

Joint effects of illumination geometry and object shape in
the perception of surface reflectance

Supplementary figures

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November 21, 2011

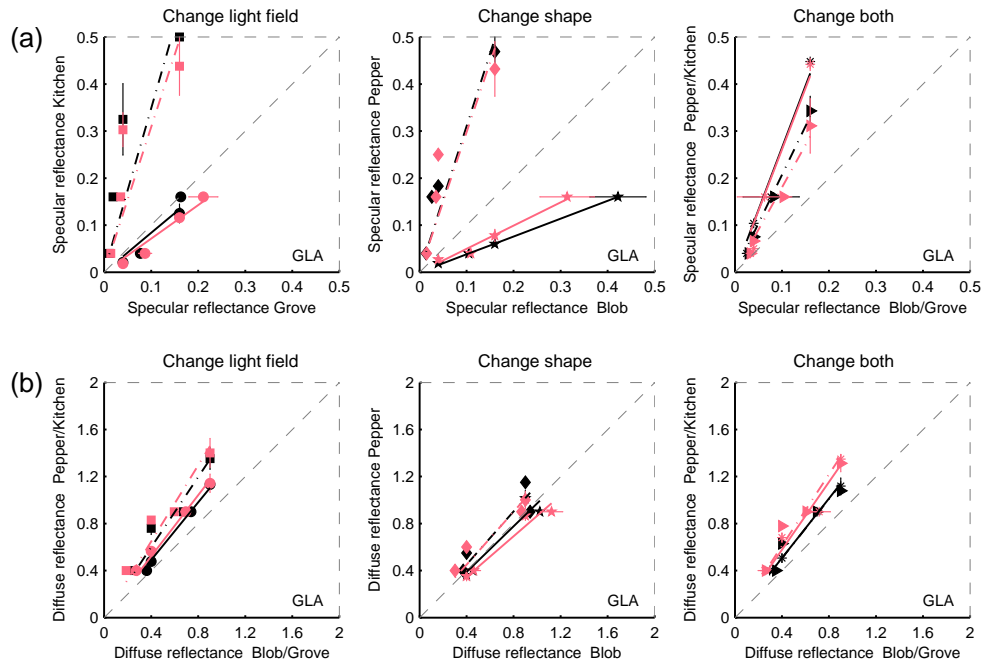


Figure S1: Perceived reflectance for observer GLA, Grove/Kitchen. (a) Specular reflectance values across perceptual glossiness matches across a change in light field (left), a change in shape (middle), and across a change in both light field and shape (right). Solid and dashed lines show the linear regression fits for each shape (left panel), light field (middle panel), or shape/light field combination (right panel). The two levels of diffuse reflectance are indicated with black (low) and pink (high) symbols and lines. Dashed diagonal line indicates unity. Dashed vertical and horizontal lines indicate the limits of the reflectance parameter space as determined by the monitor gamut. In the left panel, symbols denote shape (circles: Blob, squares: Pepper); in the middle panel, symbols denote light field (stars: Grove, diamonds: Kitchen), and in the right panel, symbols denote light field/shape conjunctions (triangles: Grove/Blob; asterisks: Kitchen/Pepper). (b) Diffuse reflectance values across perceptual lightness matches across a change in light field (left), a change in shape (middle), and across a change in both light field and shape (right). Plotting conventions are as in (a), except that the two levels of specular reflectance are indicated by black (low) and pink (high) symbols and lines.

