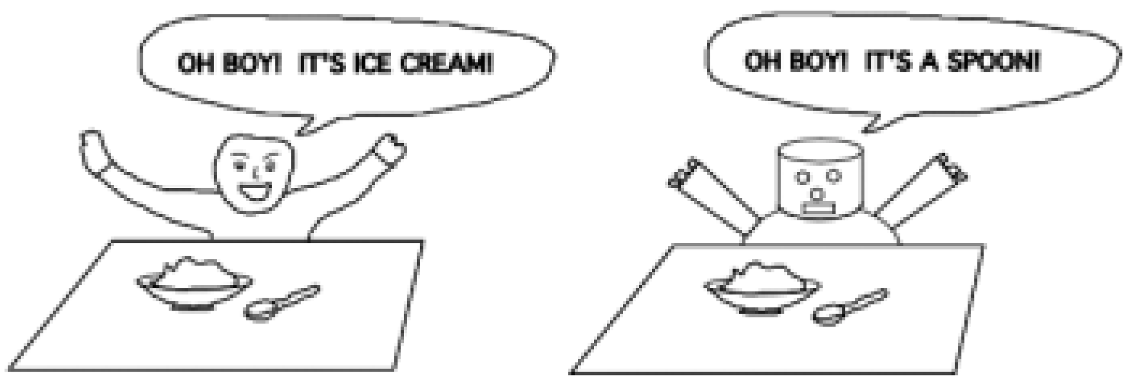
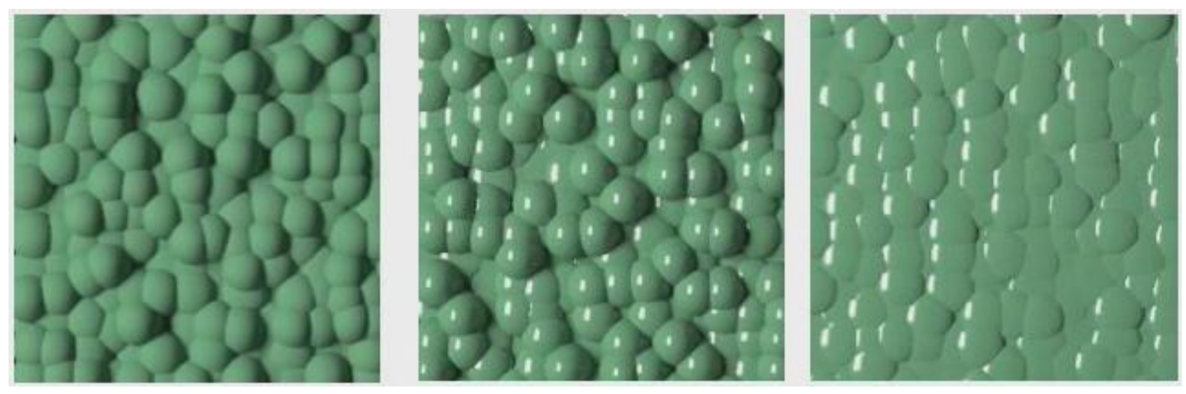
How Mesoscale and Microscale Roughness Affect Perceived Gloss

Abstract We study how mesoscale and microscale roughness affect perceived gloss. We conducted psychophysical experiments using random phase $1/f^{\beta}$ noise surfaces with varying mesoscale roughness by sampling the roll-off factor β, and rendered them using a reflectance model with different microscale roughness by sampling its parameter α. Eight observers took part in a 2AFC experiment, and the results were tested against a conjoint measurement model. The statistical test shows that the additive model is sufficient to describe the interactive influence of mesoscale and microscale roughness on perceived gloss, while α has a trend to shift the peak of gloss induced by β in the full conjoint measurement model.



