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Effect of blur in colour discrimination

Leticia Álvaro; João Linhares; Talia Ali; Monika Formankiewicz; Sarah Waugh

+ Author Affiliations

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Abstract

Blur impairs colour discrimination but this impairment has not been systematically investigated across hue. In this work we obtained colour discrimination thresholds for a number of hue angles, stimulus sizes and blur levels. A colour discrimination task (Linhares et al., 2016 JOSA A 33(3): A178-A83) was performed on a calibrated CRT monitor controlled by a ViSaGe-MKII. A square chromatic target was presented on an achromatic static luminance noise background. Observers indicated the location of the square (right or left). Discrimination thresholds were measured on repeated occasions using a staircase procedure for each of 22 hues, including those from protan, deutan and tritan confusion lines (Smith and Pokorny, 1975 JOSA A 15(2): 161-171). Four observers with corrected-to-normal visual acuity performed the task monocularly without blur and with four levels of refractive blur: +1 to +4D for 1 deg target, and +2 to +8D for 5 deg target. Colour differences (ΔE^*_{uv}) between target threshold and background were then calculated. The effect of blur was estimated from the difference in ΔE^*_{uv} between the blur and no blur conditions. A repeated measures ANOVA (size, blur and hue) revealed significant size*blur ($P < 0.001$), size*hue ($P < 0.001$) and blur*hue ($P < 0.05$) interactions. Blur affected colour discrimination more for the smaller target, where thresholds were lower. Tukey post-hoc analysis revealed a significant worsening in hue discrimination with blur for yellowish hues near the tritan confusion line when compared to hues near the protan and deutan confusion lines. The effects of lens blur on wavelength transmission as measured with a spectro-photometer (PR650) cannot explain these results. Our results may hold implications for

colour vision research especially in developing, aging and diseased populations for whom uncorrected refractive error could mimic losses along the tritan confusion line.

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