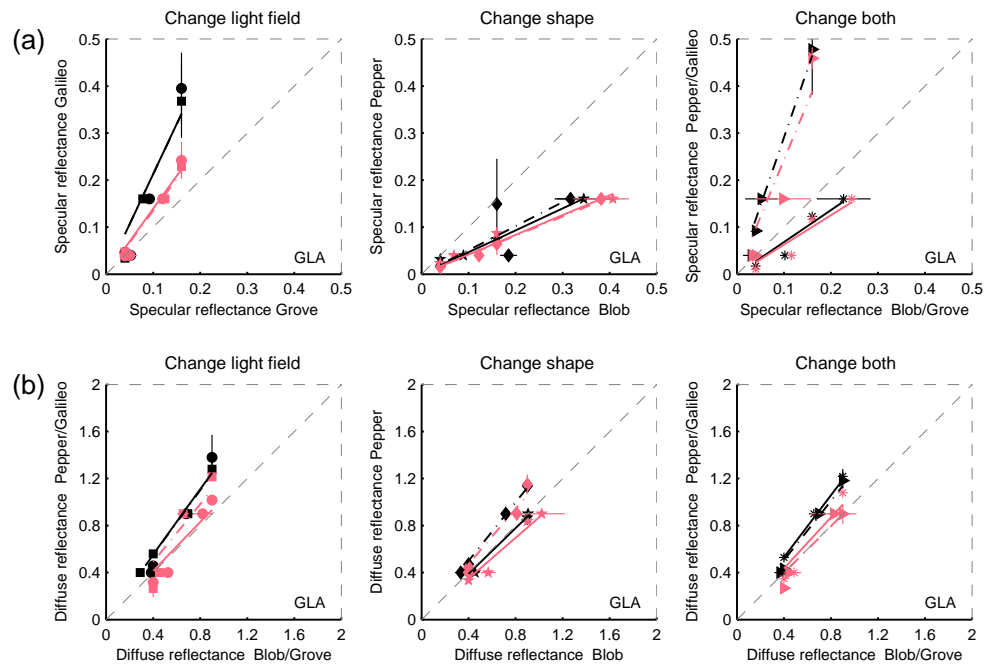


Figure S2: Perceived reflectance for observer GLA, Grove/Galileo. Plotting conventions as in Figure S1.

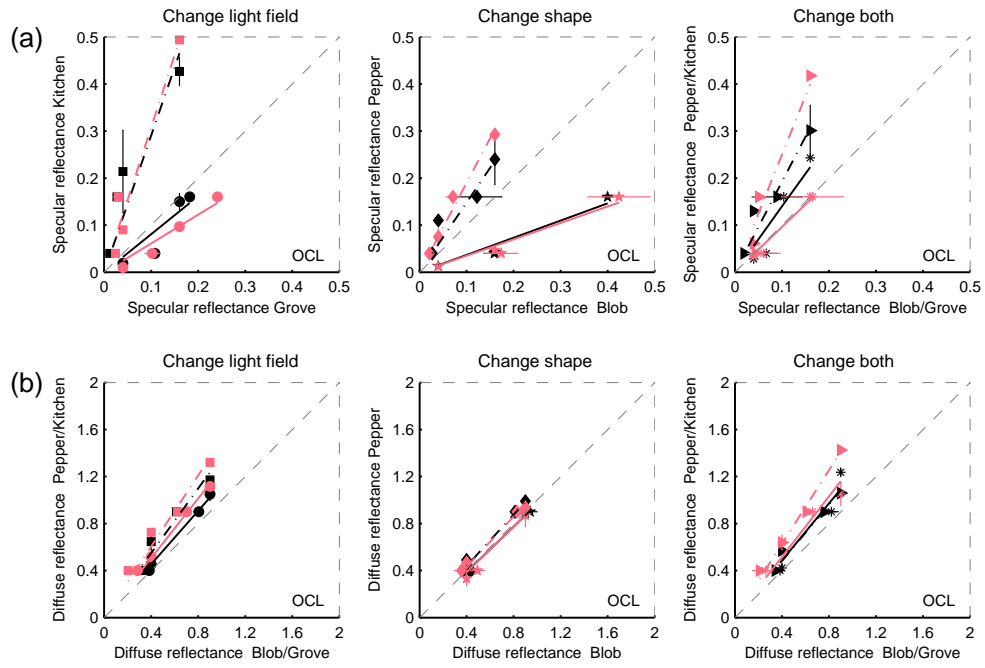


Figure S3: Perceived reflectance for observer OCL, Grove/Kitchen. The change light and change shape data for OCL are also plotted in the main paper. Plotting conventions as in Figure S1.

