

Complex Materials Models in Radiance: Grand Challenges in Cultural Heritage Visualization

Andreas Noback, Stephen Wittkopf
Competence Centre Envelopes and Solar Energy (CC-EASE)

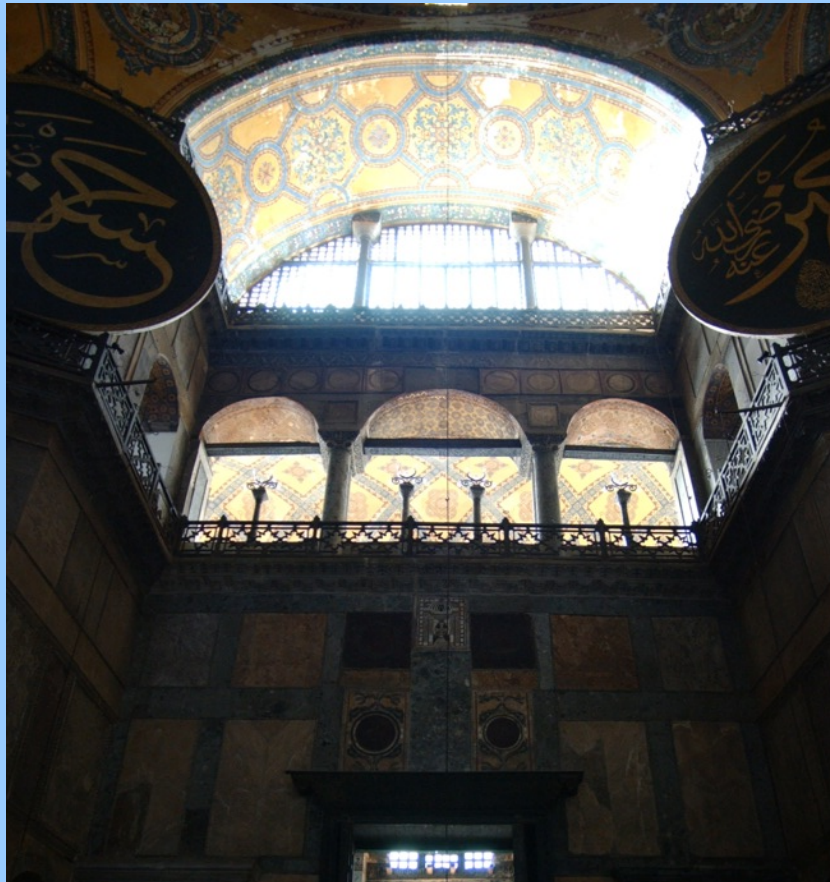
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Outline

