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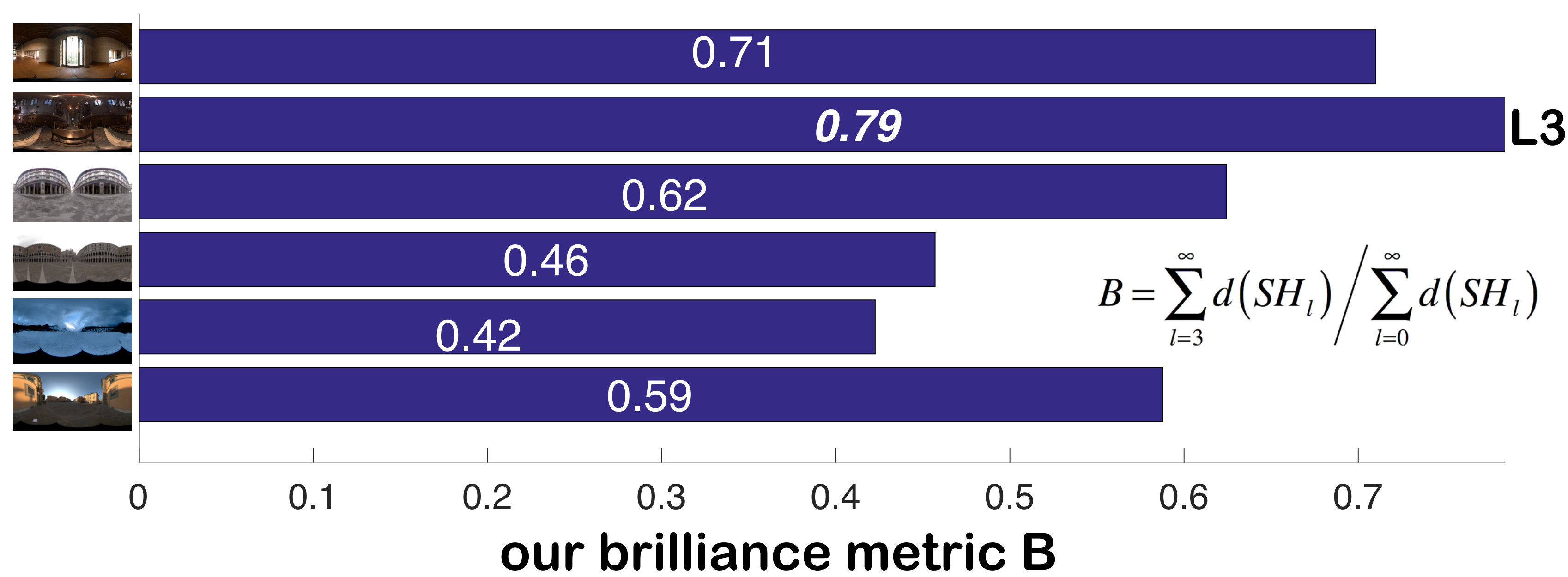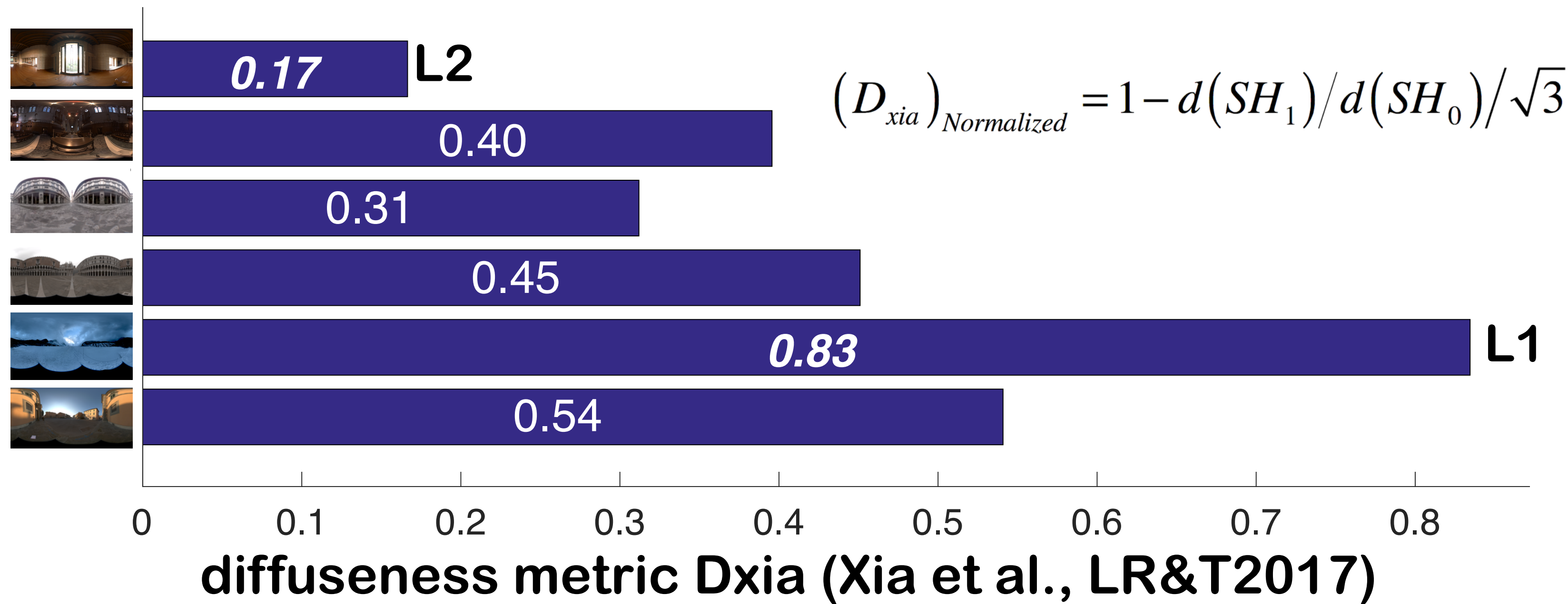# Material dependent appearance effects brought out by natural light environments