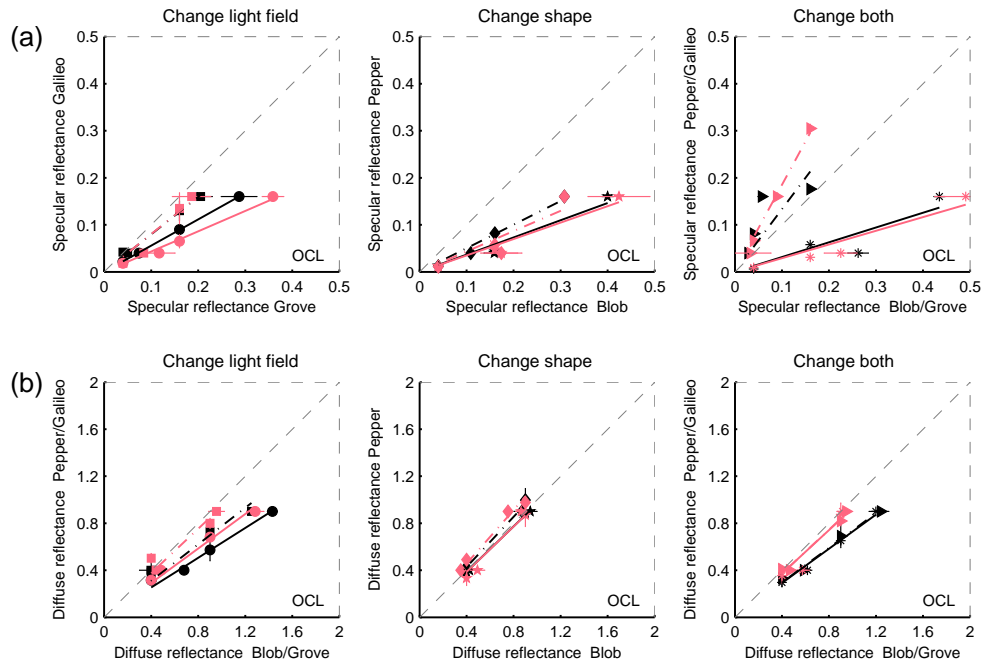


Figure S4: Perceived reflectance for observer OCL, Grove/Galileo. Plotting conventions as in Figure S1.

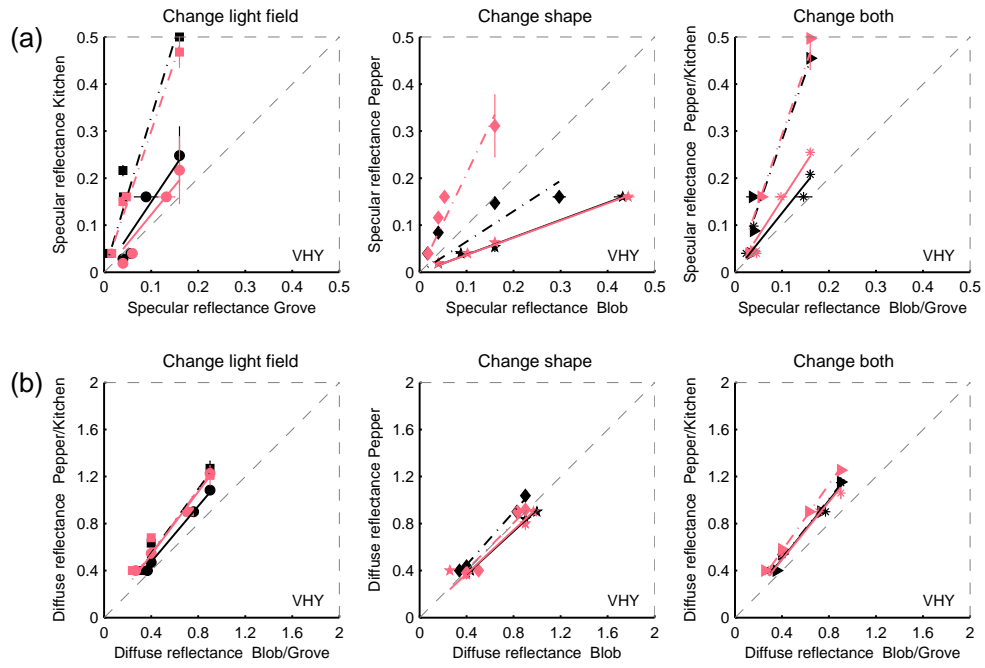


Figure S5: Perceived reflectance for observer VHY, Grove/Kitchen. Plotting conventions as in Figure S1.

