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Temporal Dynamics of Adaptation in Color Appearance and Discrimination

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Adaptation to a steady background has a profound effect on both color appearance and discriminability. The goal of these experiments was to determine the temporal characteristics of adaptation for appearance and discrimination, and for changes along different color directions.

Subjects were adapted to a large uniform background made up of a CRT screen and a $60 \times 60^\circ$ wall illuminated by computer controlled lamps. After an instant change in background color along the red-green or blue-yellow cardinal color axes, we measured thresholds for the detection of increments or decrements along the same axes at fixed times between 16 ms und 120 s. Analogously, color appearance was determined using achromatic matching.

A slow exponential time course of adaptation was observed with a half-life of 20–30 seconds that was common to appearance and discrimination. Also, a 50–100 ms component could be indentified, which was probably due to photoreceptor adaptation. There was an extremely fast mechanism with a half life faster than 10 ms, but only for color appearance. There were no differences for adaptational changes along the different color axes.

It can be concluded that the fast adaptation mechanism for color appearance is of higher order and situated after the mechanisms mediating slower adaptational changes in color discrimination and appearance.