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The Dynamics of Brightness Induction in Heterogeneous Displays

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Two experiments are described investigating the impact exerted on the brightness of a target patch by components of a heterogeneous surrounding region. A target gray square occupies the middle of a 5 x 5 grid of squares. The 24 squares surrounding the target are each randomly assigned one of four luminance's linearly increasing from black to white. Three observers were asked to judge (with feedback) whether the target was either more or less luminant than the uniform gray background. In experiment 1 stimulus presentation time was brief (60 ms for one subject, 80 ms for two others), while in experiment 2 stimulus presentation time was longer (800 ms). A general linear model is described and used to determine the impact, on target brightness, of a given luminance presented in a given grid position. Results were consistent across observers. In both experiments, the four squares sharing an edge with the target affected target brightness 2.5 to 10 times more than any other squares in the grid. For the slower presentation time, abutting squares of extreme contrast tended to repel the brightness of the target square. By contrast, abutting squares of luminance near the mean attracted the brightness of the target square: light (dark) gray squares tended to increase (decrease) target square brightness. For the faster presentation time, a striking, polarity-specific asymmetry was observed. Abutting squares of the two brighter luminances showed the sae pattern of influence as they did with the 800 ms presentation time. However in the brief display, abutting squares of sub-mean luminance (black and dark gray squares alike) exerted little or no influence on target patch brightness. The suggests that brightness induction occurs with lower latency from positive than from negative contrast abutting regions.