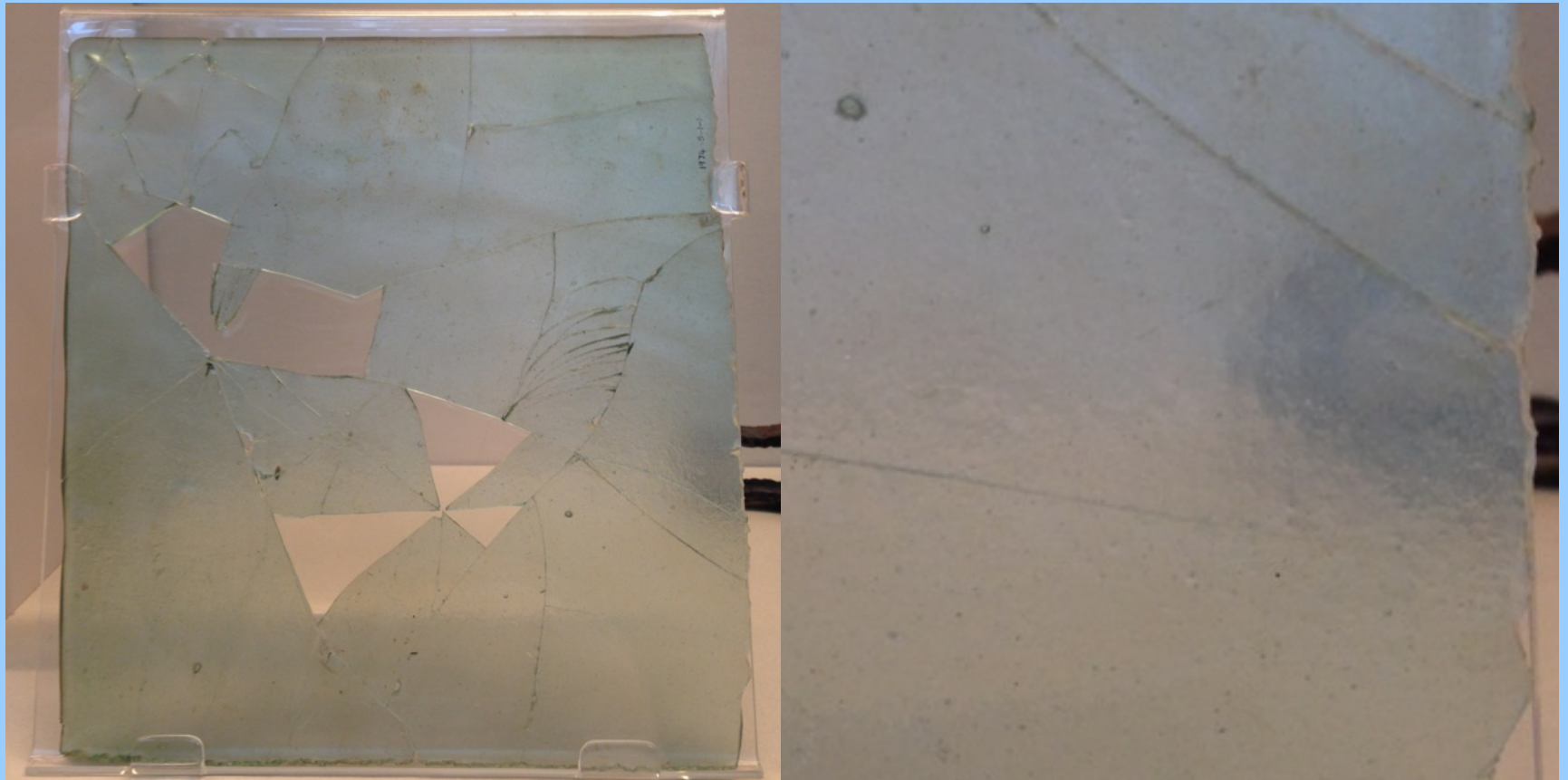
- Examples: Hagia Sophia and the Uffizi
 - Complex lighting concepts
 - Implemented with complex materials
 - Discussed in history of art
 - Questions to solve for Radiance
 - Need for data-driven models
- Measurement and Modeling
 - Our concept
 - Open Questions

