

Behavioral Measurement of Photoreceptor-directed Contrast Sensitivity in the Canine

Abstract: 1063



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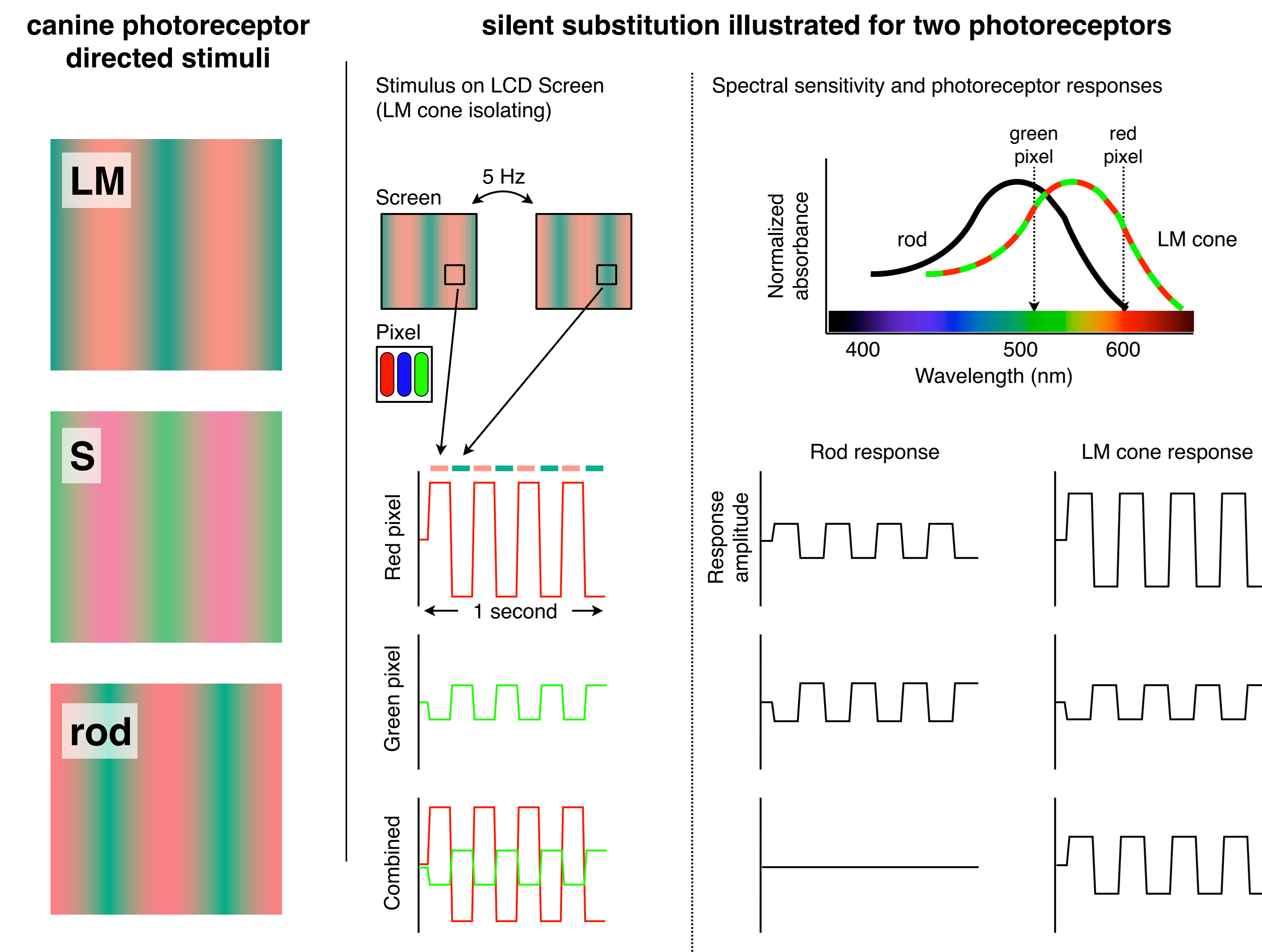
Purpose

To measure behavioral contrast-detection performance for modulations designed to selectively stimulate canine rod, LM-cone, and S-cone photoreceptors.

Methods

Subjects: One normal, adult, female mongrel dog was used to measure behavioral responses to stimuli selectively directed at rod, LM-cone, and S-cone photoreceptors.

Methodology: Photoreceptor-directed stimuli were developed using the silent substitution method, with respect to estimates of the spectral sensitivities of canine photoreceptors.

