

5078—12:00

TEMPORAL DYNAMICS REVEAL MULTIPLE MECHANISMS OF BRIGHTNESS PERCEPTION. ((D.C. Somers, K.R. Nichols, & E.H. Adelson)) Dept. of Brain & Cognitive Sciences, MIT, Cambridge, MA

**Purpose.** We have recently demonstrated strong brightness illusions that depend on spatial configuration. We hypothesize that these effects require more complex processing than simultaneous contrast (SC) effects, and thus predict that this processing may be relatively slow. Here, we investigated the temporal dependence of different brightness illusions. **Methods.** Subjects viewed brightness illusion displays in which the apparent brightness of identical, static test patches was manipulated by temporally modulating surrounding luminance values. For SC displays, patch backgrounds were modulated. In configural displays, the non-local, configural elements were modulated. Subjects reported brightness matches at different frequencies and reported "cut-off" frequencies for the brightness modulations. **Results.** At low temporal frequencies ( $\leq 0.25$  Hz), modulations of configural elements produced strong modulations of the apparent brightness of test patches. The apparent luminance ratio of identical test patches can be modulated between 4 (strong illusion) and 1.1 (weak illusion). As the temporal frequency of the luminance modulations increases, the apparent brightness modulation amplitude monotonically decreases, cutting off at approximately 1.5 Hz. Over this frequency range, brightness modulations produced by adjacent surround modulations were largely constant. Compared with configural modulations, these effects were weaker at low frequencies, but had much higher cutoff frequencies ( $\geq 4$  Hz). Interestingly, brightness filling-in was observed with surround modulations, but not with the stronger, configural modulations. **Conclusions.** Simultaneous contrast and our configural brightness illusions exhibit very different temporal dependencies. It is well known that classical SC effects are fast, consistent with local edge-based mechanisms. Conversely, our configural displays exhibit slow but strong effects, possibly consistent with grouping or surface-level mechanisms. These differences appear to reflect both the spatial extent and complexity of different brightness mechanisms. EY-12690 None

Somers, D.C., Nichols, K.R., and Adelson, E.H. (2000)  
Temporal dynamics reveal multiple mechanisms of  
brightness perception. *Invest. Ophthalmol. Vis. Sci.*  
Suppl., 41, S956