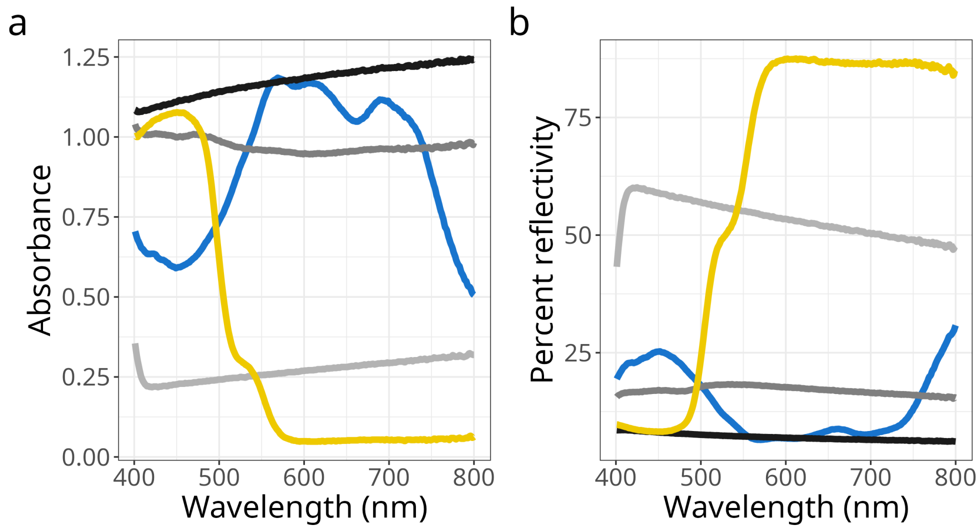
Procedures

Experimental Set-Up. Two experimenters conducted each experimental trial. Experimenters wore neutral-colored shirts (white/black, no colors) for all experimental sessions. Experimenter 1 presented the dog with the experimental stimuli, and Experimenter 2 recorded the data. All experimenters rotated between the roles of Experimenter 1 and 2 throughout the study.

To begin the set-up, experimenters placed the wooden board in a grassy area at the testing location. Experimenters placed two leashes on the ground 2 m away from and parallel to the board with one on either

Figure 1

Absorbance and Reflectivity of Bowl Colors



Note. (a) Absorbance and (b) percent reflectivity as a function of wavelength in nm for yellow, blue, light grey, medium grey, and dark grey paint.

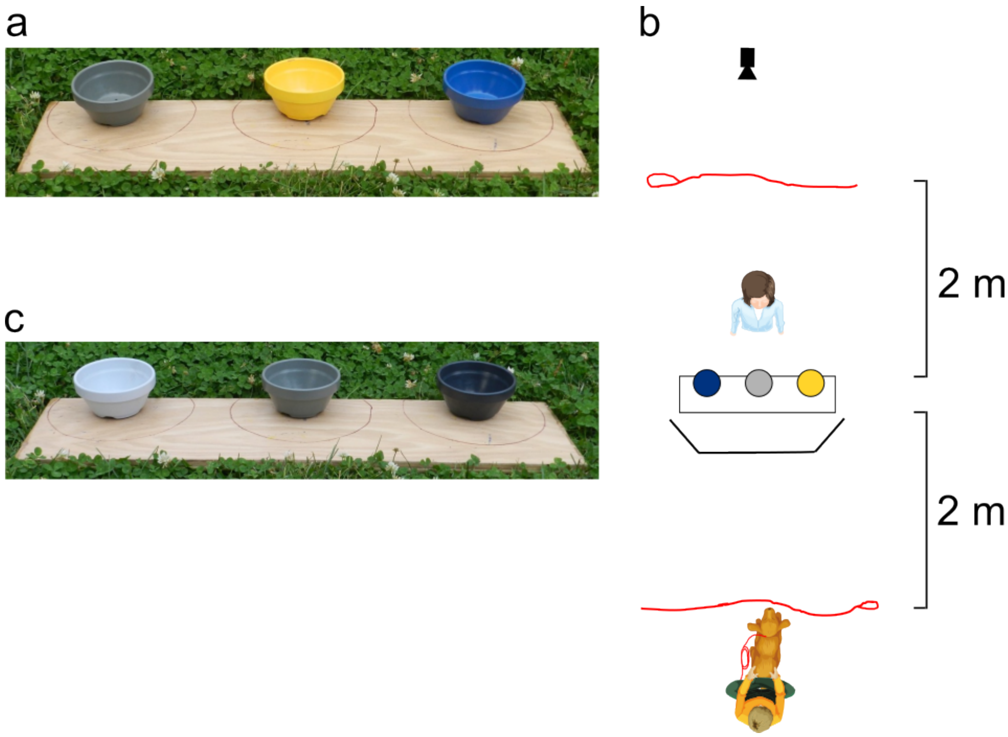
side (Figure 2b). On the far side of the leash, a 2.75 m leash was attached to the base of a camping chair. Before each trial, experimenters placed the three bowls in the appropriate randomized color order on the board (counterbalanced across subjects). An occluder blocked visibility of the board from the "dog side".

