Very-long-chromatic adaptation and short-term chromatic adaptation: same or different mechanisms?

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This research tested whether very-long-term (VLT) chromatic adaptation and short-term chromatic adaptation share a common mechanism. VLT chromatic adaptation results from exposure to an altered chromatic environment experienced over hours or weeks. Color shifts from VLT adaptation are measured hours or days after leaving the altered environment. Short-term chromatic adaptation results from exposure for a few minutes or less, with color shifts measured within a few seconds after the adapting light is extinguished. In this experiment, both types of adaptation were combined. All adaptation was to reddish-appearing long-wavelength light. Shifts in unique yellow were measured following adaptation. Previous research showed shifts in unique yellow following VLT chromatic adaptation, but shifts in unique yellow caused by short-term chromatic adaptation can be ~10 times greater than for VLT adaptation. This research determined whether the color shift from VLT adaptation is cumulative with the far larger shift from short-term adaptation or, alternatively, if short-term adaptation saturated a unified adaptation mechanism or inhibited VLT adaptation.

For VLT chromatic adaptation, the subject viewed for one hour per day a CRT monitor that displayed a moving red/black grating composed primarily from the R phosphor (Judd x = 0.60, y = 0.35, 22.4 cd/m^2). Exposure was repeated daily for 12 to 14 days. Unique yellow was measured each day before the start of the VLT adaptation exposure, i.e., 22 hours after the end of viewing of the very-long-term adapting environment. The subject set an admixture of 540nm-plus-660nm light to appear equilibrium yellow at five luminance levels between 0.5 and 2.5 log trolands. For short-term adaptation, a three-minute exposure to a 660 nm light at 100 td was incorporated into a testing session just before the equilibrium yellow measurements.

Shifts in unique yellow due to only short-term or only CRT adaptation were measured separately at all test-stimulus levels. The color shifts from VLT and short-term adaptation were cumulative, which is consistent with short-term and long-term chromatic adaptation acting on separate neural mechanisms.