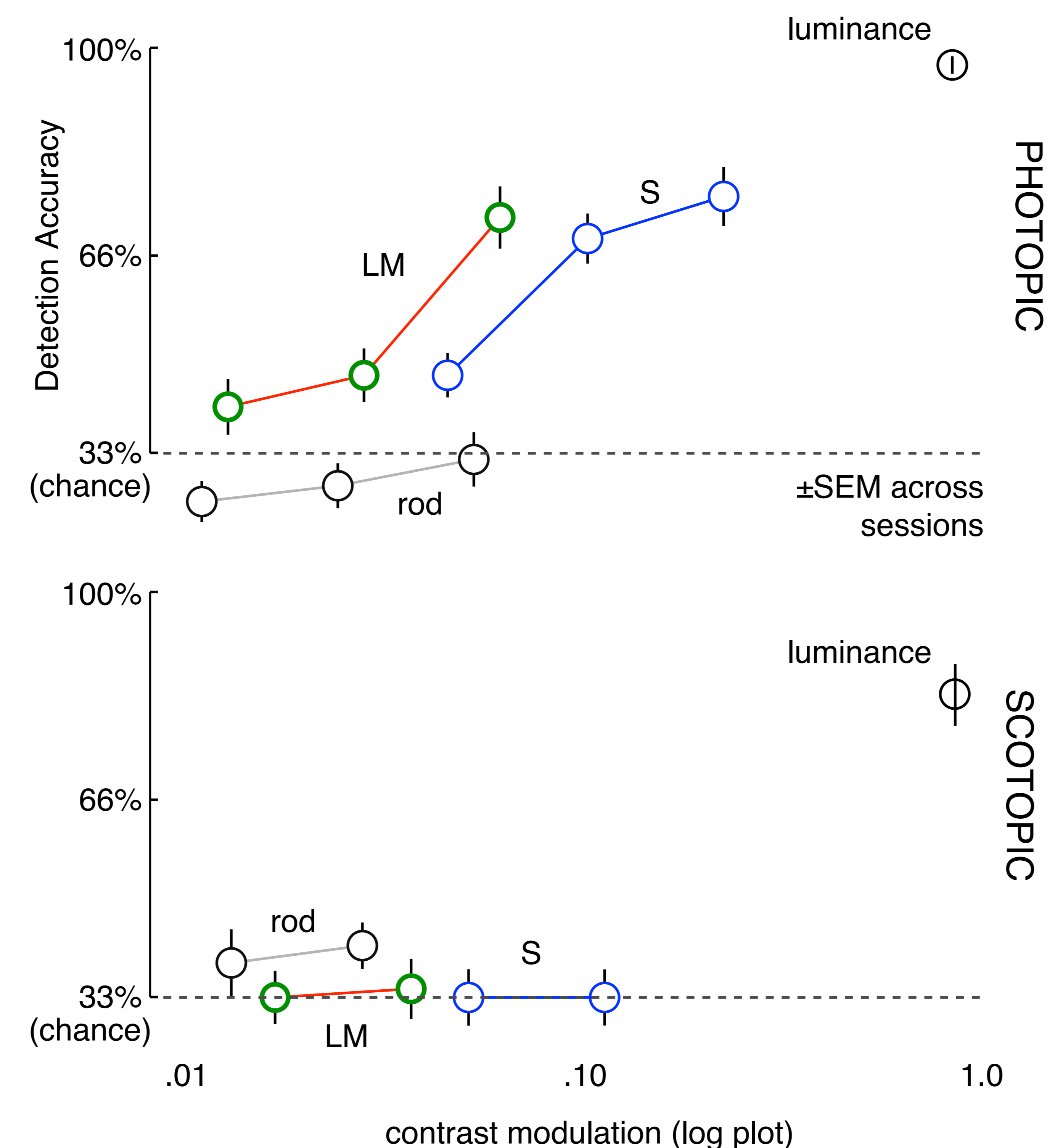


Visual Stimuli: On each trial, a vertical sinusoidal grating flickering at 5 Hz was presented on one randomly chosen monitor. Gratings were presented at three contrast levels in each of the three color directions; each direction was constructed to selectively stimulate one of the three canine photoreceptor classes (rod, LM-cones, S-cones). A maximal-contrast luminance modulation was also included.

Testing Apparatus: Three computer-controlled monitors were used to present the stimuli. A thin foot step detector mat and an automated food pellet dispenser were associated with each of the monitor stations. The dog received an automatic food reward for approaching the monitor with the visual stimulus.

Testing Conditions: The animal was tested in photopic and scotopic (dark-adapted) conditions. The average luminance of the photopic and scotopic stimuli was ~ 60 cd/m² and 0.1 cd/m², respectively. A total of 23 photopic sessions (1150 trials) were conducted over 56 days. A total of 17 scotopic sessions (595 trials) were conducted over 23 days.

Results



• Accuracy for rod-directed stimuli under photopic conditions was no better than chance (33%) at all contrast levels, whereas both LM and S-cone detection accuracy increased with contrast.

• Under scotopic conditions, rod-directed modulations were detected above chance, while detection of LM and S cone directed stimuli was at chance.

• The interaction of photoreceptor direction and luminance level was significant [$t(38)=2.3$, $p=0.03$].

Conclusions & Future Directions

• Canine visual performance can be measured for stimuli detected by different photoreceptor classes.

• Receptor class-specific visual performance in congenital canine achromats is being measured and will be compared to the performance after LM-cone gene therapy.

References

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Acknowledgments

BWF, Pennsylvania Lions Club, FFB, NIH, and the Retinal Disease Studies Facility (RDSF) staff.

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