Contrast Polarity Influences Visual Sensitivity in Behaving Rats

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Humans can detect negative contrast (black on gray) better and more easily than positive contrast (white on gray). The black-over-white preference in visual perception is accordance with the findings that negative-contrast stimuli can evoke larger neuronal responses than positive-contrast stimuli in primary visual cortex (V1). In contrast, strong white-dominant responses were recently found in mouse V1 with the voltage-sensitive dye imaging (VSDI) technique. Based on these findings, it is possible that nocturnal rodents may prefer positive contrast to negative contrast. Here we used a two-alternative forced choice task to test the preference of contrast polarity in behaving rats (Long Evans). We manipulated contrast polarity (positive or negative contrast), contrast intensity and the mean luminance of the screen (high: 50 cd/m^2, low: 20 cd/m^2) in our experiments. Surprisingly we found that rats could detect the negative-contrast stimuli better when the contrast intensity became stronger in the low mean luminance condition. This asymmetry also occurred in the learning progress when rats were learning the contrast detection task. Overall, our behavioral results show that nocturnal rodents detect negative contrast

better, but not positive contrast, in photopic vision. It suggests that the visual system of nocturnal rodents also displays black-over-white bias in visual processing. The white-dominant responses in mouse V1 might reflect the inhibitory local field potential evoked by the positive-contrast stimuli.