Warm-Up. The owner sat in the camping chair with their dog in front of them facing toward the board (Figure 2b). Experimenter 2 clipped the leash attached to the base of the chair to the dog's collar/harness. The owner held the dog (by leash or collar) at the start line. With the occluder in place, Experimenter 1 crouched on the "experimenter side" of the board and placed a treat in front of each bowl location. Experimenter 1 called the dog's name to get their attention before lifting the occluder and placing it between the treats and the bowls on the board. This made the treats visible to the dog while still occluding the bowls. Experimenter 1 kept their gaze on the ground and waited for three seconds. After the pause, Experimenter 1 said "now" and the owner released the dog to approach the treats. If the dog approached the board right away to eat the treats, the warm-up ended. If the dog was hesitant to approach, the experimenters tapped on the board to draw the dog's attention or hand-fed one of the treats to the dog. The warm-ups were successfully completed if the dog eventually ate all three treats and at least one of them was on the board (not hand-fed). Dogs that did not successfully complete the warm-up did not continue to participate in the experimental trial.

Experimental Trial. After successful completion of the warm-up, the owner recalled the dog back to the starting line. Experimenter 1 crouched on the "experimenter side" of the board and put one treat in each of the three bowls on the board. To begin the trial, Experimenter 1 called the dog's name to get their attention. Then Experimenter 1 lifted the occluder and walked backward in a crouch with the occluder until they were between the leash and the tripod. Once behind the leash, Experimenter 1 waited three seconds before saying "now", signaling the owner to release their dog to approach the bowls. Experimenter 2 recorded the order that the dog chose the bowls in (e.g. yellow, then blue, then gray). We defined a choice as the dog putting their nose within 2 cm of a bowl. If the dog did not choose any of the three bowls after 1 minute, the outcome was recorded as No Choice. Repeat visits to the same bowl were not recorded.

Figure 2

Experimental Set-Up



Note. (a) Grey, yellow, and blue bowls on wooden tray used in Experiments 1 and 2. (b) Schematic showing owner holding dog, red leashes as starting lines, experimenter behind the occluder, tray of bowls, and camera. (c) Light, medium, and dark grey bowls on wooden tray used in Experiment 3.

Experiment 2

Experiment 2 used the same locations, set-up, and materials as Experiment 1. It ran from 09:00-20:00 h from June 2025 to August 2025.

Participants

Experiment 2 participants differed from experiment 1 by restricting participation to dogs under 7 years old based on the owner's report. We collected data from 217 dogs with 43.1% being female, 85.1% being neutered/spayed, and a mean (±standard deviation) age of 3.0±1.7 years. We excluded 63 dogs due to failing to complete the warm-up for the experiment, failing to choose in the experimental trial, or if the owner of the dog wanted to discontinue for any reason, resulting in 154 dogs with complete data. To follow our pre-registration and match Roy et al. (2025), we only analyzed data from the first 76 dogs that we tested in the food condition and the first 58 dogs that we tested in the no food condition, totaling 134.

Materials and Procedures

The materials and procedure were the same as Experiment 1, except that there was an added condition of having bowls without food. A total of 76 dogs chose between bowls with treats in them, and 58 dogs chose between bowls with no treats.

Experiment 3

We conducted Experiment 3 at four dog parks, one city park, one dog bar, one dog show, and one dog daycare. Tests ran from 08:15-18:00 h from September 2025 to November 2025.

Participants

Like Experiment 2, Experiment 3 participants were restricted to dogs under 7 years old. We pre-registered collecting up to 150 dogs with complete data or as many as we could collect by October 31, 2025. Due to inclement weather in the final weeks of testing, we deviated from our pre-registration by continuing to collect data until November 2, 2025. We collected data from 194 dogs with 45.6% being female, 75.1% being neutered/spayed, and a mean (±standard deviation) age of 2.8±1.7 years. We excluded 54 dogs due to failing to complete the warm-up for the experiment, failing to choose in the experimental trial, or if the owner of the dog wanted to discontinue for any reason, resulting in 140 dogs with complete data.

Materials

Materials were identical to Experiments 1 and 2 except for bowl colors. We replaced the yellow and blue bowls with light and dark grey bowls (Figure 2c). To choose shades of gray similar in brightness to yellow and blue, we converted photos of the yellow and blue bowls to grey scale and mixed black and white paint to reach comparable shades of grey. We used a combination of Apple Barrel Gloss (Black 20409E, White 20621E) and FolkArt Multi-Surface Satin (Titanium White 4645CA) non-toxic acrylic paints. All three greys show fairly constant reflectivity across the spectrum, and reflectivity decreases from light to medium to dark grey (Figure 1). Medium and dark grey show reflectivity levels similar to blue and light grey shows reflectivity levels intermediate between yellow and medium grey. Light grey showed peak absorbance at 401 nm and peak reflectivity at 425 nm. Medium grey showed peak absorbance at 401 nm and peak reflectivity at 537 nm. Dark grey showed peak absorbance at 794 nm and peak reflectivity at 410 nm.

Procedures

Procedures were identical to Experiments 1 except we used three grey bowls labeled light, medium, and dark grey.