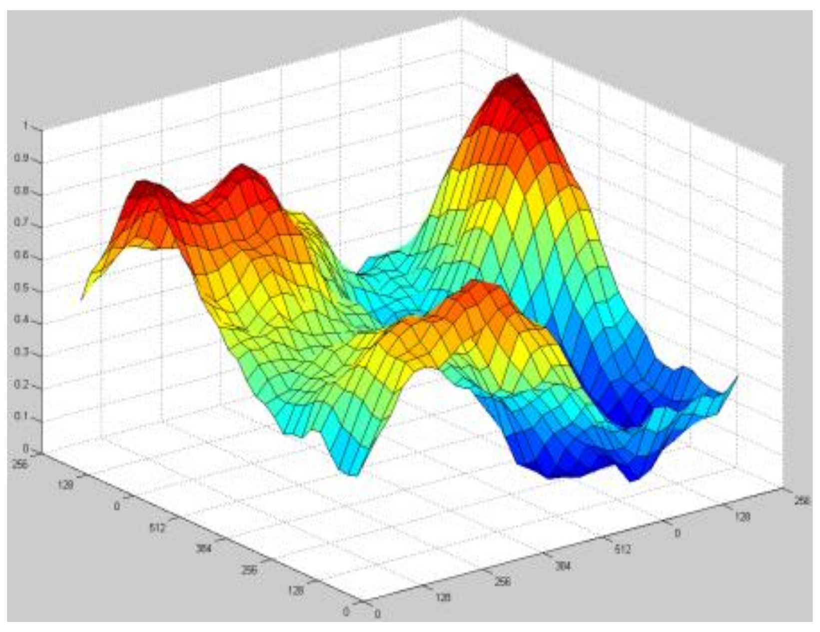
People are good at judging materials, while computers are not yet. (Adelson2001)

Surface reflections determines the material perception. (Fleming2003)

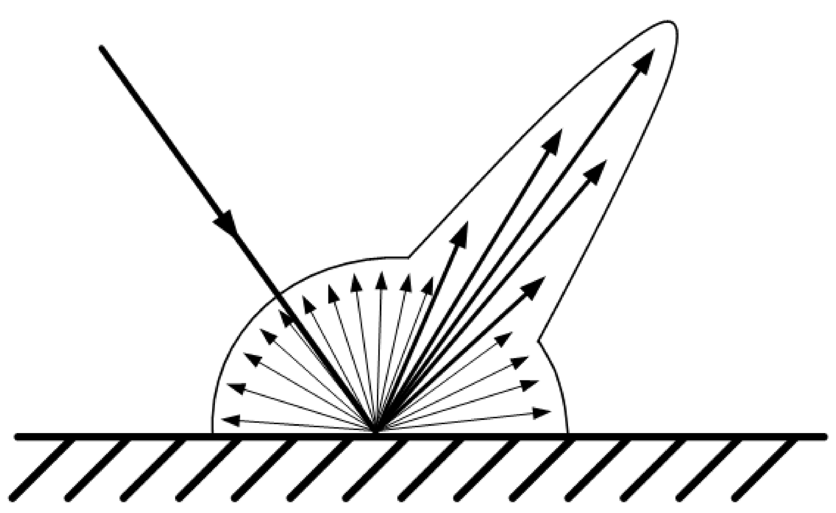


Perceived bumpiness and glossiness mutually influence each other. (Ho2008)

Motivation How perceived gloss is affected by surface geometry, particularly on roughness. The previous works lack of well controlled surface generation or realistic illumination and rendering. Our study therefore advantages in these respects and investigate how people perceive gloss on rough surfaces with varying mesoscale and microscale roughness.

