Simplification of triangle meshes with radiance attribute

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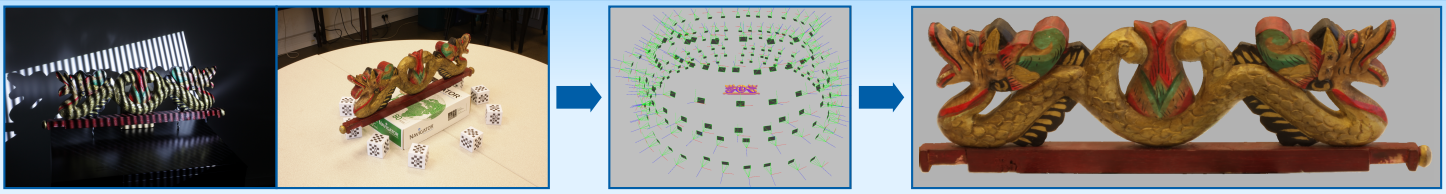
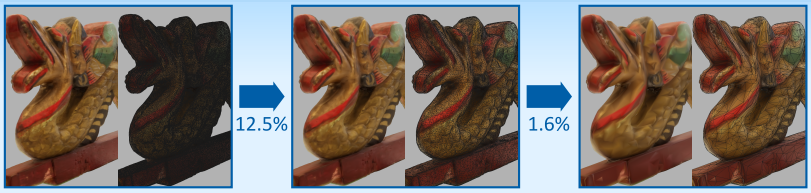
Pre-processing: acquisition and reconstruction



3D scanning + photometric acquisition Registration Reconstruction

Reconstructed data: dense triangle mesh with outgoing radiance attribute (one continuous hemispherical function per vertex) **[VSG*13]**.

Objective: radiance-aware simplification



Problem: data is too dense and needs to be simplified while preserving its appearance.

Issue: how to manage directional color features consistently with geometry?

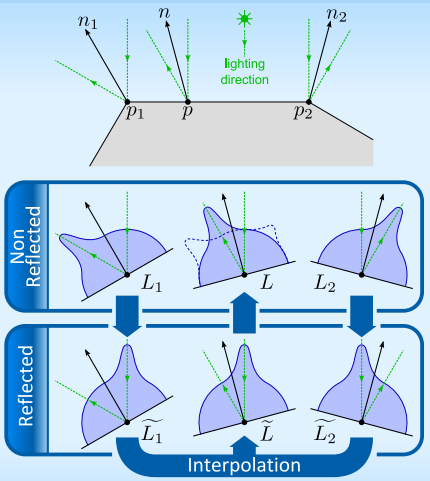
Contribution: calculations on radiance

Most materials are mainly diffuse, with a specular peak located around the ideal reflection direction.

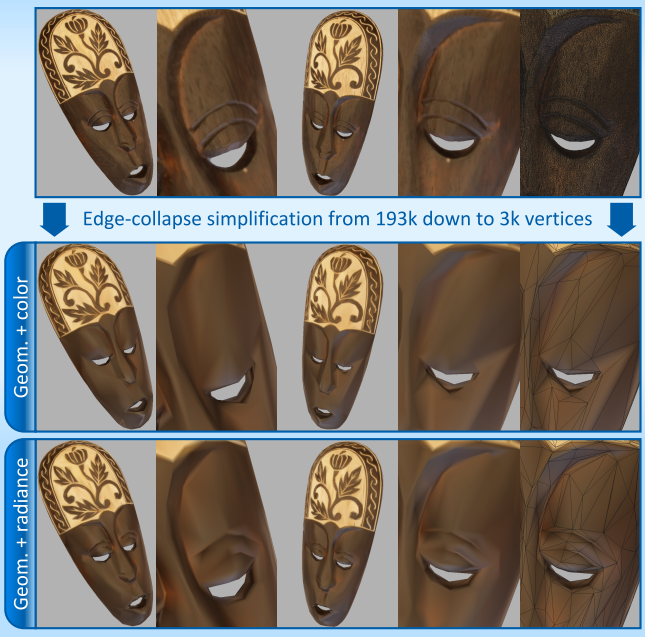
Assuming that the lighting environment is infinitely distant, reflecting the radiance L around the surface normal n improves the spatial coherence **[WAA*00]**: specular peaks tend to be aligned with the lighting direction.

Working with the reflected functions, we define for radiance attribute:

- **coherent interpolation** L at p between p_1 and p_2.
- **norms** $\|L\|$ and **distances** $dist(L_1, L_2)$.
- **derivatives** ∇L with respect to space (over the surface).
- **error measures** for mesh simplification.

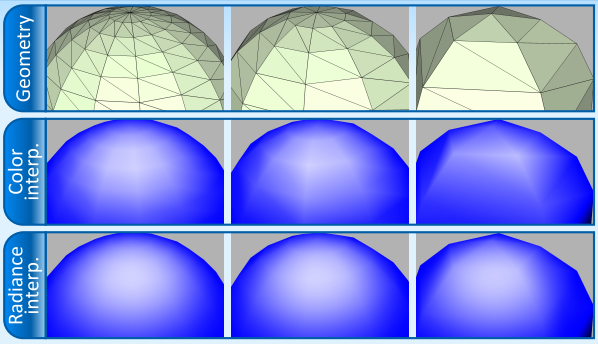


Simplification



Compared to state-of-the-art measures on geometry and color, our measure on radiance better preserves directional color features.

Rendering



Conversely to color interpolation, radiance interpolation over triangles smoothly renders directional features.

[VSG*13] Vanhoey K., Sauvage B., Génevaux O., Larue F., Dischler J-M.: *Robust fitting on poorly sampled data for surface light field rendering and image relighting*, Computer Graphics Forum, 2013.

[WAA*00] Wood D. N., Azuma D. I., Aldinger K., Curless B., Duchamp T., Salesin D.H., Stuetzle W.: *Surface light fields for 3d photography*, SIGGRAPH 2000.