

SEMINAR ANNOUNCEMENT

The Effect Of Context-Dependent Lightness On Contrast Detection And Identification, And Its Neural Correlates

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ABSTRACT

Perceived contrast of a grating varies with its background (or mean) luminance: of the two gratings with the same photometric contrast the one on higher luminance background appears to have higher contrast. On the other hand, context often causes a large perceived difference between equiluminant regions (e.g. simultaneous brightness contrast). Does perceived contrast also vary with context-dependent background lightness even when the luminance remains constant? In this study, the effect of context-dependent lightness on contrast perception was investigated using psychophysical and functional magnetic resonance imaging (fMRI) methods. First, we measured appearance judgments of participants and demonstrated that context-dependent lightness of background influences the perceived contrast of rectified gratings. Perceived contrast of gratings superimposed on equiluminant but perceptually lighter background is higher compared to ones on perceptually darker backgrounds. However, this pattern is valid only for incremental, not for decremental contrast.

Literature indicates a significant difference between visual processing near and above threshold. Also, behaviorally it has been shown that appearance and threshold tasks are mediated by different mechanisms. Therefore, here, we also measured the effect of context-dependent lightness on contrast detection and discrimination thresholds using a 2-IFC procedure. Results indicate that both detection and discrimination thresholds are lower for the gratings superimposed on perceptually lighter backgrounds. Differently from the appearance results, the effect was observed both for incremental and decremental contrast.

In an fMRI study, we investigated whether activity in any brain region correlates with lightness-dependent contrast. Although our stimulus was physically identical we observed difference in BOLD response within pre-defined region of interests (ROIs) in different visual areas. Both for incremental and decremental contrast, activation, especially in V1, was greater when the grating was superimposed on lighter background for all the contrast levels tested. Thus, variation in V1 activity with varying contrast links better with the detection and discrimination thresholds than the appearance results. Therefore, this study might offer a neural evidence for dissociation between the mechanisms underlying detection (threshold) and identification (appearance) measures. However, the relationship between the threshold and fMRI data does not really agree with the previous findings in literature. These results indicate that the neural activation caused by the detection mechanism may change depending on the absolute or perceived value of the contrast.