

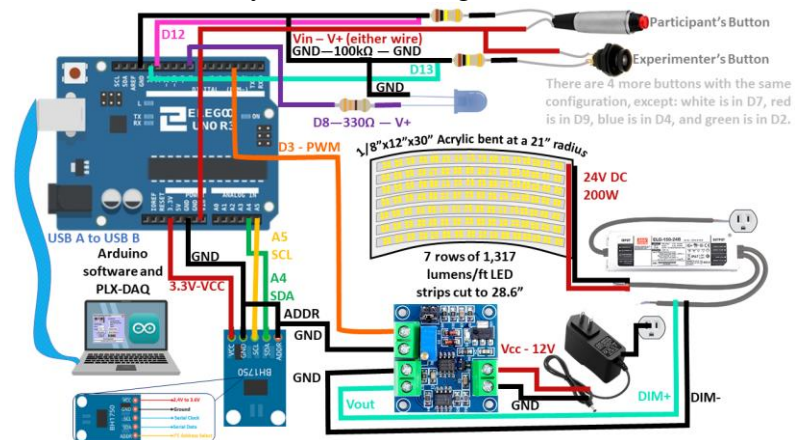


CHROMATIC PHOTOPHOBIA L.E.D. APPARATUS MANUFACTURING

Shannon T. Lamb (Dr. Melissa M. Cortez, Cecilia Martindale)

Department of Neurology

One of the key diagnosis criteria for migraine disorders is abnormal sensitivity to light, also known as photophobia. Patients with migraine disorders have a significantly lower photophobia threshold compared to healthy controls (Cortez et al., 2017, p. 801), however, little is known about the effects of colored lights on one's photophobia threshold. The Autonomic Physiology Laboratory at the University of Utah conducted an initial study on white light sensitivity threshold using two halogen lights aimed at a participant from 21 inches away. The experimenter increased the light intensity by turning a potentiometer every 2 seconds. A lux meter above the participant's forehead displayed light output continuously. The participant was directed to state when the light became uncomfortable, and the experimenter then had to quickly record the lux value and rheostat step before turning off the light. To improve this protocol by adding chromatic light and a second discomfort rating from participants, an automated LED system was needed. The ideal device is an automated system of LED lights that would increase in lux values (<20 lux to >10,000lux) incrementally every two seconds, measure the value at every interval, encapsulate one's full range of vision, respond to participant feedback, and export results of testing for analysis. Each participant has three trials of white, red, green, and blue light. The LEDs increase incrementally using pulse width modulation (PWM), a voltage output in a square wave rather than continuous, from 0% to 100% of the duty cycle. When the light intensity becomes uncomfortable to the participant, they press their button for two seconds and the current lux value is logged. When the light intensity becomes a moderate pain, they press the button a second time, the lux value is logged, and the lights turn off. Lux values are collected using a BH1750 sensor. The chromatic element is altered using red, green, and blue light filters. The entire device is programmed using Arduino.io in conjunction with PLX DAQ, allowing the serial data to be directly uploaded to a data sheet. Future research utilizing this device may identify sensory biomarkers of headache disorders and aid in prescribing personalized tinted glasses that minimize the impact of light sensitivity in patients with migraine and headache disorders.



Resource: Cortez, M. M., Rea, N. A., Hunter, L. A., Digre, K. B., & Brennan, K. C. (2017). Altered pupillary light response scales with disease severity in migrainous photophobia. *Cephalalgia : an international journal of headache*, 37(8), 801–811. <https://doi.org/10.1177/0333102416673205>