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prism

TUDelft Delft University of Technology

Inria

Introduction

- In a previous study, we asked observers to rate real materials for nine material qualities that are commonly used in the literature, and found that certain material qualities could be brought out by certain canonical lighting modes (Zhang et al., VSS2017).
- The aim of the current study was to validate our predictions of the material dependent light effects for generic lighting environments.
- Three high resolution HDR maps were selected as the most representative lighting environments for the canonical lighting modes.
- Then, four canonical materials were rendered under the selected natural lighting environments using state-of-the-art BRDF models.

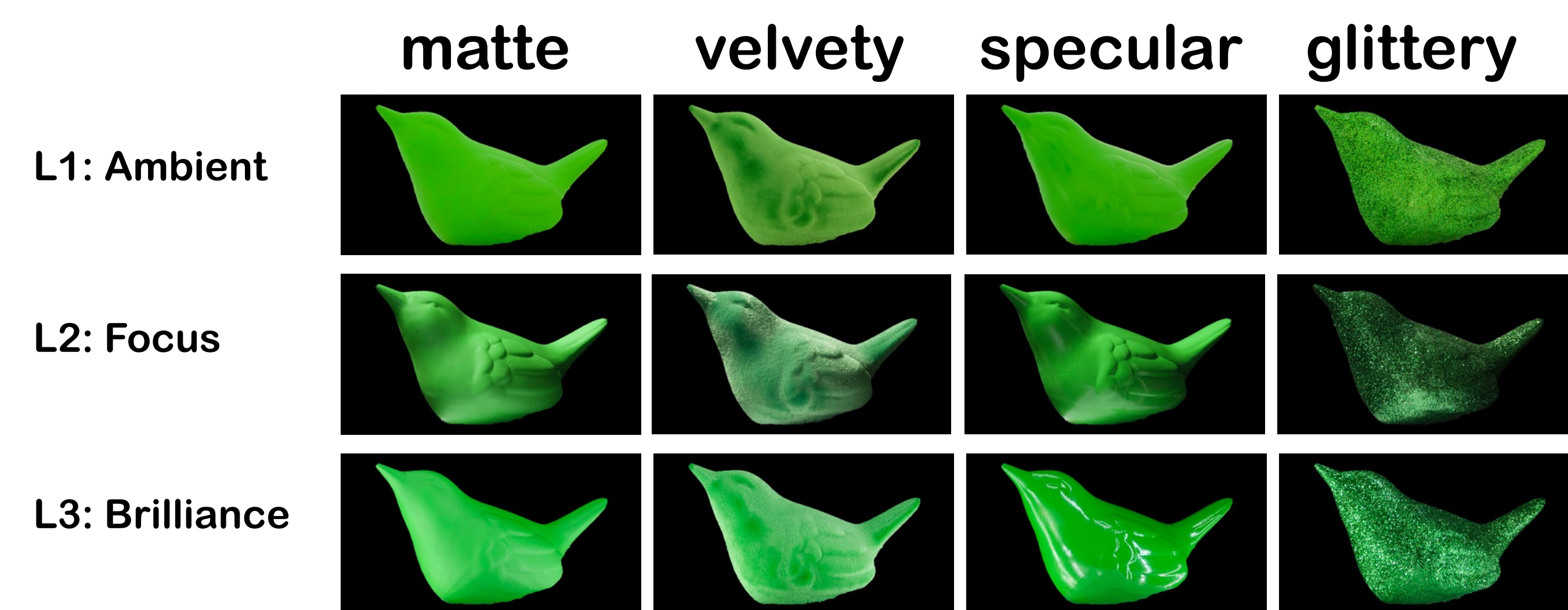## Select natural light environments