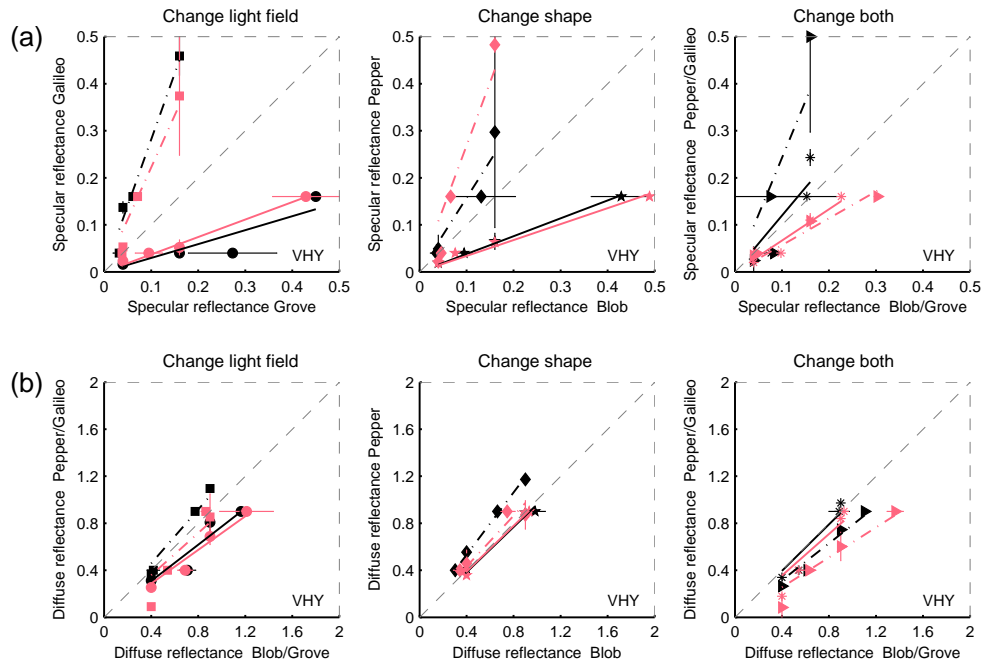


Figure S6: Perceived reflectance for observer VHY, Grove/Galileo. Plotting conventions as in Figure S1.

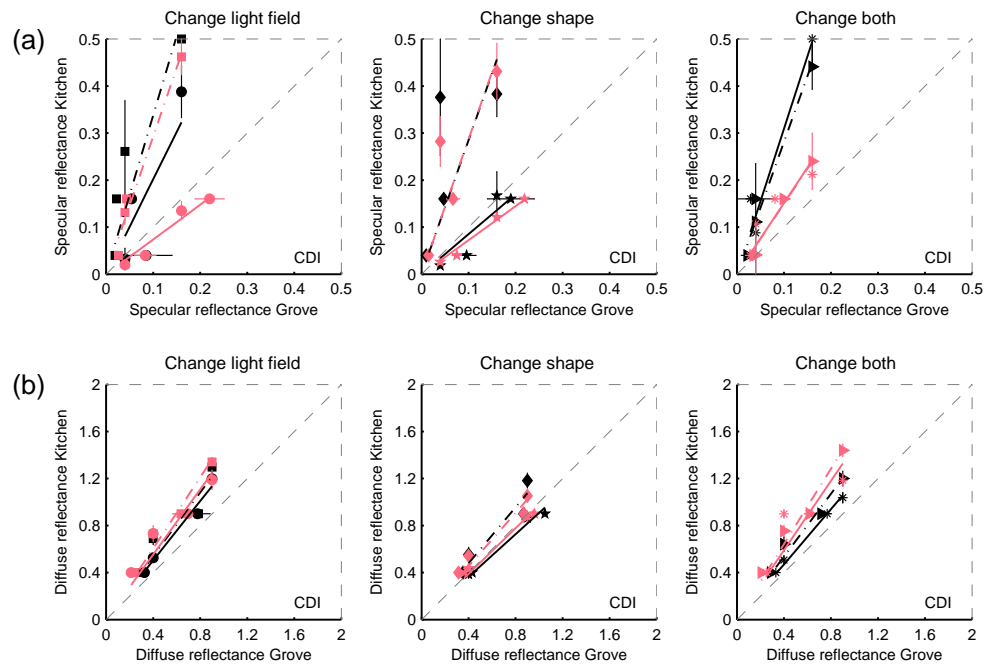


Figure S7: Perceived reflectance for observer CDI, Grove/Kitchen. Plotting conventions as in Figure S1.