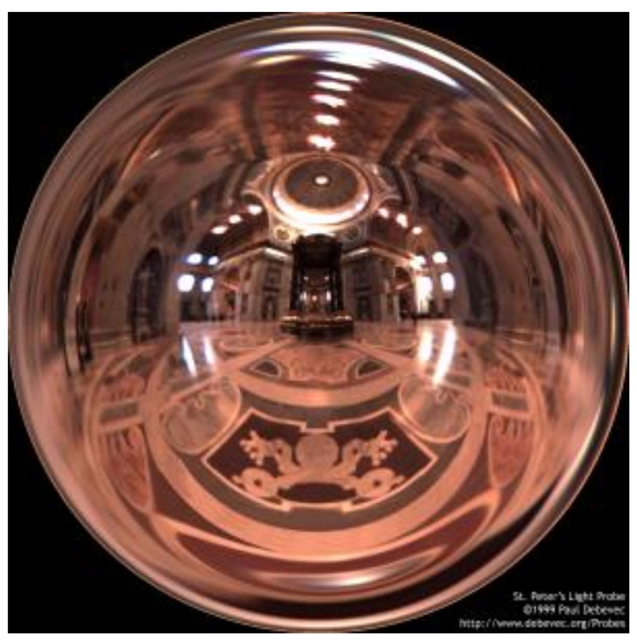


$1/f^{\beta}$ noise surfaces with different mesoscale roughness



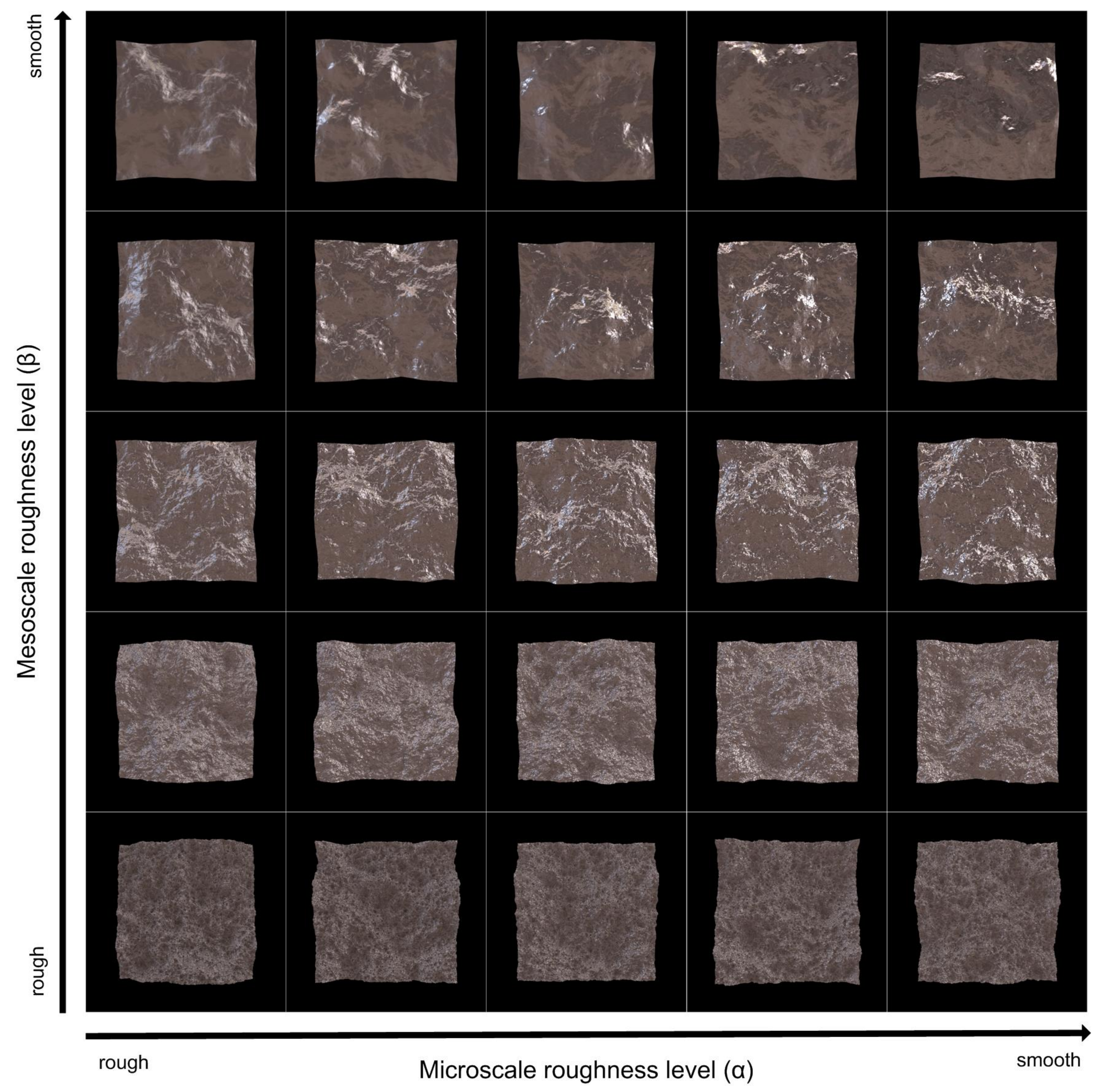
Reflection models with different microscale roughness levels