Example: Hagia Sophia Lighting concept



Guillaume Piolle / CC-BY-3.0

Example: Hagia Sophia Roman glass



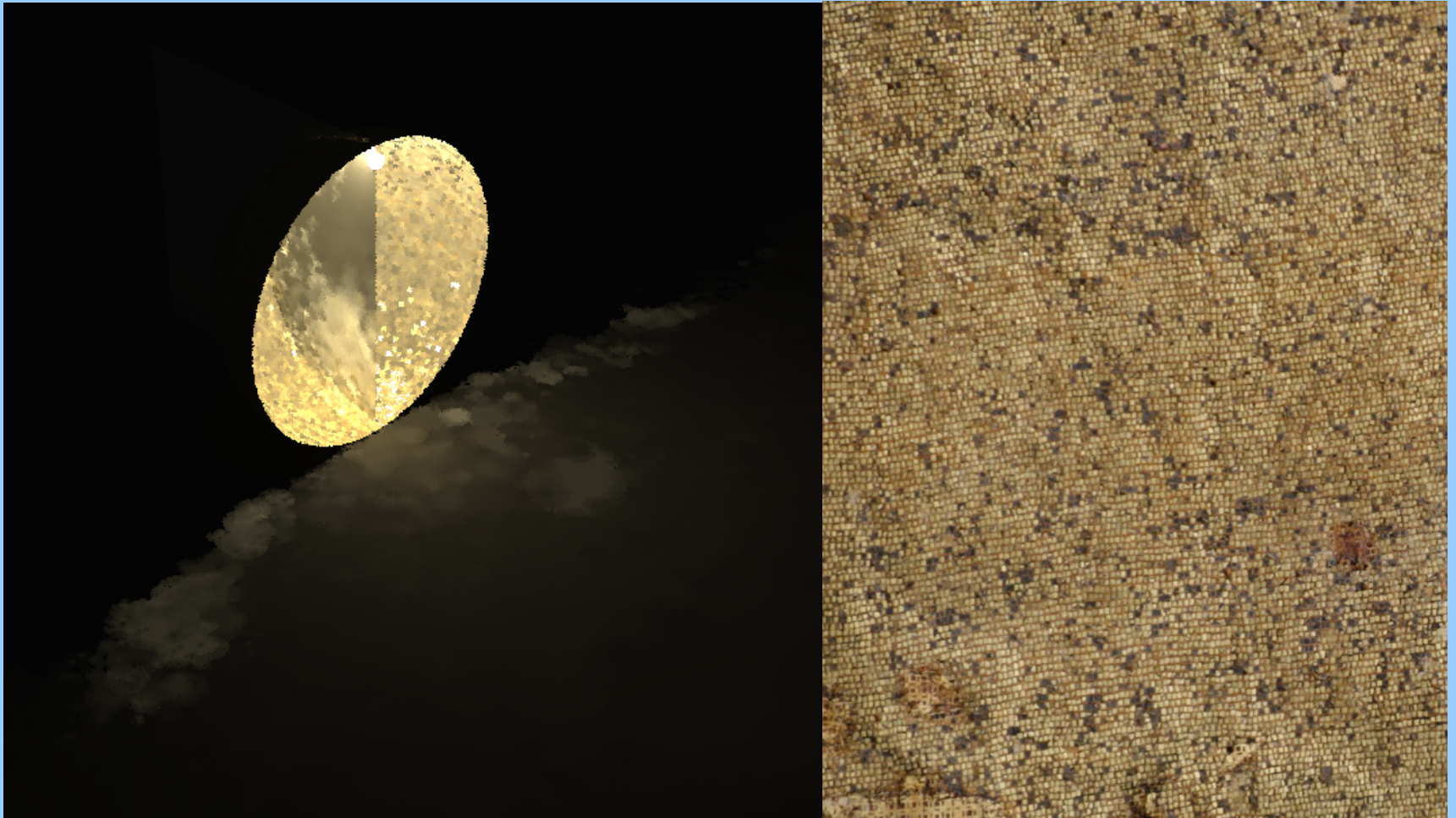
**Example: Hagia Sophia
Translucent marble (Ravenna)**