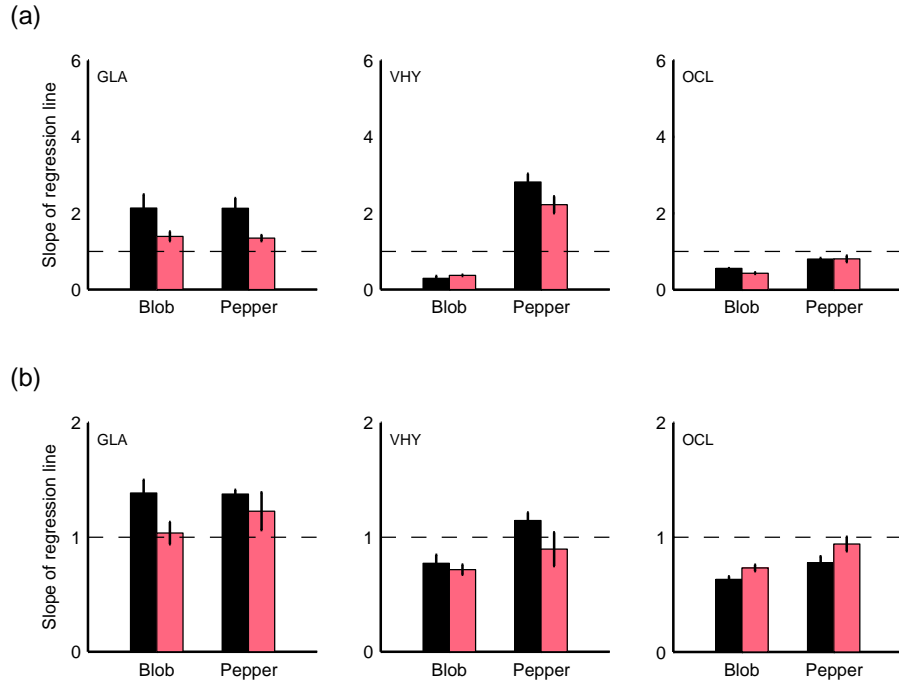


Figure S8: Effect of light field on perceived reflectance, Grove/Galileo. (a) Each panel shows the slopes of regression lines fitted to the equal perceived glossiness data for each observer. Each set of bars in a panel shows the slopes for one shape. Slopes for low and high diffuse reflectance are shown in black and pink, respectively. Error bars show the 67% confidence intervals of the regression line fit. (b) Slopes of linear regression lines fitted to the equal perceived lightness data for each observer. Plotting conventions are as in (a) with the exception that here the black and pink symbols indicate stimuli with low and high specular reflectance, respectively.

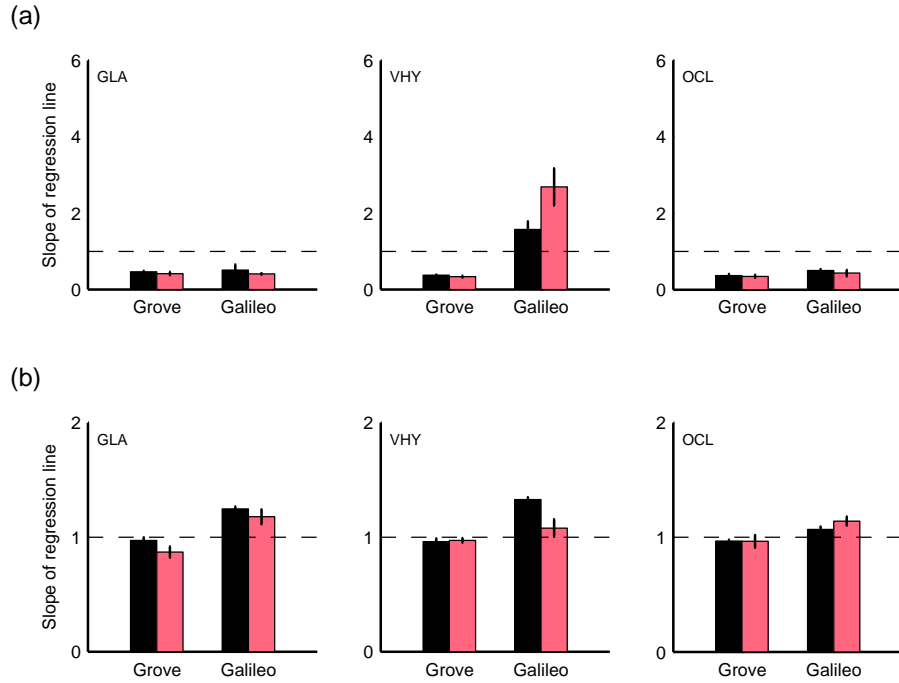


Figure S9: Effect of shape on perceived glossiness (A) and lightness (B), Grove/Galileo.