Data Analysis

We used R (Version 4.5.2; R Core Team, 2025) and the R-packages *assertr* (Version 3.0.1; Fischetti, 2023), *BayesFactor* (Version 0.9.12.4.7; Morey & Rouder, 2024), *here* (Version 1.0.2; Müller, 2025), *multibridge* (Version 1.3.0; Alexandra et al., 2023), *patchwork* (Version 1.3.2; Pedersen, 2025), *rstatix* (Version 0.7.3; Kassambara, 2025), and *tidyverse* (Version 2.0.0; Wickham et al., 2019) for our analyses. The manuscript was created using *cocoon* (Version 0.2.1.9000, Stevens, 2025), *knitr* (Version 1.51, Xie, 2015), *papaja* (Version 0.1.4, Aust & Barth, 2025), *quarto* (Version 1.5.1, Allaire & Dervieux, 2025), and the *apaquarto* Quarto extension (Schneider, 2025). Data, analysis scripts, and reproducible research materials are available at the Open Science Framework (https://osf.io/kh3s5/). These three experiments were pre-registered at https://aspredicted.org/yj5jq5.pdf, https://aspredicted.org/8xp2bu.pdf, and https://aspredicted.org/ra33ex.pdf.

Our pre-registered analysis for all three experiments followed Roy et al. (2025) by conducting a Chi-squared goodness-of-fit test comparing the frequency of first choice across the three colors against a null expectation of chance using the `chisq.test()` function. For Experiment 1, we only conducted a Chi-squared goodness-of-fit test with color as the category. For Experiments 2, we first conducted a Chi-squared test of independence with color and food/no food as categories before limiting the analysis to just a goodness-of-fit test of color. We also conducted a test of independence with color and dog sex, as well as goodness-of-fit tests for bowl position (left, center, right). For Experiment 3, we conducted a Chi-squared goodness-of-fit test with color as the category, a goodness-of-fit tests for bowl position, and a test of independence with color and dog sex. In addition to pre-registered analyses, we report exploratory analyses.

To replicate Roy et al. (2025), we draw inferences based on the frequentist Chi-squared test. But we also calculated Bayes factors for goodness-of-fit tests using Bayesian multinomial tests with the `mult_bf_equality()` function from the *multibridge* package (Alexandra et al., 2023). This analysis assumes that data follow a multinomial distribution and assigns a Dirichlet distribution as prior for the model parameters (i.e., underlying category proportions). For Chi-squared tests of independence, we used the `contingencyTableBF()` function from the *BayesFactor* package (Morey & Rouder, 2024). We used independent multinomial sampling for food condition with fixed sample sizes per group and joint multinomial sampling for sex, weather, and breed—both sampling types used prior concentration of 1. Bayes factors offer bidirectional information about evidence supporting both the alternative (H_1) and the null (H_0) hypotheses. Bayes factors provide the ratio of evidence for H_1 over evidence for H_0 (Wagenmakers, 2007). Therefore, a Bayes factor of 3 (BF_{10}=3) indicates three times more evidence for H_1 than H_0, whereas a Bayes factor of 1/3 (the reciprocal of 3) indicates 3 times more evidence for H_0 than H_1. We interpret Bayes factors based on Wagenmakers et al. (2018), where a $BF_{10} > 3$ is considered sufficient evidence for the alternative hypothesis, $BF_{10} < 1/3$ is considered sufficient evidence for the null hypothesis, and $1/3 < BF_{10} < 3$ indicate neither hypothesis has evidence supporting it (suggesting the sample size is too small to draw conclusions).

Results

Experiment 1

Pre-registered Analyses

Experiment 1 included 75 dogs with complete data. Though yellow was chosen first most often (Figure 3a), a Chi-squared test of goodness-of-fit did not detect a difference in the first color chosen ($\chi^2(2)$ = 0.6, p = .756). The Bayesian analysis provided strong evidence supporting the null hypothesis of no difference across colors (BF_{10} = 0.04). Therefore, our results did not replicate the findings of Roy et al. (2025), who found a clear preference for yellow.

Exploratory Analyses

When pondering why we may not have replicated Roy et al. (2025), we considered the fact that most of their subjects were likely relatively young since free-ranging dogs likely do not live as long as pet dogs. It is possible that dogs' color vision deteriorates with age, though we know of no evidence of this yet (Barber et al., 2020). Therefore, we conducted an exploratory analysis in which we restricted our data set to dogs younger than 7 years. We chose the 7 year cutoff based on previous work examining cognitive decline in dogs (Studzinski et al., 2006; Szabó et al., 2016; Harvey, 2021). This exploratory analysis suggested a stronger preference for yellow in this subset of younger dogs (Figure 3b), though the sample size was lower that we would like (N = 61).

