



Transfer and Manipulation of Appearance from the Image of a Sphere

Carlos Jorge Zubiaga Peña, Laurent Belcour, Pascal Barla, Xavier Granier

► To cite this version:

Carlos Jorge Zubiaga Peña, Laurent Belcour, Pascal Barla, Xavier Granier. Transfer and Manipulation of Appearance from the Image of a Sphere. PRISM2: The science of light & shade, Oct 2013, Bordeaux, France. 2013. hal-00990327

HAL Id: hal-00990327

<https://hal.inria.fr/hal-00990327>

Submitted on 13 May 2014

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

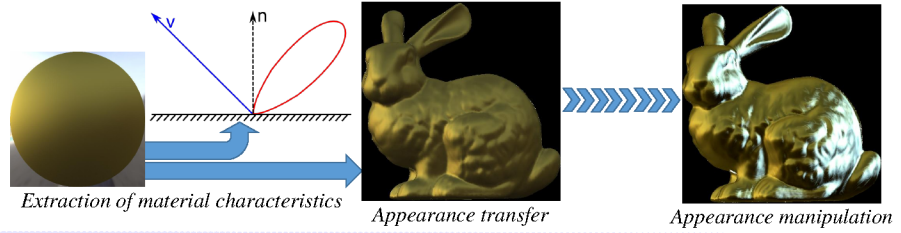
L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

Transfer and Manipulation of Appearance from the Image of a Sphere

Carlos J. Zubiaga, Laurent Belcour, Pascal Barla, Xavier Granier²
Inria¹, Institut d'Optique²

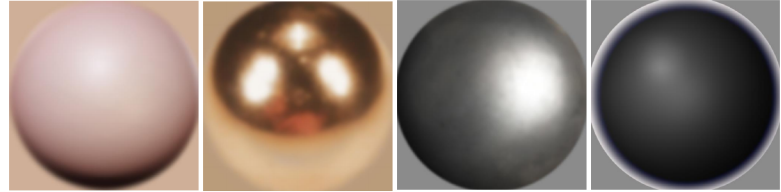
Goals

- > **Vision:** Extract material characteristics from a single image of a sphere
- > **Graphics:** Transfer its appearance to another shape and manipulate material & lighting



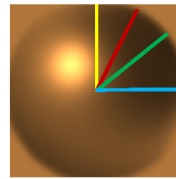
Input Image

- > Image of a Sphere seen from an orthographic view
- > Obtained by photography, rendering, painting, matcaps (ZBrush™)
- > LitSphere [Sloan01]: use normal orientation for color look-up
- ✗ Does not permit manipulations of material or lighting...



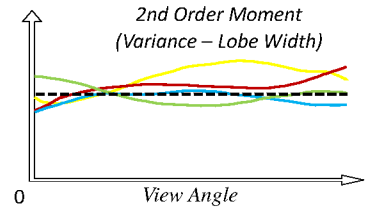
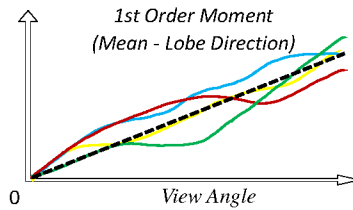
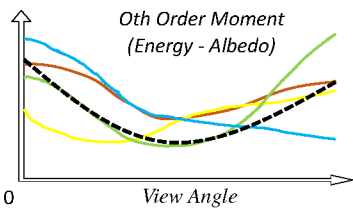
Inferring Material Properties

- > Hypothesis: uniform BRDF defined by view-dependent Gaussian lobes
- > The Gaussian lobe is completely defined by the 0th to 2nd order moments
- > Lobe statistics (moments) observable through slices of input LitSphere
- > Use redundancy across slices to recover view-dependent lobe parameters



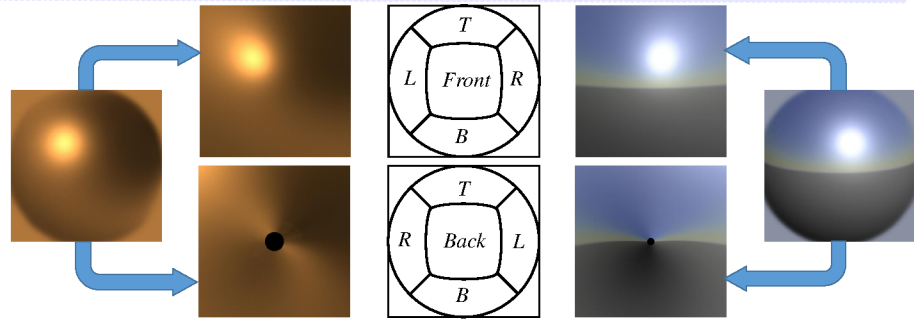
Statistics measured from slices show redundancy across viewing angles

Dashed lines represent the estimated BRDF lobe parameters



Output Representation

- > **Pre-filtered environment lighting:** spherical map looked-up via lobe direction
- > Material parameters: albedo and lobe width profiles characterize lobe shapes
- > Directions reaching the back of our spherical map might not be filled in.
- ✗ They need to be reconstructed

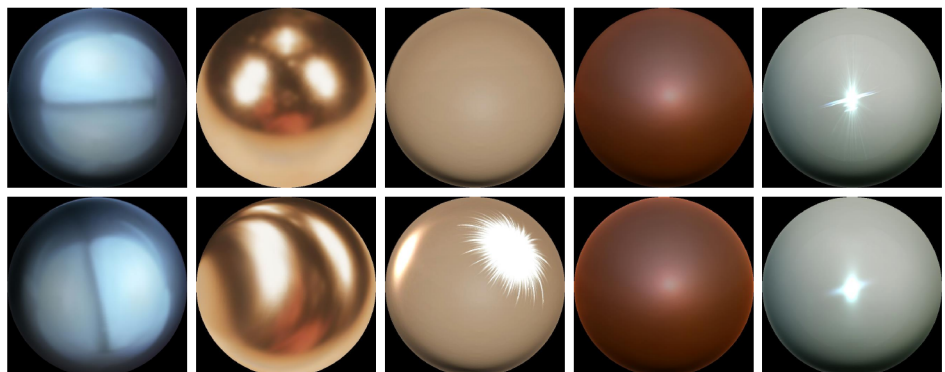


Paraboloid map visualization of our reconstructed spherical map

Manipulation

Manipulation	Rotate Light	Warp Light	Add Light	Mat. Fresnel	Mat. Gloss
Re-filter Albedo	X	X	X	X	X
Re-filter Direction	X	X			
Re-filter Width			X		X

- > **Re-filtering** the spherical map using inferred material properties permit to manipulate appearance without knowledge of lighting
- > The table presents different types of manipulations and the lobe moments they rely upon
- > The resulting spherical map is readily used to shade arbitrary-shaped objects as with LitSpheres
- > Spatially-varying effects may be produced simply by varying filtering parameters on the surface



Conclusions

- > A single image of a sphere contains **sufficient information** for the manipulation of appearance
- > BRDF **lobe moments** and their profiles could be considered as relevant characteristics to perception



prism



INSTITUT D'OPTIQUE
GRADUATE SCHOOL