Illumination

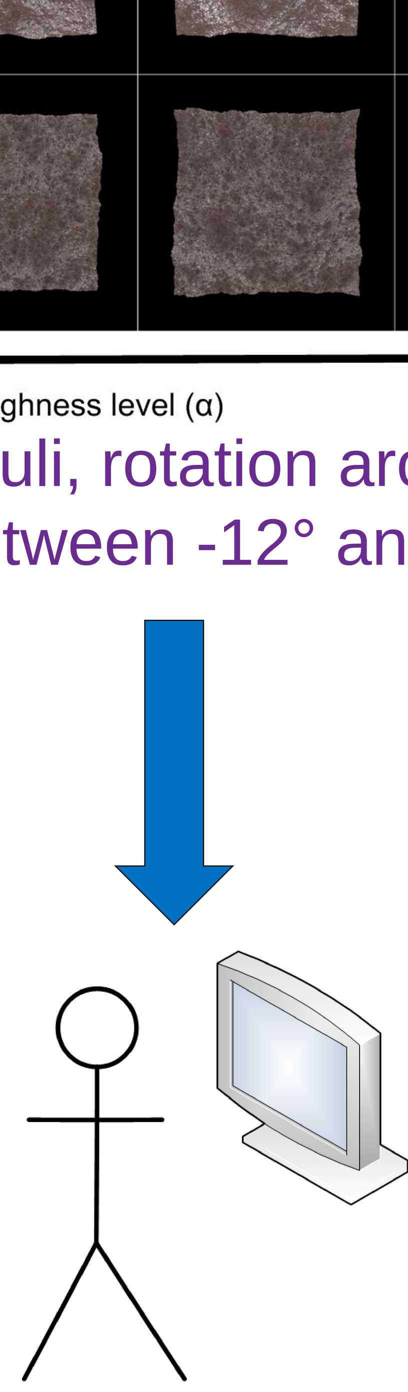


HDR environment map

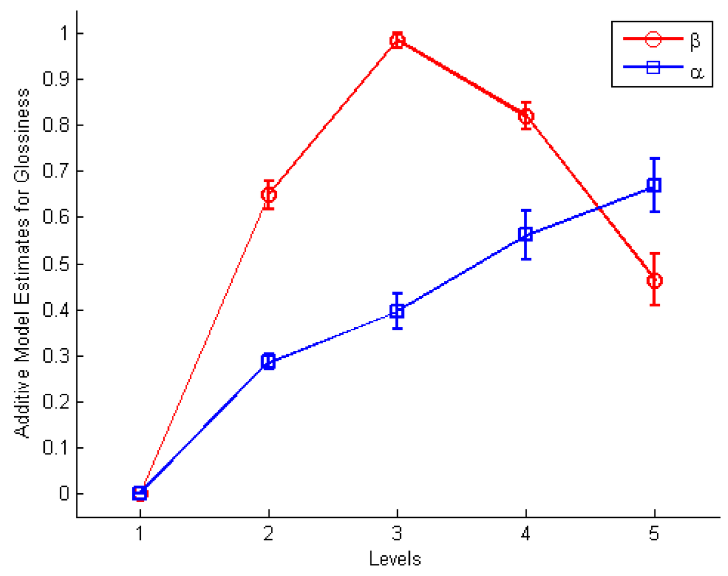
Rendering

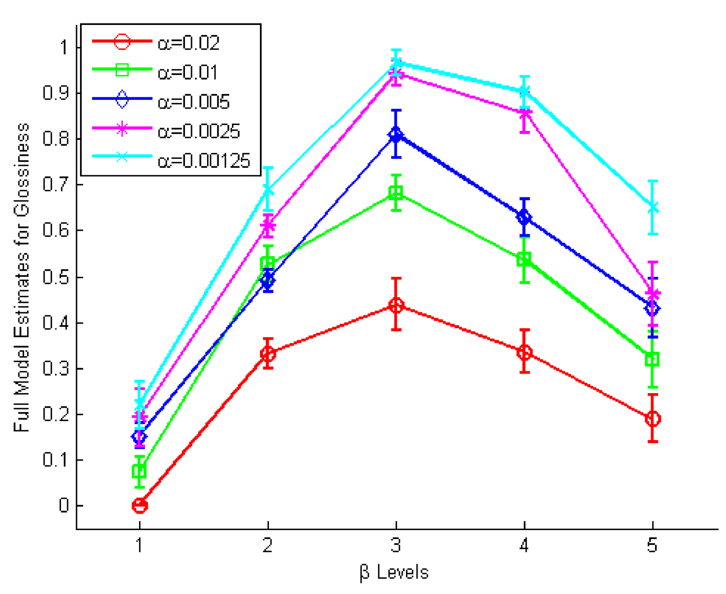


Animation stimuli, rotation around vertical axis between -12° and 12°



Conducting a 2AFC psychophysical experiment with eight observers





Additive and full conjoint measurement model results

Conclusion Perceived gloss varies significantly with mesoscale roughess parameter β (nonmonotonically, a bell curve) and microscale roughness parameter α (near linearly). We also found α has a trend to shift the peak of gloss induced by β in the full conjoint measurement model.

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