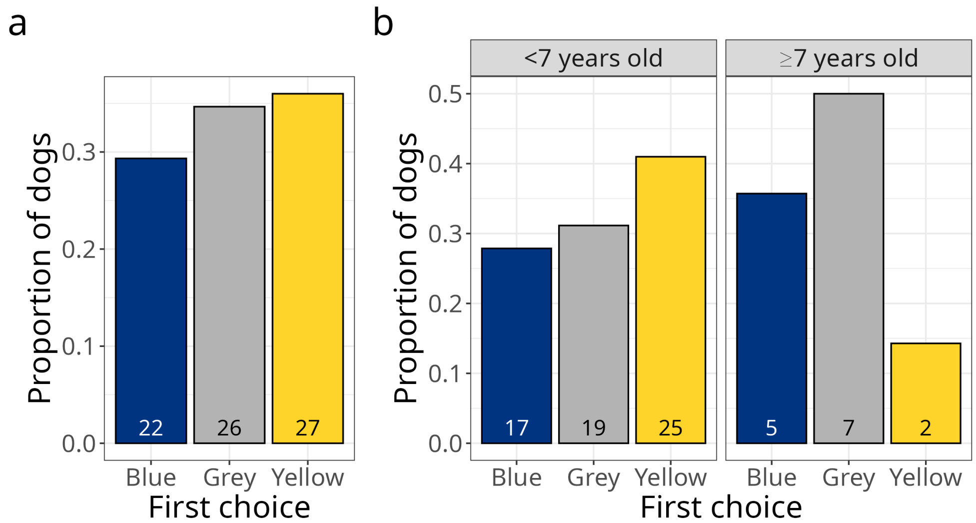
Experiment 2

Pre-registered Analyses

Experiment 2's analyses replicated Roy et al. (2025) more closely by first testing whether the distribution of first color choices differed across food conditions (n_{food} = 76, $n_{\text{no\_food}}$ = 58; Figure 4a). A Chi-squared test of independence did not show a difference across food conditions ($\chi^2(2)$ = 2.0, p = .361, Cramér's V = 0.1, BF_{10} = 0.18). Following Roy et al., we then combined the conditions (N = 134) and conducted a goodness-of-fit test, which did find a difference between the colors ($\chi^2(2)$ = 7.2, p = .028, BF_{10}

Figure 3

Results for Experiment 1



Note. (a) Overall number of subjects who chose blue, grey, and yellow bowls first. (b) Number of subjects who chose blue, grey, and yellow bowls first faceted by dog age.

= 0.71), with yellow being chosen most frequently (Figure 4b). The distribution of choices across colors did not differ between the sexes ($\chi^2(2) = 1.8$, $p = .412$, Cramér's V = 0.1, $BF_{10} = 0.28$; Figure 4c), but the distribution of first choices did differ based on spatial position ($\chi^2(2) = 7.6$, $p = .022$, $BF_{10} = 0.86$) with a preference to choose the left bowl first (Figure 4d).

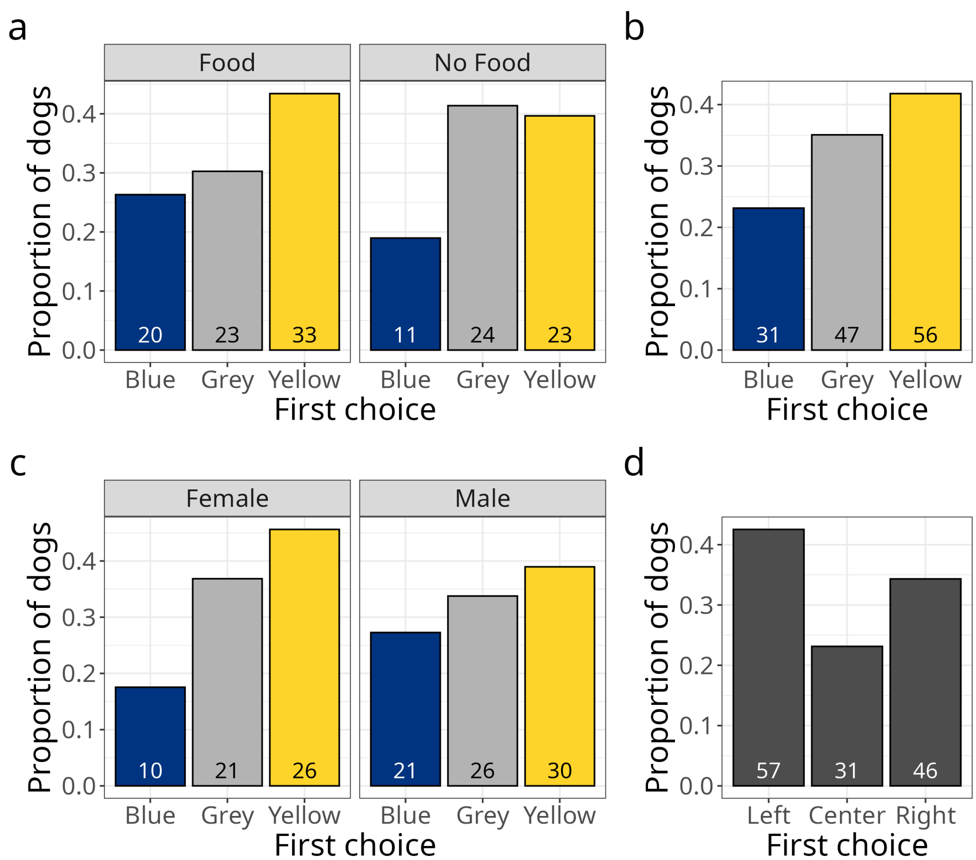
Exploratory Analyses

Though the frequentist statistics suggest a difference between first color chosen, the Bayesian analysis did not have sufficient evidence supporting the hypothesis of a difference, likely due to an inadequate sample size. We conducted an exploratory analysis in which we combined all Experiment 2 data with the Experiment 1 data for all subjects under 7 years old, yielding a total sample size of 214. The analysis on the combined data found evidence for a difference between colors for both frequentist and Bayesian statistics ($\chi^2(2) = 12.5$, $p = .002$, $BF_{10} = 6.9$; Figure 5a). We used the `pairwise_chisq_gof_test()` from the *rstatix* package (Kassambara, 2025) to conduct pairwise goodness-of-fit tests adjusting for multiple comparisons. This analysis supported a difference between yellow and blue preferences ($\chi^2(1) = 12.6$, $p = .001$), supported a marginal difference between blue and grey ($\chi^2(1) = 5.1$, $p = .048$), and did not support a difference between yellow and grey ($\chi^2(1) = 1.8$, $p = .186$).