Example: Hagia Sophia Mosaics



Example: Hagia Sophia Mosaics

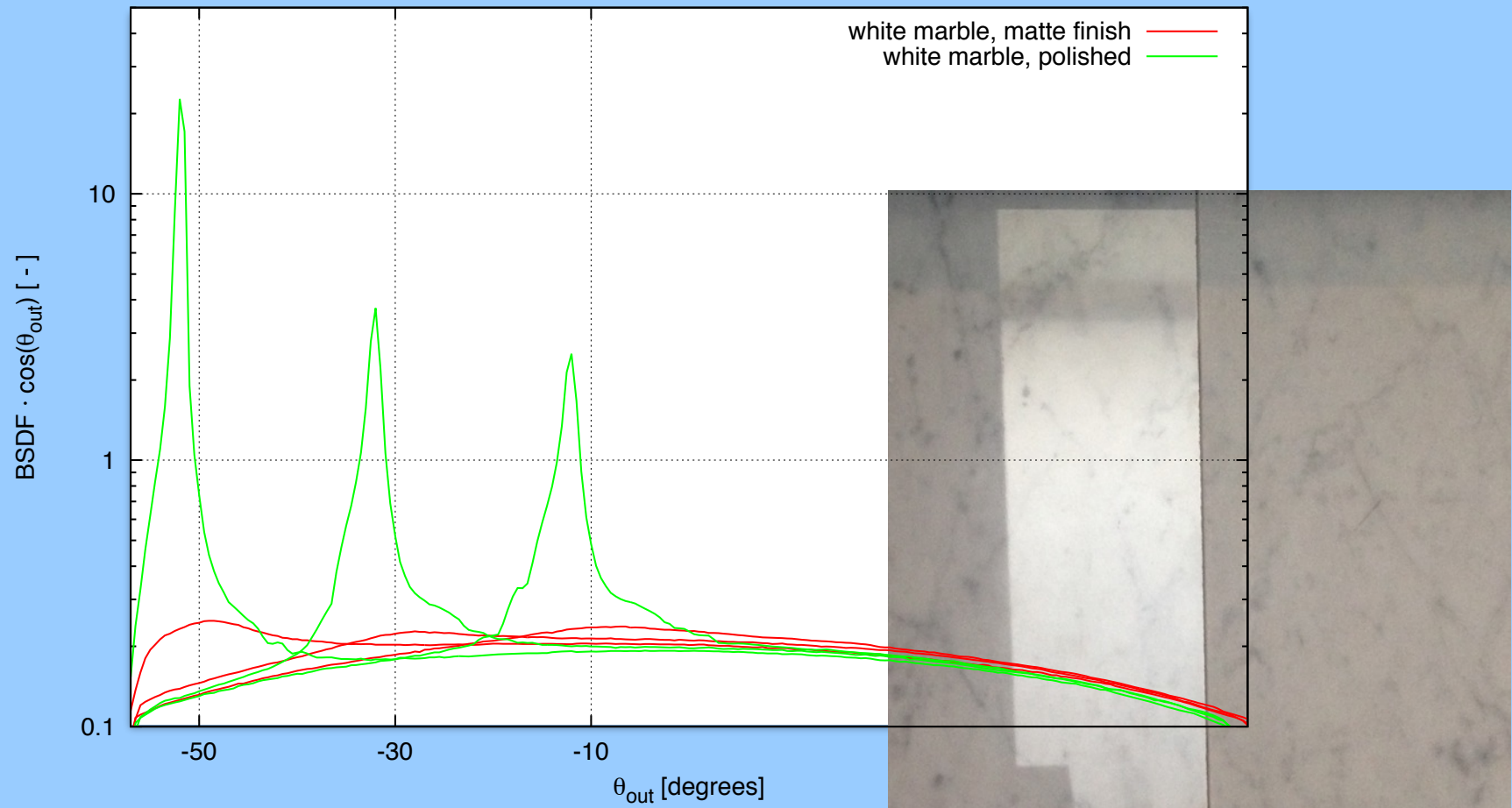


Example: Hagia Sophia Marble



Example: Hagia Sophia Marble

BSDF in scatter plane for two marble samples, ϕ_{in} 0 degrees, θ_{in} 10, 30 and 50 degrees.



