Modeling the interaction of two rapid adaptation processes: contrast comparison and contrast normalization
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1 ~ Introduction
Contrast is important. We spend most of our waking hours looking at patterned regions (non-zero contrast). We see very little time looking at un-patterned areas (zero contrast).
A few years ago we discovered a rather surprising effect of short-term adaptation to contrast: the Weber zone. A Straddle test pattern is composed of two Test contrasts that straddle the Adapt contrast (one of the Test contrasts is below the Adapt contrast and the other is above it). Example test patterns are shown under section “2 ~ Methods”. Performance is very poor on Straddle test patterns. Performance is much better on Below and Above test patterns (the two Test contrasts are both below the Adapt contrast or both above it). Performance declines again for Far Below and Far Above test patterns.

2 ~ Methods
Performance declines again for Far Below and Far Above test patterns.
Performance is very poor on Straddle test patterns. The mean luminance was approx 50 cd/m^2. Gabor patch spatial frequency was about 2 cycle per deg at the viewing distance of 0.9 meters. Gabor patch orientation was the same through a trial.

3 ~ Data & Predictions
We suggest that two different processes/zones underlie performance...
...in the center is the “Buffy zone” where contrast comparison produces a Weber-like behavior. At the ends is the “Weber zone” where contrast normalization produces Weber-like behavior.

4 ~ Model
Psychophysical trial with example contrast values

5 ~ Conclusions & Speculations

The model in section “4 ~ Model” explains well both the steady-state Straddle Effect and the Weber-like behavior.

The experimental and modeling results together suggest that...
The important quantity in much human contrast processing is not monotonic with physical contrast. It is more like the (unsigned) difference between the current contrast and the recent average contrast.

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