With the combined sample, we also conducted exploratory tests of independence for the effects of breed type (purebreed vs. mixed breed) and weather (sunny vs. cloudy/rainy) on the distribution of first color chosen. There was no support for a difference in color chosen based on breed type ($\chi^2(2) = 0.1$, $p = .937$, Cramér's V = 0.0, $BF_{10} = 0.08$; Figure 5b) or weather ($\chi^2(2) = 0.6$, $p = .749$, Cramér's V = 0.1, $BF_{10} = 0.09$; Figure 5c).

Figure 4

Pre-registered Results for Experiment 2



Note. (a) Overall number of subjects who chose blue, grey, and yellow bowls first faceted by presence or absence of food in the bowl. (b) Number of subjects who chose blue, grey, and yellow bowls first. (c) Number of subjects who chose blue, grey, and yellow bowls first faceted by dog sex. (d) Number of subjects who chose left, center, and right bowls first.

Experiment 3

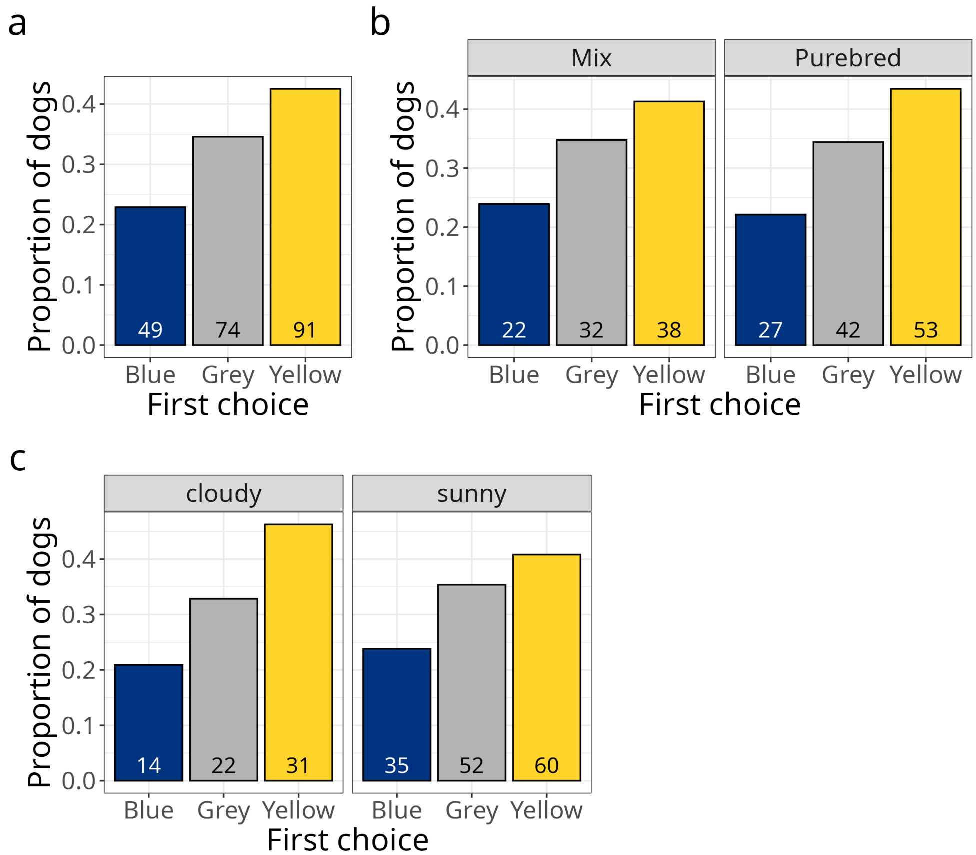
Pre-registered Analyses

Experiment 3 replaced the colored bowls with light, medium, and dark grey and only included the food condition for 140 dogs with complete data. Though dark grey was chosen more than the other shades (Figure 6a), a Chi-squared test of goodness-of-fit did not detect a difference in the first shade chosen ($\chi^2(2)$ = 5.8, p = .056, BF_{10} = 0.26). Thus, we did not find that dogs preferred the brightest shade of grey.

A test of independence found no effect of sex on shade chosen ($\chi^2(2)$ = 0.4, p = .809, Cramér's V = 0.1, BF_{10} = 0.14; Figure 6b), but the distribution of first choices did differ based on spatial position ($\chi^2(2)$ = 7.9, p = .019, BF_{10} = 0.83) with a preference to choose the left bowl first (Figure 6c).