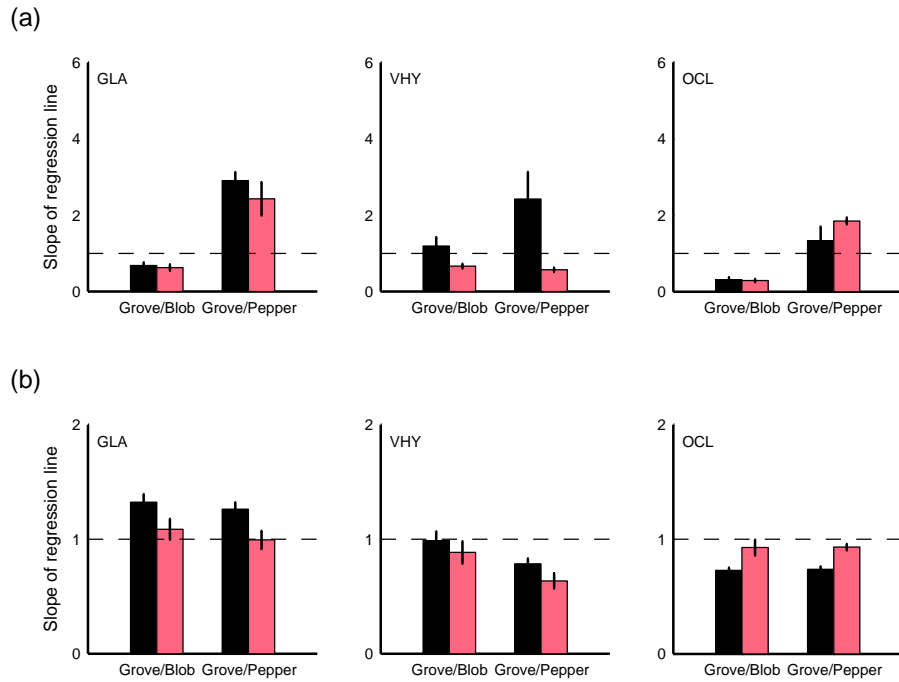


Figure S10: Effect of a joint shape and light field change on perceived glossiness (A) and lightness (B), Grove/Galileo.