$$\left(D_{xia}\right)_{Normalized} = 1 - d(SH_1)/d(SH_0)/\sqrt{3}$$

0.17 L2
0.40
0.31
0.45
0.83 L1
0.54

diffuseness metric Dxia (Xia et al., LR&T2017)

0.71
0.79 L3
0.62
0.46
0.42
0.59

$$B = \sum_{l=3}^{\infty} d(SH_l) \bigg/ \sum_{l=0}^{\infty} d(SH_l)$$

our brilliance metric B

Real Stimuli - the "Bird set"

matte | velvety | specular | glittery

L1: Ambient
L2: Focus
L3: Brilliance

Rendered Stimuli

L1 "Glacier"
L2 "Ennis"
L3 "Grace-new"

Task

- Four names we previously used for our canonical material modes were tested:
  - "matte", "velvety", "specular", "glittery"
- Plus, five terms that were commonly used to describe material qualities in the literature were tested:
  - "hard", "soft", "rough", "smooth", "glossy"
- Observers were asked to rate per term per stimulus.
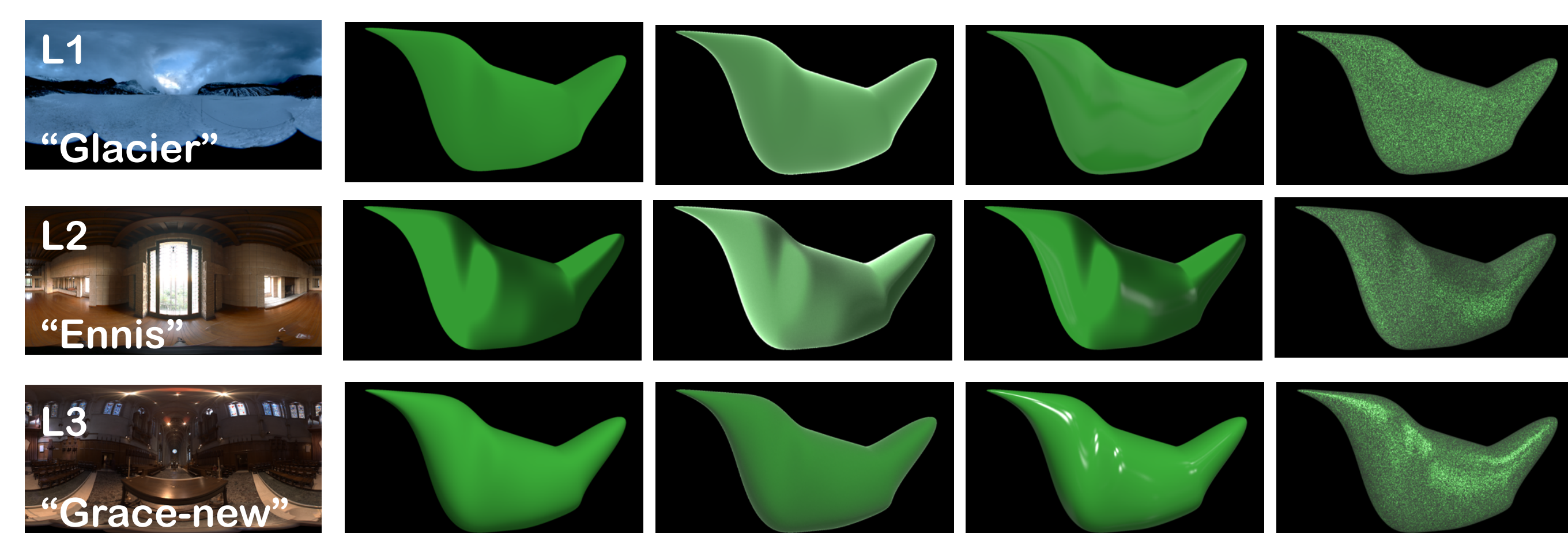- Results were analysed by taking the median of all responses.

