

# Spatially Varying BRDFs and BTF

October 18, 2004

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## Announcement

- Guest speakers next Monday.
- Paper presentation on 10/21 and 10/28. Please read the papers in advance.

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# BRDF Measurement

- From G. Ward, "Measuring and Modeling Anisotropic Reflection" SIGGRAPH 2002:

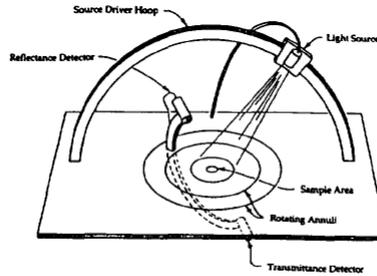


Figure 1. A conventional gonioreflectometer with movable light source and photometer.

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# Image-Based BRDF Measurement

- Image-based BRDF Measurement Including Human Skin**  
Marschner et al., *10th Eurographics Rendering Workshop* (1999)

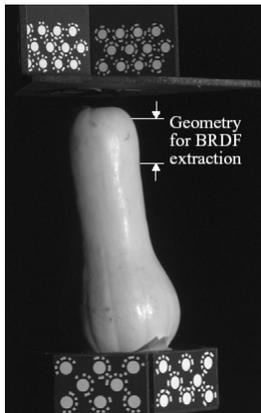


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# Spatially Varying BRDF

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G. Müller, J. Meseth, M. Sattler, R. Sarlette & R. Klein / Acquisition, Synthesis and Rendering of BTFs

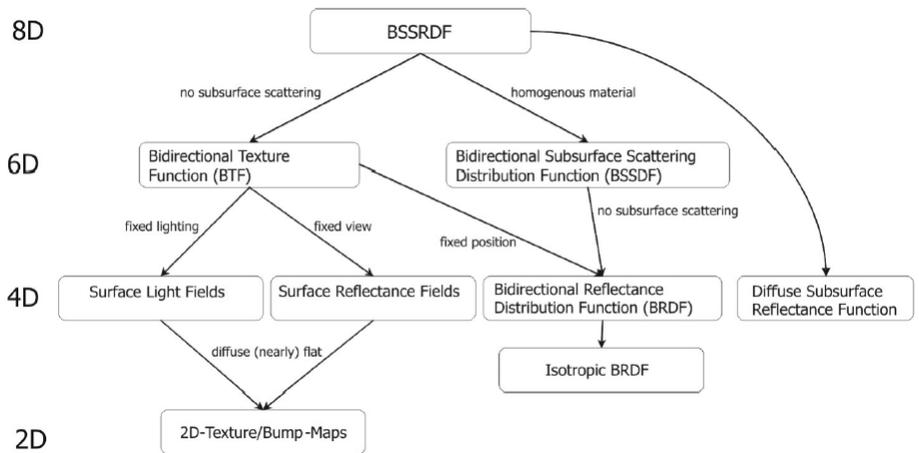


Figure 4: A hierarchy of reflectance functions

- Source: Muller et al, "Acquisition, Synthesis, and Rendering of Bidirectional Texture Functions" Eurographics 2004 State of the Art Reports, pages 69-94

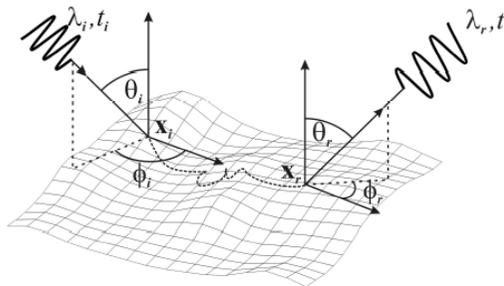
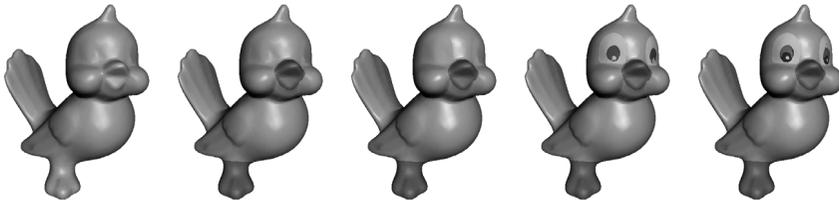


Figure 3: The parameters of general light-material interaction

## A Clustering Approach

- Lensch et al., “Image-Based Reconstruction of Spatially Varying Material” *Rendering Techniques '01 (Proceedings of Eurographics Rendering Workshop)*,, pages 103-114.