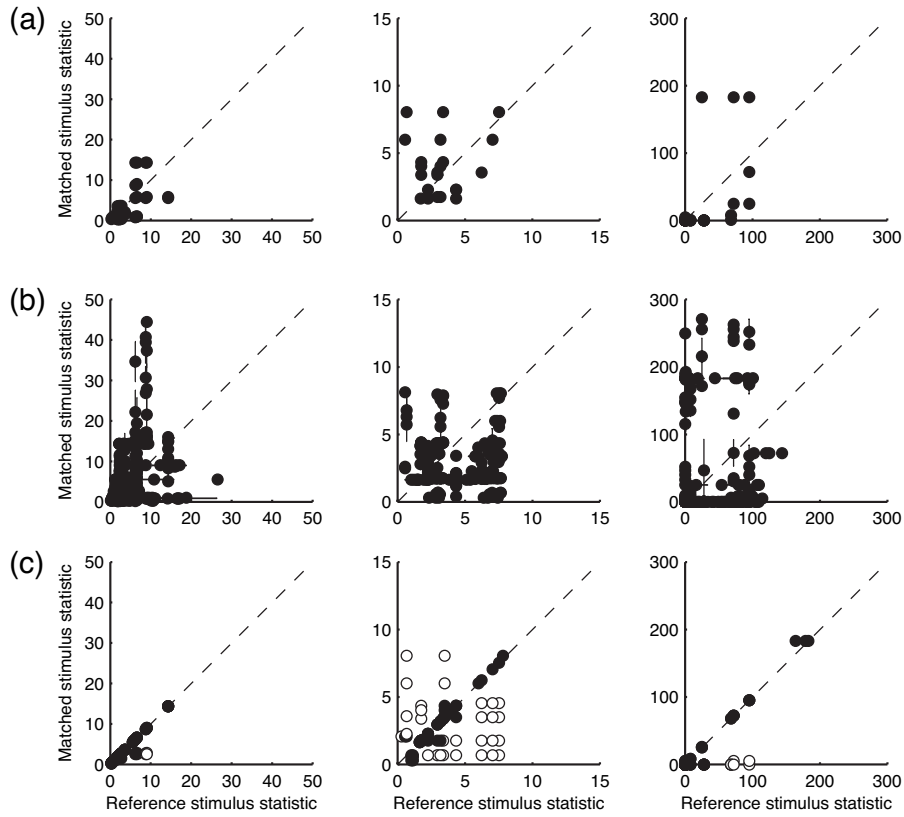


Figure S11: Analysis of luminance histogram statistics for the upper left ROI. (a) Each panel shows how changing the light field, shape, or both changes image statistics for stimuli of fixed reflectance. For each change, the reference statistic is plotted on the x axis and the matched statistic on the y axis. Data are plotted only for stimuli for which the statistics could be matched within our stimulus parameter space. From left to right, the statistics analyzed are the standard deviation of the luminance histogram, the skewness of luminance histogram, and the number of bright pixels. (b) Each panel shows the statistics for perceptually matching pairs across the three changes. Error bars show one standard error of the mean across two measurements of each data point. Data are plotted only for stimuli for which the statistics could be matched within our stimulus parameter space. Other plotting conventions are as in (a). (c) Statistics for pairs of stimuli matched by an optimization algorithm. See main text for details. The closed symbols show data points where the difference between the optimized statistic and the statistic of the reference stimulus is less than 10% of the maximum value that the statistic took on. Open symbols show the remaining cases.

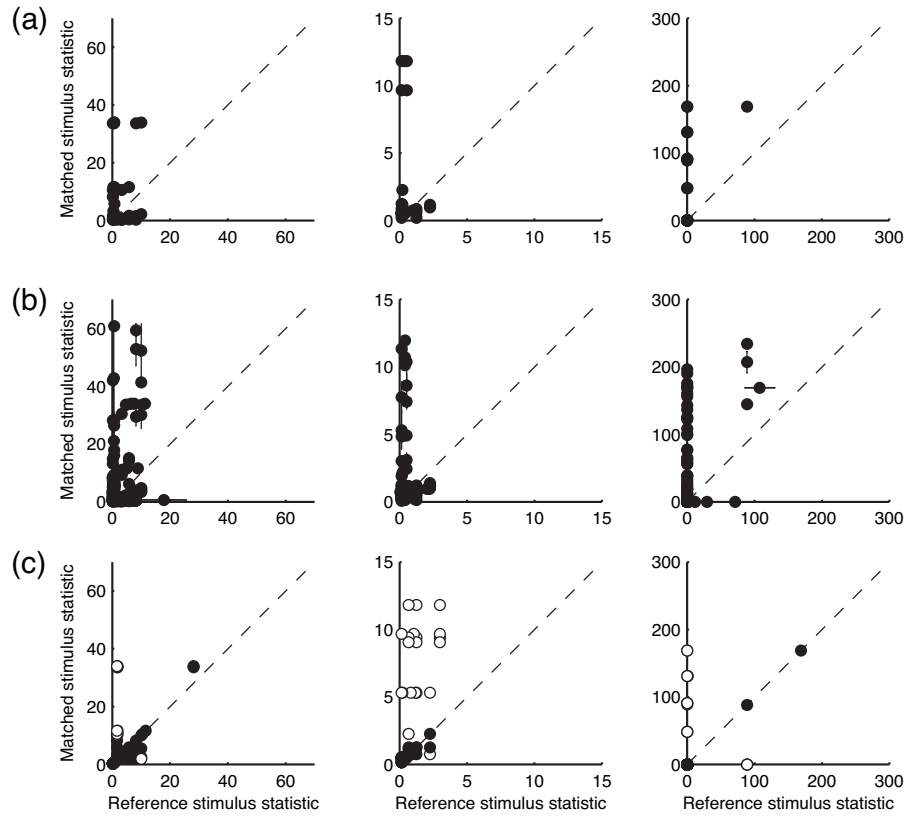


Figure S12: Statistics, center ROI. Details as in Figure S11.