Figure 5

Exploratory Results Combining Experiment 1 and 2 Data



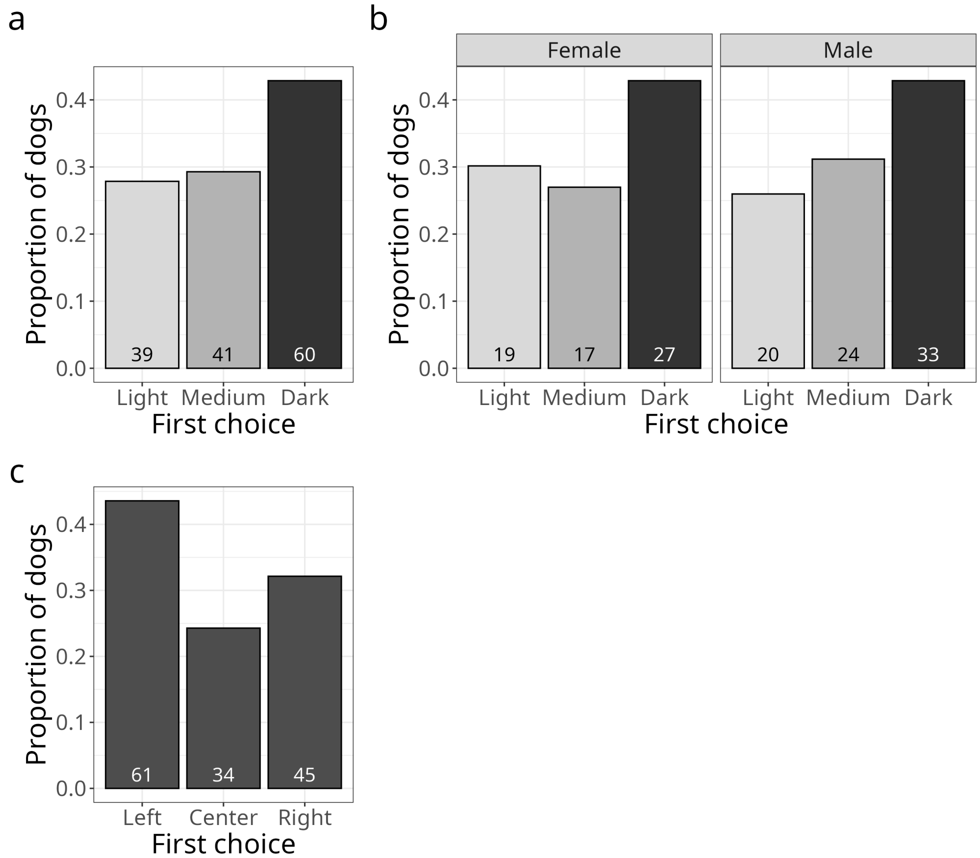
Note. (a) Overall number of subjects who chose blue, grey, and yellow bowls first. (b) Number of subjects who chose blue, grey, and yellow bowls first faceted by whether dog was a mixed breed or purebreed. (c) Number of subjects who chose blue, grey, and yellow bowls first faceted by whether the weather was cloudy/rainy or sunny.

Discussion

The primary aim of this study was to replicate Roy et al. (2025) to assess whether pet dogs in the United States also preferred yellow over blue or grey. We tested this with three pre-registered experiments. In Experiment 1, we did not find a strong preference for yellow. However, our sample included dogs with no age restrictions, likely differing from Roy et al.'s sample of free-ranging dogs. An exploratory analysis restricted to dogs younger than seven years old suggested that they might prefer yellow, but the sample size was too small to strongly test this. In Experiment 2, we restricted the sample to dogs under seven years old and replicated Roy et al.'s finding that dogs chose yellow bowls first most often. This preference was not affected by either the presence of food or dog sex. Experiment 3 tested preferences between light, medium, and dark grey investigating whether the preference for yellow was actually driven by brightness rather than hue. We did not find a preference for light grey and, if anything, there was a preference for dark grey, not supporting brightness as a driving factor for the observed preference for yellow.

Figure 6

Pre-registered Results for Experiment 3



Note. (a) Overall number of subjects who chose light, medium, and dark grey bowls first. (b) Number of subjects who chose light, medium, and dark grey bowls first faceted by dog sex. (c) Number of subjects who chose left, center, and right bowls first.

Implications

Taken together, our experiments suggest that young dogs have a general preference for the color yellow over blue, replicating Roy et al. (2025). This pattern is not explained by a lower-level preference for brighter stimuli. Though the overall findings align with Roy et al., our effects were not as strong or universal as observed previously. The relative preference for yellow was smaller than that of Roy et al. Also, the preference for grey fell in between yellow and blue, whereas for Roy et al., the preference for blue and yellow were equally low. Nonetheless, companion dogs in Nebraska and free-ranging dogs in India do appear to show a similar affinity for the color yellow. This begs the question: Why do dogs prefer the color yellow?

Why yellow?

The color yellow may possess properties that make it particularly appealing. Research on human and macaque visual systems have revealed notable properties of the color yellow. In humans, yellow is processed more quickly and accurately than the color blue (Wool et al., 2015). Macaques, too, display a faster and greater amplitude of visual cortex activity in response to yellow compared to blue (Wool et al., 2015). So, while we interpret our findings as preference, speed of processing may also shape which color is approached first. However, we do not know whether dogs have the same color processing as humans and macaques.

Humans may also interpret the colors blue and yellow differently. When viewing objects, humans tend to interpret a bluish tint as a property of the lighting and a yellowish tint as a property of the object itself (Webster, 2020). How our brains react to the colors blue and yellow is likely rooted in our real-world experiences, as shadows from natural light take on a blue tint and objects themselves have warmer tints (Webster, 2020). Thus, yellow may be chosen in this context because it is interpreted as a property of objects.

