

CONTROL ID: 2919951

SUBMISSION ROLE: Abstract Submission

## AUTHORS

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**Commercial Relationships Disclosure (Abstract):** Brian Schmidt: Commercial Relationship: Code N (No Commercial Relationship) | Alexandra Boehm: Commercial Relationship: Code N (No Commercial Relationship) | Austin Roorda: Commercial Relationship(s);USPTO#7,118,216, USPTO#6,890,076:Code P (Patent) ;C.Light Technologies:Code I (Personal Financial Interest)

**Study Group:** (none)

## ABSTRACT

**TITLE:** Plucking strings and playing chords: percepts elicited from single and multiple cone stimulation

### **ABSTRACT BODY:**

**Purpose:** Incoming sensory information is often noisy and ambiguous. One strategy the brain uses to reduce uncertainty is to pool signals from multiple detectors. We studied the rules for combining signals from sensory receptors by targeting pairs of cones with light and recording the associated percept.

**Methods:** Two male and one female subject were enrolled in the study. Cone mosaics (at 1-3 degrees of eccentricity) were imaged and tracked with an adaptive optics scanning laser ophthalmoscope (AOSLO). Stimuli (543 nm; 0.35 arcmin; 500 ms) were delivered to cones of interest following established procedures (Harmening et al. 2014). Thresholds for detecting 85% of flashes were found with an adaptive staircase procedure for both one- and two-cone conditions. Subsequently, we recorded the appearance of flashes at the measured detection threshold. Subjects indicated the appearance of each stimulus with a hue and saturation scaling procedure (Gordon et al. 1994). During each session groups of three cones were targeted both individually and in pairs; trials were randomly interleaved. The background in both experiments was dim white. Separately, cone mosaics were classified with AOSLO densitometry (Sabesan et al. 2015).

**Results:** The mean threshold (light intensity per cone) in the two-cone condition was half of the single cone case, on average. In the appearance task, the most common hue reports in both conditions fell along a red-green axis, while blue and yellow were used at a lower frequency; saturation was variable between cones. Two-cone color appearance reports were predicted by a weighted sum of the responses measured in the one-cone condition:  $R^2=0.67$ ,  $N=147$ ,  $p<0.001$ . Overall, the chromatic reports measured in the two-cone condition were slightly more saturated than what was predicted by a simple average of individual cone responses.

**Conclusions:** Two-cone detection thresholds followed the expectations of a single detector that linearly summed signals from individual cones assuming each cone carried minimal noise. In comparison, two-cone appearance judgments were better predicted by a non-linear spatial summation model. Together these observations suggest that the detection and appearance judgments were mediated by different neural pathways; potentially implicating the magno- and parvocellular pathways, respectively.

(No Image Selected)

## DETAILS

**PRESENTATION TYPE:** #1 Paper, #2 Poster

**CURRENT REVIEWING CODE:** 1640 color vision - VI

**CURRENT SECTION:** Visual Psychophysics/Physiological Optics

**Clinical Trial Registration (Abstract):** No

**Other Registry Site (Abstract):** (none)

**Registration Number (Abstract):** (none)

**Date Trial was Registered (MM/DD/YYYY) (Abstract):** (none)

**Date Trial Began (MM/DD/YYYY) (Abstract):** (none)

**Grant Support (Abstract):** Yes

**Support Detail (Abstract):** NIH F32 EY027637, NIH R01 EY023591, NIH P30 EY003176, NIH T32 EY007043, Minnie F. Turner Memorial Fund, American Optometric Foundation Ezell Fellowship

## **TRAVEL GRANTS and AWARDS APPLICATIONS**

**AWARDS:** ARVO Members-in-Training Outstanding Poster Award

## **AFFIRMATIONS**

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