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Title	Visual Simulation of Low-Order Aberrations on Monochromatic Images
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Corresponding Author	Mr. Matheus L. Krueger (UFRGS)
Contributing Authors	Prof. Manuel M. Oliveira , Dr. Airton L. Kronbauer
Abstract	Purpose: To describe a practical approach for modeling and simulating the visual perception of monochromatic images observed by an optical systems with low-aberrations (i.e., myopia, hyperopia and astig- matism) Methods: We have created images of Sloan letters at LogMAR (Logarithm of the Minimum Angle of Resolution) values ranging from -0.3 to 1.0 in steps of 0.1. And captured them by using a DSLR camera in order to represent a perfect eye (i.e., without refractive aberrations). We place additional lenses in front of the camera's optical system to induce low-order aberrations. Finally, we characterize the optical aberrations of the human eye using a wavefront aberration function, which is used, together with the images captured by the camera, to per- form simulations in the frequency domain. Results: To objectively evaluate the quality of the simulated results, we use three objective metrics: the SSIM (Structural Similarity Image Metric), the PSNR (Peak Signal-to-Noise Ratio), and the AD (Absolute Difference) of the pixelwise differences between the captured and simulated images. Considering all simulations, we have obtained a SSIM mean value of 0.93 (minimum of 0.91) and a PSNR mean value of 35.50dB (minimum of 29.50dB). Conclusions: The results of the SSIM and PSNR metric confirm that the results produced by our simulations are structurally and perceptually similar to the ground truths captured by the camera.
Precis	We describe a visual simulation technique together with all mathematical and optical concepts. Also, we present a validation of our simulation technique by comparing its results with images captured by a camera instrumented with additional lenses to induce myopia, hyperopia, and astigmatism.
Suggested Reviewers to Include	N/A
Suggested Reviewers to Exclude	N/A
Keywords	Low-order aberrations, Fourier optics, PSF
Subject Areas	visual acuity, visual acuity charts, computational modeling, depth, optics, optotypes, psychophysics, refractive error
Conflict of Interest	**No**
Clinical Trial	No
ARVO Animal Statement	Not Applicable

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