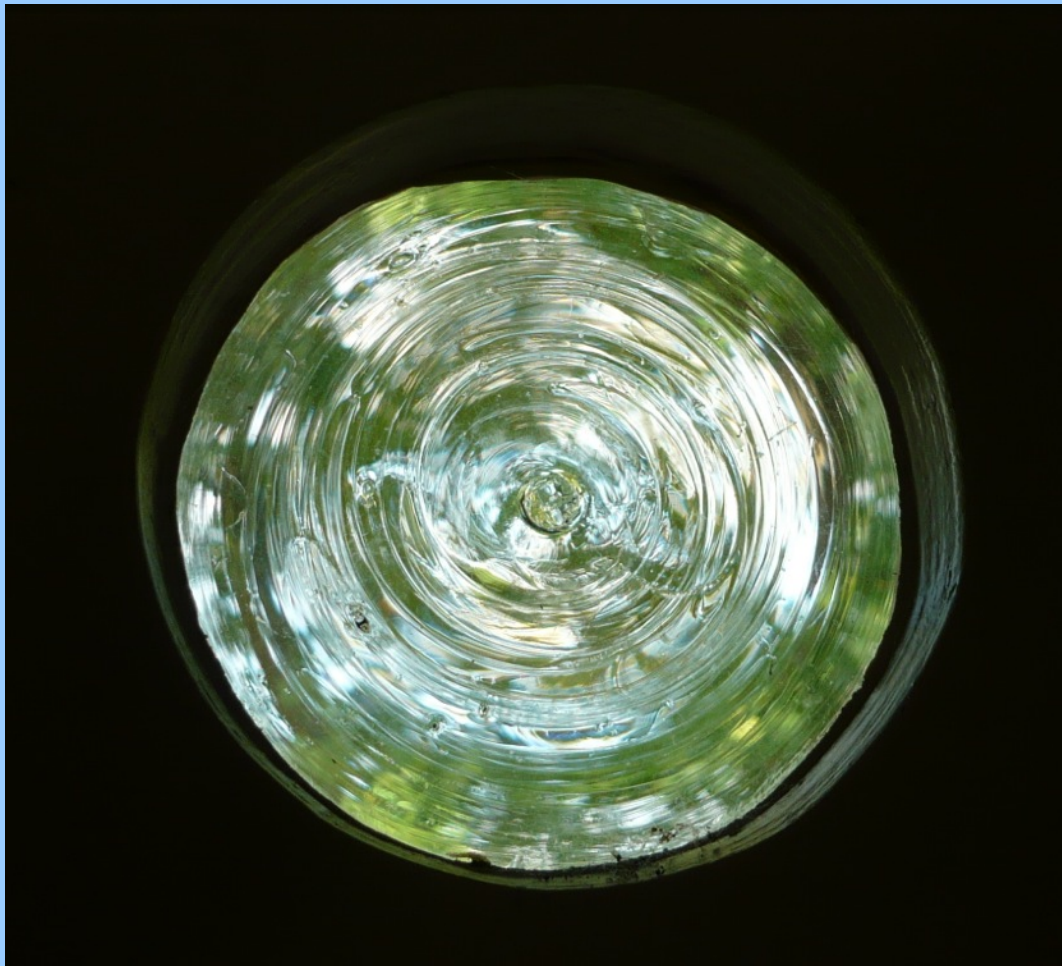
Example: Hallways of the Uffizi



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Joanbanjo CC BY SA

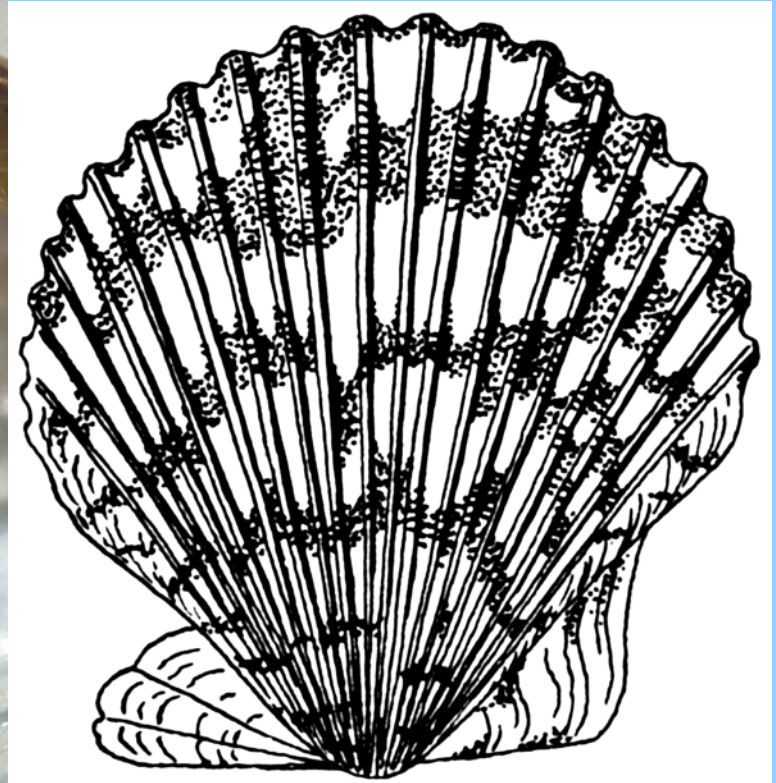