Lastly, humans show strong associations between colors and odors, emotions, and concepts (Österbauer et al., 2005; Mohammad, 2011; Tham et al., 2020), though these can vary across cultures (Barchard et al., 2017). Just as we associate the color yellow with familiar odor stimuli (e.g., lemon or banana), dogs could have similar associations with relevant stimuli in their environment. The fact that we also found a preference for yellow in pet dogs in the United States suggests that either (1) Roy et al.'s (2025) findings were not due to something unique about the free-ranging dog experience in India but to something more general about dog preferences or (2) the same associations were made across these two populations. A shared association seems less likely given the different environments experienced by these two populations. This leaves open the reason why dogs prefer yellow.

Brightness

Though the color yellow differs in hue from blue, it also typically differs in brightness. The yellow bowl in Figure 1 of Roy et al. (2025) appears to be brighter than their blue bowl. The blue used in our study is brighter than Roy et al.'s, but it is still darker than our yellow (Figure 1). We investigated whether brightness could account for our finding a preference for yellow over blue by offering dogs three different shades of grey that vary in brightness. However, we did not find a difference between the shades, though a more highly powered design might have suggested a preference for the darkest shade of grey. Therefore, we did not find evidence for brightness accounting for the preference for yellow over blue.

There are a few possibilities for why brightness may not drive the preference. First, our test of brightness moved from chromatic (yellow, blue) to achromatic (grey) hues. In an effort to completely control brightness, we removed color, which may result in different preferences. That is, the preference for yellow could have resulted from an interaction between hue and brightness, and removing chromatic hue might change the dynamics. A follow-up study offering choices between different shades of yellow could help address this. Also, offering choices between yellow, blue, and grey with equal brightness would be useful, though accomplishing this with paint can be tricky when trying to create exact brightness values. Computer-generated colors would simplify maintaining constant brightness, though preference may be more difficult to assess with computer stimuli. Moreover, brightness is more of a subjective than objective, physical measure—it is the *perception* of how much light is reflected. Thus, measures of brightness based on human vision may not carry over to canine vision.

A second possibility for the lack of a brightness effect could be because dogs react more strongly to hue than brightness. Two discrimination studies in dogs varied both hue and brightness found that hue drove their behavior more than brightness (Kasparson et al., 2013; Byosiere et al., 2019). This would make sense if hue has a stronger functional benefit than brightness, but further work is needed to support this.

Age Effects

In Experiment 1, we did not restrict ages. But upon faceting the data based on age (Figure 3b), we noticed that younger dogs seemed to show a yellow preference but older dogs did not. We restricted the age of subjects to under seven years old in Experiment 2 and found a preference for yellow. Though we do not have good estimates for ages in the dogs in the Roy et al. (2025) study or for the Indian free-ranging dogs more generally, a study of free-ranging dogs in Baltimore, Maryland, USA showed a maximum age of seven years (Beck, 1973). Thus, by restricting our analyses to dogs under seven years old, we are likely more closely matching the age distribution found in Roy et al.

In addition to matching the original study demographics, age could be an important influence on the color preference itself. Little work has investigated age effects on color perception or preferences in dogs. However, studies on other aspects of visual anatomy and cognition indicate a decline with age (Head et al., 1998; Milfont & Gouveia, 2006; Studzinski et al., 2006; Snigdha et al., 2012; Szabó et al., 2018; Barber et al., 2020). Humans show impairments in color perception as they age (Faubert & Bellefeuille, 2002; Han et al., 2016). Moreover, humans also prefer a saturated yellow over dark blue when young but find them equally preferable when older (Zhang et al., 2019). Thus, though we have a small sample size in our study, the age effects we observe in dogs might reflect real differences in color preferences of their lifespan.

Applications

Color preferences in dogs are not just academic or aesthetic—they can be useful in designing dog toys, environments, and research sessions. Knowing what colors dogs can discriminate or prefer could be useful for dog toy manufacturers to help guide the design of toys that maximally engage dogs' attention. Currently, dog toys are likely designed with humans in mind, since we are the ones who buy the toys (Coren, 2025). Tests of toy color preferences could be useful to the dog toy industry to determine whether dogs' preferences differ from their owners'.

Color preferences could also be useful in designing dog living areas. Shelters, for example, usually want to create a calming environment for dogs that face the stressful experience of being in a shelter. If dogs prefer some colors over others, it is possible that those colors may influence their physiology, which can affect their well-being. It could be useful for shelters to paint their walls colors that dogs perceive as calming.

Finally, for canine behavioral scientists, understanding color preferences is critical because we frequently choose colors for stimuli that we present to subjects. If researchers present stimuli of different colors, preference for a particular color could bias results toward that stimulus and skew the results based on what should be an arbitrary logistical choice rather than research-relevant properties under investigation. This fact is what inspired us to replicate Roy et al. (2025), and given their and our findings, color is an important variable that must be considered carefully and counterbalanced across stimuli.

Considerations

There are a number of considerations to keep in mind with our findings. First, we tried to directly replicate the methods of Roy et al. (2025), which included simultaneously presenting bowls of three colors. Like Roy et al., we only used three colors, though these are the three primary colors that dogs can see (Pongrácz et al., 2017). Testing additional colors would be useful, even for hues that may be perceived similarly (e.g., red and green). Other components such as brightness and saturation may influence preferences. Including more hues using multiple pairwise comparisons of hues would provide a more sophisticated measure of color preference. Having multiple trials within subjects would provide important test-retest reliability measures to assess the stability of preference.