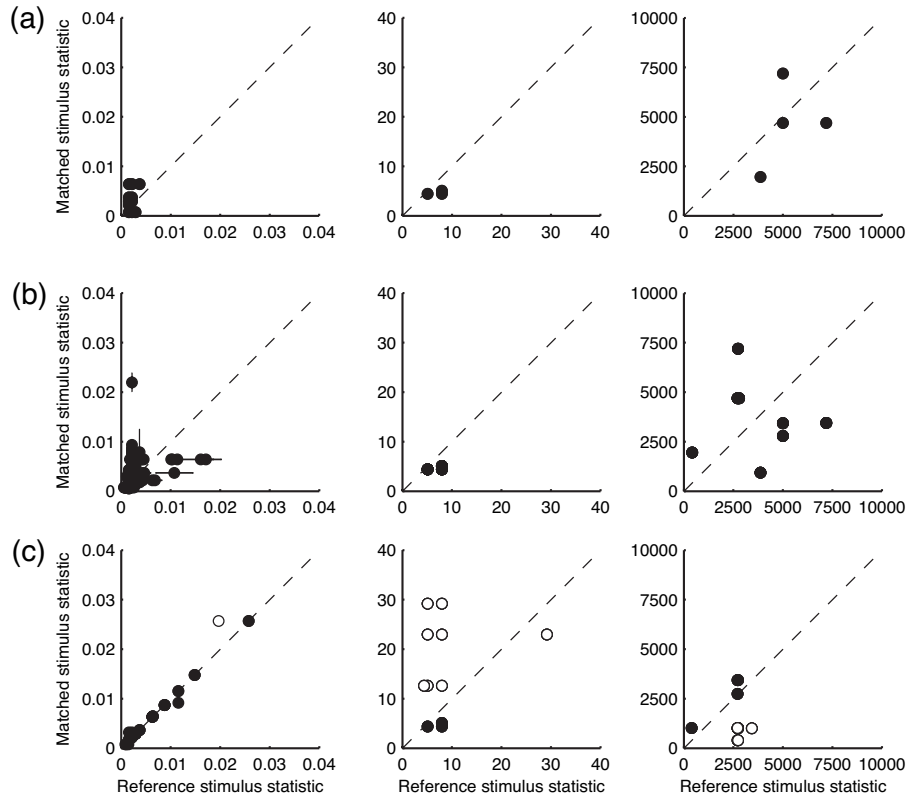


Figure S13: Statistics, specular image. Details as in Figure S11. Note that for a fixed shape and lighting geometry, scaling the specular image does not affect its skewness. Thus the skewness of the specular image cannot predict the observed dependence of perceived glossiness on the strength of the specular component within a light field. This dependence is not incorporated into our slope measure of effects across light field and object shape, and thus the fundamental failure of this statistic to account for performance is not visible in the skewness plots.

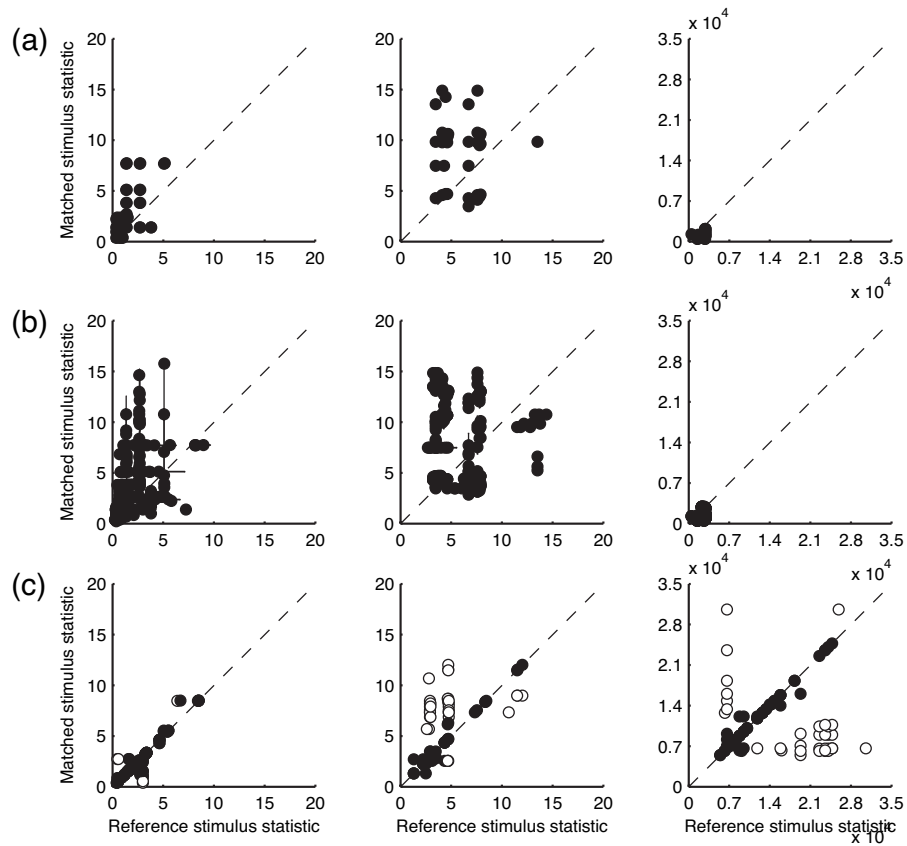


Figure S14: Statistics, image subband 64 cycles/stimulus. Details as in Figure S11. Analysis of subbands at 32 cycles/stimulus and 128 cycles/stimulus appeared very similar to this figure.