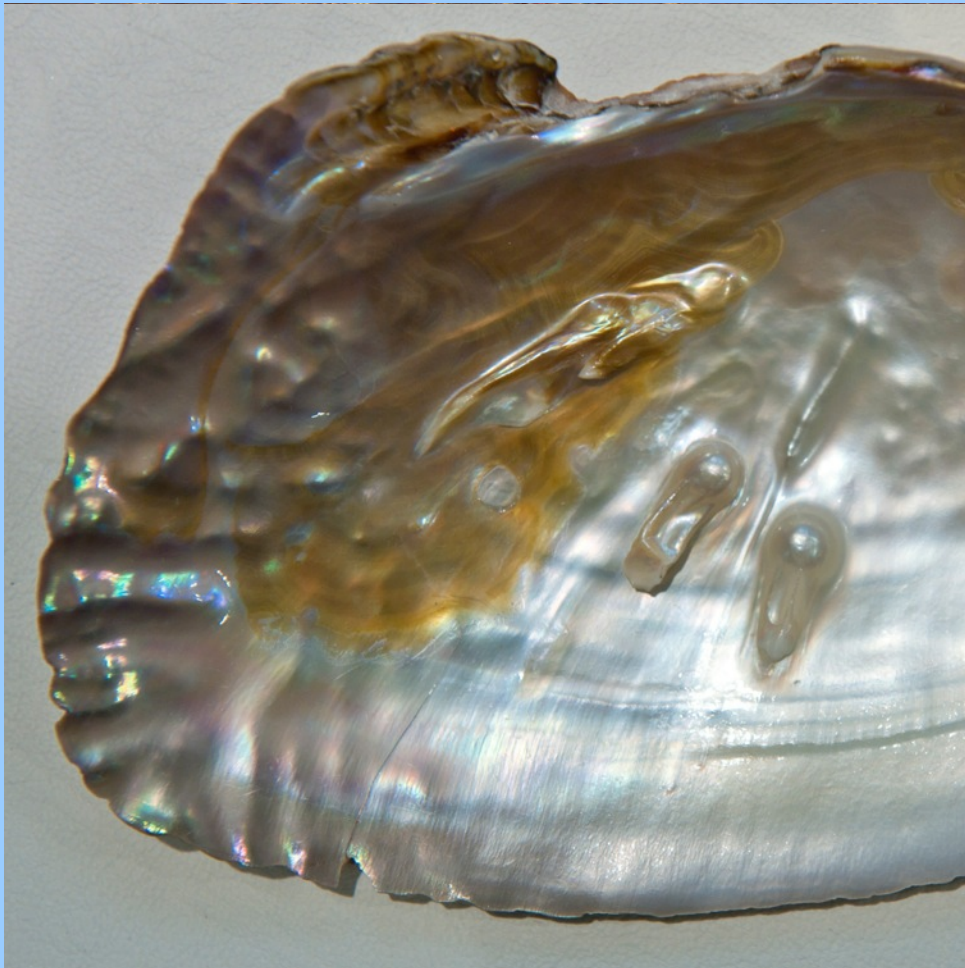
Example: Hallways of the Uffizi Crown Glass



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Example: Tribuna of the Uffizi Dome

