Why is colour perception slow?

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It is well known that chromatic perception is "slow". For instance, chromatic flicker produced by the alternation of coloured lights fades to achromatic as their alternation rate is increased. Chromatic mechanisms have a characteristically lowpass temporal frequency response (one that falls monotonically with frequency) with a poor response to higher temporal frequencies compared with the luminance mechanism, which has a characteristically bandpass response (one that peaks in sensitivity at an intermediate frequency). The greater chromatic sensitivity loss with increasing frequency is generally assumed to reflect greater temporal integration within chromatic mechanisms. However, the loss might be consistent with a limit in the rate at which chromatic mechanisms can signal changes in hue. That is, chromatic mechanisms might be "slew-rate-limited". Seemingly consistent with this view are the results of series of experiments in which observers were presented with M- and L-cone-isolating sawtooth stimuli that could be either rapid-on (slowly-off) or rapid-off (slowly-on). Between about 6 and 13-Hz rapid-on-L-cone and rapid-off-M-cone sawtooth stimuli appear greener, while rapid-off-L-cone and rapid-on-M-cone sawtooth stimuli appear redder, even though they have the same mean chromaticities. These changes can be explained by supposing that slew-rate-limited chromatic mechanisms can track the slowly changing part of the sawtooth better than the quickly changing part—with the result that their mean output is always skewed in the direction of the slow change. More formal measurements of the detection of the coloured offset as a function of sawtooth modulation depth and as a function of sawtooth slope yield experimental data with which we can test the slew-rate model. The predictions of the slew-rate model are complex. In its simplest from, the model predicts a *bandpass* chromatic response with a precipitous loss of high frequency sensitivity, which is inconsistent with the lowpass characteristics of chromatic mechanisms.

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