Conclusion

- Results correlated strongly with previous study (r = 0.87).
- The material dependent lighting effects could be reproduced using rendered stimuli under the selected generic lighting environments.
- Specifically, as marked in the plots with ★
  - L2 (focus light / "Ennis") brought out "hard" for the matte mode and "velvety" and "rough" for the velvety mode the most.
  - L3 (brilliance light / "Grace-new") brought out "specular", "hard", "smooth" and "glossy" for the specular mode and "glittery" for the glittery mode the most.
- This suggests that material qualities can be systematically influenced by enhancing or attenuating the corresponding modal components of the lighting.
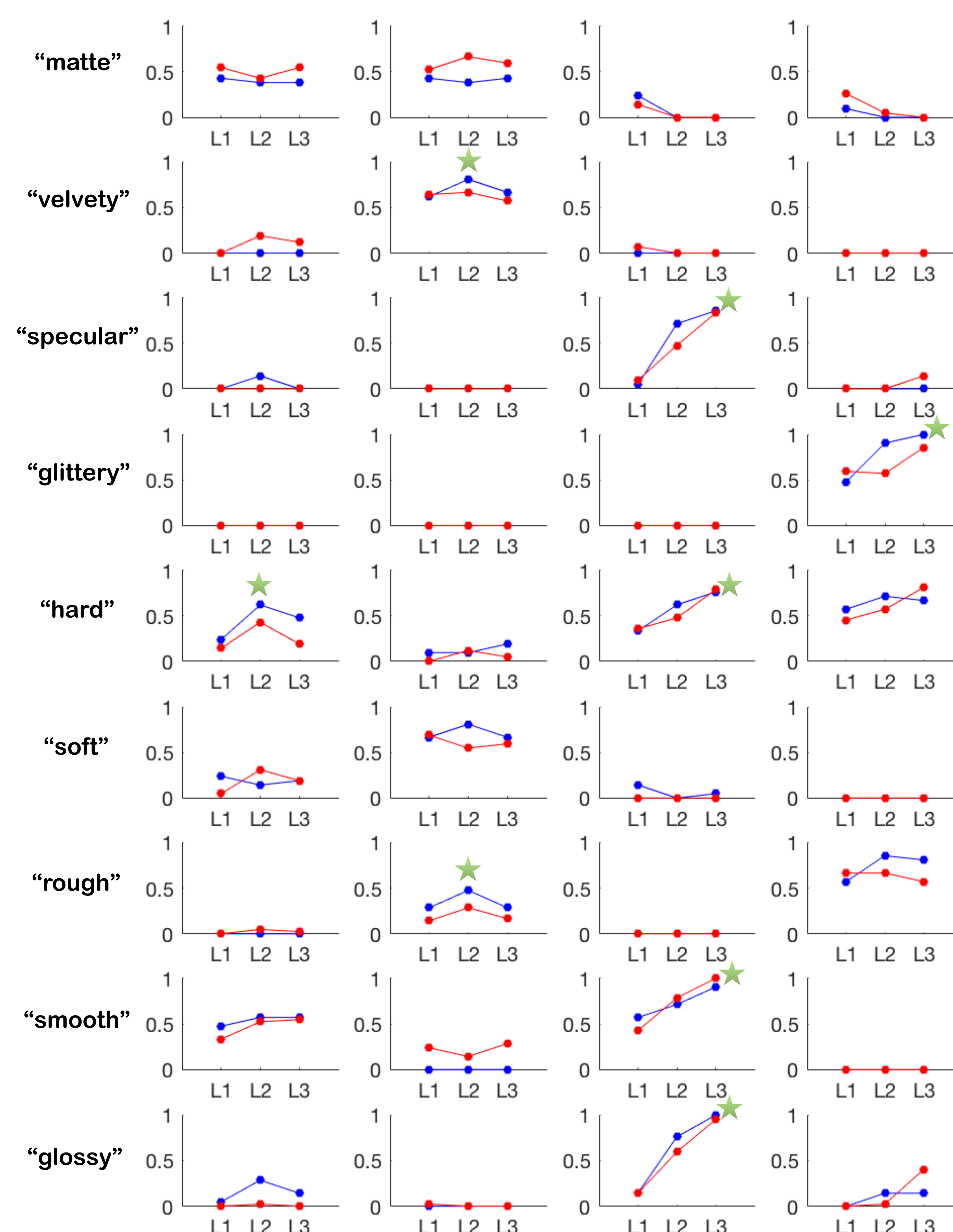
Real v.s. Rendered (median)