Example: Tribuna of the Uffizi Mother-of-pearl



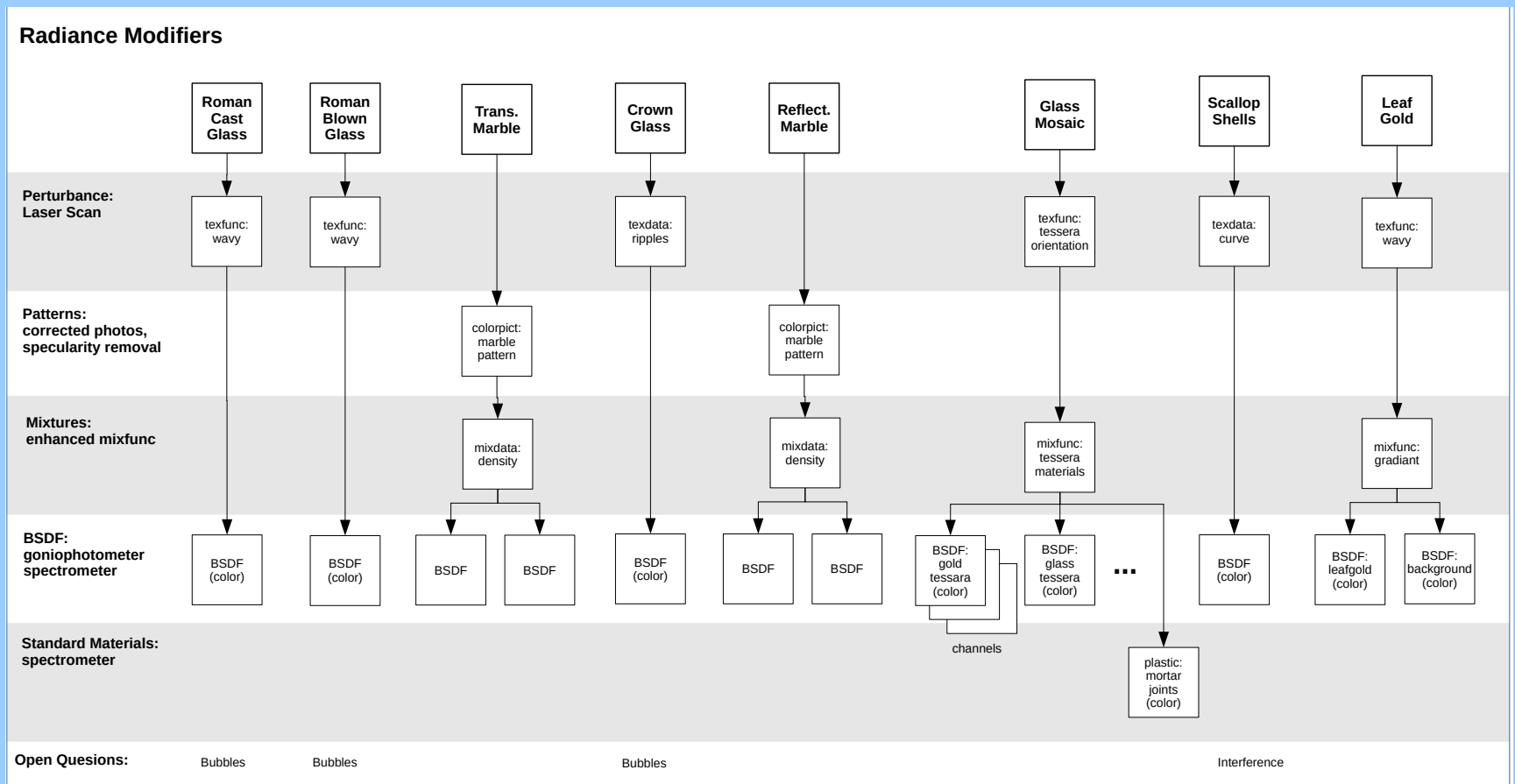
Pearson Scott Foresman PD

Hannes Grobe/AWI CC BY SA

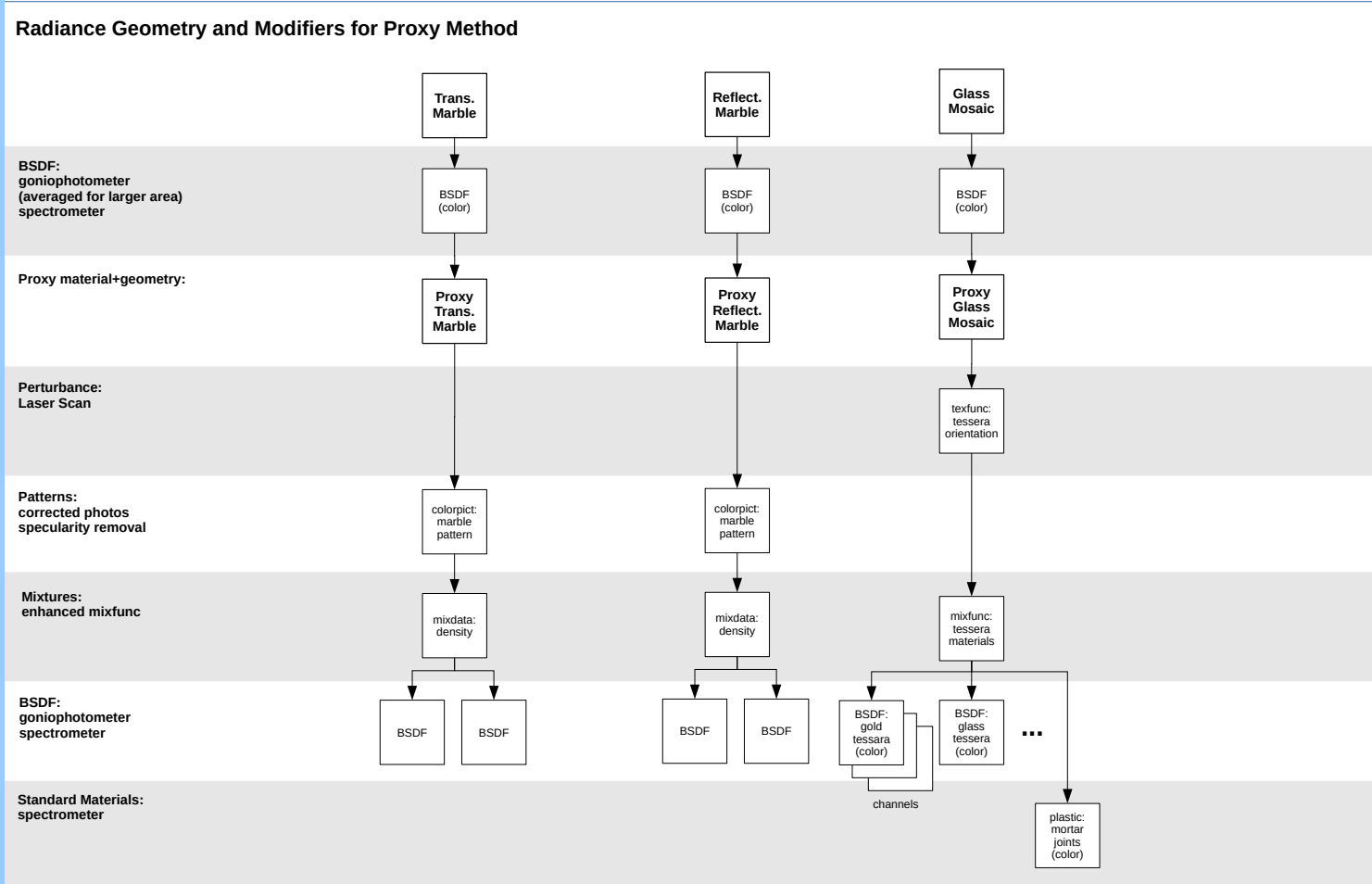
Examples: Overview

Type	Material	Origin Production	Surface Type Front / Back	Main Redirecting Characteristic	Expected Transmittance Reflectance	Color	Roughness	Subsurface Scattering	Composite	Layers
Glazing materials	Cast Roman glass	synthetic artisan	matte / blank	translucent	80 %	tinted	wavy	air bubbles	no	no
	Blown Roman glass	synthetic artisan	blank / blank	transparent scattering	90 %	clear tinted	wavy	air bubbles	no	no
	Translucent marble	natural artisan	matte / matte	translucent	10 %	tinted	even	yes texture	no	conglomerate
	Crown glass	synthetic artisan	blank / blank	transparent scattering	80 %	clear tinted	ripples	air bubbles	yes framing	no
Redirecting materials	Glass mosaic	synthetic artisan	glossy	specular scattering	50 – 70 %	gold colored patterns	uneven perturbed curved	yes	yes, mixed with different colored glasses	yes varying
	Marble	natural artisan	matte, glossy	lambertian specular	5 – 40 %	texture	even	yes texture	no	conglomerate
	Scallop shells	natural	glossy	specular	60 %	pearl	wavy curved	yes interference	no	nanostructure
	Leaf gold on red ground	synthetic artisan	glossy	metallic	40 %	gold ground color	wavy	no	yes gradient	yes

Measurement & Modeling



Measurement & Modeling: Proxy Approach



Measurement & Modeling: Progressive Photon Mapping

- Caustics
- Noise
- Parallelization

Open Questions

- Does it all work that way?
- Rendering Times
- Measurements on site:
 - Face normal perturbations (Polynomial Texture Maps in Radiance)
 - Patterns (Color correction)
 - Specularity removal
- Artificial Light
- Suggestions
- Contribution

Thank you for your attention!

andreas.noback@hslu.ch
+41 41 349 33 11