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## A Data-Driven Approach

- Matusik et al., “A Data-Driven Reflectance Model” SIGGRAPH 2003.
- Measured and built a “database” of BRDF.
- Each new (i.e. unknown or “novel”) BRDF may be decomposed into a combination of known BRDFs.
  - Quoted from paper: “We treat each acquired BRDF as a single high-dimensional vector taken from a space of all possible BRDFs”

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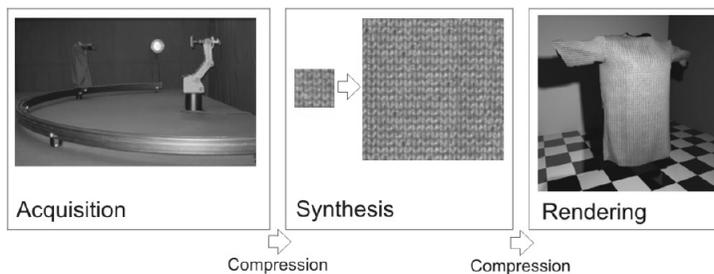
## BTF (1)

- First proposed by Dana et al. in 1996 and later published in:
  - “Reflectance and Texture of Real-World Surfaces”  
ACM Trans. on Graphics 1999.
- 6 dimensional, dependent on:
  - Texture coordinates (u, v)
  - Light direction
  - View direction

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## BTF (2)

- A good survey in:
  - Muller et al, “Acquisition, Synthesis, and Rendering of Bidirectional Texture Functions”  
Eurographics 2004 State of the Art Reports



**Figure 1:** In principle there is no conceptual difference between using BTFs and 2D-textures. The compression steps can be omitted, but in fact they are absolutely necessary to achieve acceptable frame-rates and processing times.

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# View-Dependent Displacement Map

L. Wang et al., SIGGRAPH 2003.

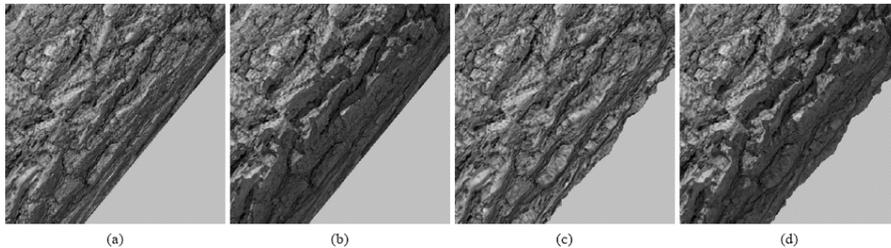


Figure 1: Comparison of different mesostructure rendering techniques: (a) bump mapping, (b) horizon mapping, (c) conventional displacement mapping, and (d) view-dependent displacement mapping with self-shadowing.

	Fine-scale Visual Effect			
	Shadow	Occlusion	Silhouette	Interreflection
Bump Mapping				
Horizon Mapping	X			
Displ. Mapping		X	X	
BTF	X	X		X
VDM	X	X	X	

## Other Related Papers

- Tom Malzbender et al., “Polynomial Texture Maps” SIGGRAPH 2001, pages 519-528.
- Yanyun Chen et al., “Shell Texture Functions” SIGGRAPH 2004.
- Xin Tong et al, “Synthesis of Bidirectional Texture Functions on Arbitrary Surfaces” SIGGRAPH 2002.

# SG2004 Video Excerpt

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