Another consideration for our work deals with odor. Dogs have outstanding olfactory abilities (Johnen et al., 2013; Lazarowski, 2023). And different paint colors are created with pigments generated from different chemical compounds. Though undetectable to us, it is possible that the pigments produce different odors, and dogs could have actually been demonstrating a preference for the *odor* of the yellow paint. This could explain why the dogs in Roy et al. (2025) showed a stronger preference for yellow than our dogs. If our paints were composed of different chemicals, their yellow paint might have smelled "better" than our yellow paint. Roy et al. conducted an odor control preference test where they covered yellow and blue bowls with magenta sleeves. They did not find a preference for the underlying yellow bowls, suggesting odor did not drive their findings. To fully control for this, researchers should either use non-pigment-based paints or use computer-generated colors to test dog color preferences.

Our data clearly showed individual differences in the color chosen first. In examining the combined data (Figure 5a), there is an almost two-fold stronger preference for yellow over blue (91 vs. 49 dogs; 1.86 ratio). However, there is not a difference between preference for yellow and grey (74 dogs). The preference for yellow in our data is slightly smaller than that in Roy et al. (2025) (72 yellow vs. 30 blue; 2.40 ratio). One-trial measures of preferences are noisy. Our data could reflect individual differences in color preferences or individual differences in attending to experimental stimuli. Thus, the preference could be stronger if dogs paid more attention to the color of the bowls before approaching. Another factor that could account for preferences is the dogs' experiences with different colors. If dogs have food bowls, toys, walls, or food itself that is yellow, dogs could associate the color yellow with food. Given the wide range of possible environmental variables where color could play a role, we did not assess our subjects' experiences with different colors. Future studies to try to assess dogs' exposure to and experience with different colors to investigate whether these influence color preferences.

The aim of this study was to replicate Roy et al. (2025), which focused on the context of food. Because colors may have associations with food, these results may not generalize beyond food contexts. That is, dogs may not have a preference for yellow generally but may when food is involved. To test general color preferences, researchers should conduct color preference tests with other objects, such as dog toys to determine whether food preferences generalize to toys, wall paints, or other objects.

A final consideration is our study population. Typical lab-based experiments sample a fairly select subgroup of dog owners: those who have the interest in and means to bring their dogs to a dog lab (Espinosa et al., 2026). The sample for this study is slightly different but also potentially unique. The majority of our subjects were tested outside of dog parks and a dog bar. A key advantage of these locations is that it opens up our study to dog owners beyond those willing to visit our lab. However, testing in these locations restricts the sample to dogs who are taken to dog parks and other facilities, which may favor dogs who are social and friendly with other dogs. Also, we used treats to draw attention to the apparatus. So, our sample favored food-motivated dogs because those with low food interest likely did not complete the warm-up trial and advance to the experimental trial, thus further restricting our sample. This was especially evident when we tested outside a dog show. Many of the show dogs were used to very high-quality treats to keep their motivation during shows. Several of them were not interested in our rather mid-quality treats, and therefore those dogs were not included in our data. Despite the possibility of our data coming from a narrow subpopulation of dogs, our overall findings replicated those of Roy et al. (2025), suggesting that a color preference for yellow generalizes from free-ranging dogs in India to pet dogs in the United States. Nevertheless, testing dogs in other geographical locations and social situations would further investigate the generalizability of color preferences.

Conclusion

Our study replicated the Roy et al. (2025) finding that dogs approached a yellow bowl first, suggesting that this color preference may be general to domestic dogs. This preference did not differ based on presence of food, dog sex, dog breed type, or lighting conditions and it did not seem to be driven by differences in brightness. However, we only found the effect in younger dogs, indicating that color preference may change over the lifespan. This preference for yellow may be due to low-level visual processing in the brain, though most of the work on these features occur in species with three color photoreceptors, so more work is needed in dogs and other species with two color photoreceptors. Understanding color preferences in dogs is important for both their welfare and the integrity of research studying them. Knowing which colors they prefer can inform how to design both toys and environments meant to calm dogs (e.g., shelters). And researchers should consider color preferences when designing studies, especially when having dogs choose between multiple stimuli of different colors.

Compliance with Ethical Standards

All procedures were conducted in an ethical and responsible manner, in full compliance with all relevant codes of experimentation and legislation and were approved by the University of Nebraska-Lincoln Internal Review Board (project ID UNL-00020491) and the Institutional Animal Care and Use Committee (project ID 2632). All participants (dog owners) offered consent to participate, and they acknowledged that de-identified data could be published publicly.

Competing Interests

No funding was received for conducting this study. Kenl Inn, Lincoln Parks and Recreation, Sandhills Global Event Center, and Urban Hound granted access to their facilities to conduct this research. All authors certify that they have no affiliations with or involvement in any organization or entity with any financial interest or non-financial interest in the subject matter or materials discussed in this manuscript.

Data Availability

Data, analysis scripts, and reproducible research materials are available at the Open Science Framework (https://osf.io/kh3s5/). Pre-registrations are available at https://aspredicted.org/yj5jq5.pdf, https://aspredicted.org/8xp2bu.pdf, and https://aspredicted.org/ra33ex.pdf.

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