

MDL + SUBSTANCE PAINTER

Manuel Kraemer - GDC 2016



PHYSICALLY BASED LOOK DEVELOPMENT

VISUAL PERCEPTION

Don't eat that !

- Static cues :
color / texture
- Dynamic cues :
roughness / glossyness
- Optic Flow



HUMAN VISUAL SYSTEM

“CG looks like plastic !”

- Material Perception:
 - Identification : GREAT !
 - Spatial relationships : poor
 - Inferring properties : poor



“EMPIRICAL” RENDERING

And why we moved on...

- ▶ Few things look “just right”
- ▶ Inconsistent lighting
- ▶ Very labor intensive



PHYSICALLY BASED RENDERING

The “correct” solution

- A big hump for users:
 - Physical quantities (radiance, flux, IES...)
 - Constrained parameters
 - Must be fully integrated : cameras + lights + BRDF



Benoit Dereau (Unreal 4)

PHYSICALLY BASED MATERIALS

Dielectrics and conductors

- New BxDF :
- Energy conservative
- Fresnel
- All light scatter paths
- Fewer parameters



(Unreal 4)

PHYSICALLY BASED MATERIALS

The art of constraints

- Reduced search space
 - Reduced human bias
- “Plausible” glossy materials
- Increased image fidelity
- Increased productivity

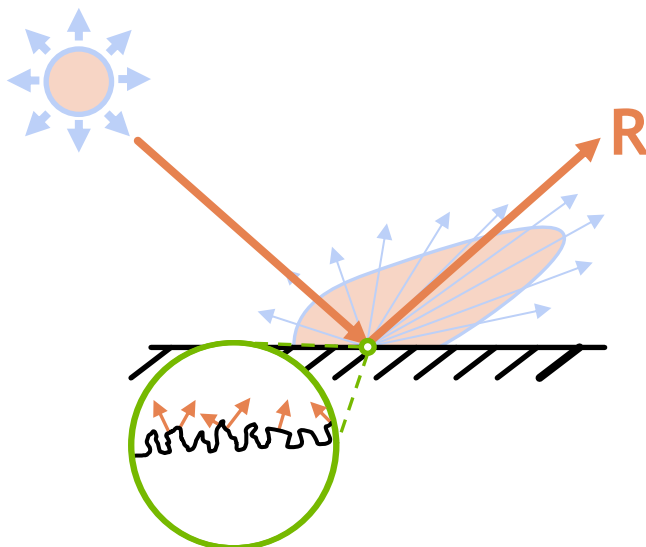


Mizuchi | ©Silicon Studio Corp

MICRO-STRUCTURES

Human Skin

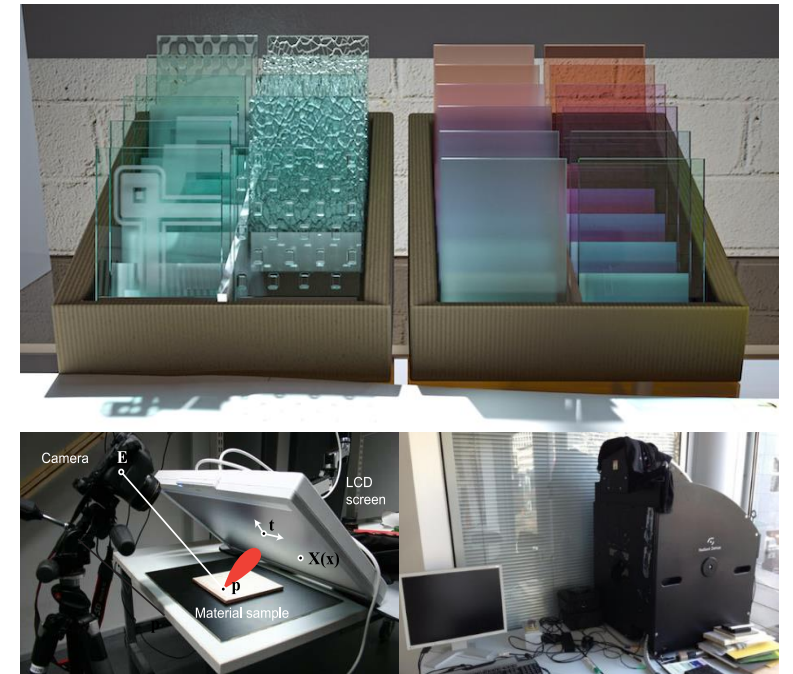
- Micro-facets:
 - Off-specular peak
 - Forward scatter (skin)
 - Retro-reflective (cloth)
- Complex BRDF
- How to guess parameters ?



DATA DRIVEN MATERIALS

The painter's palette

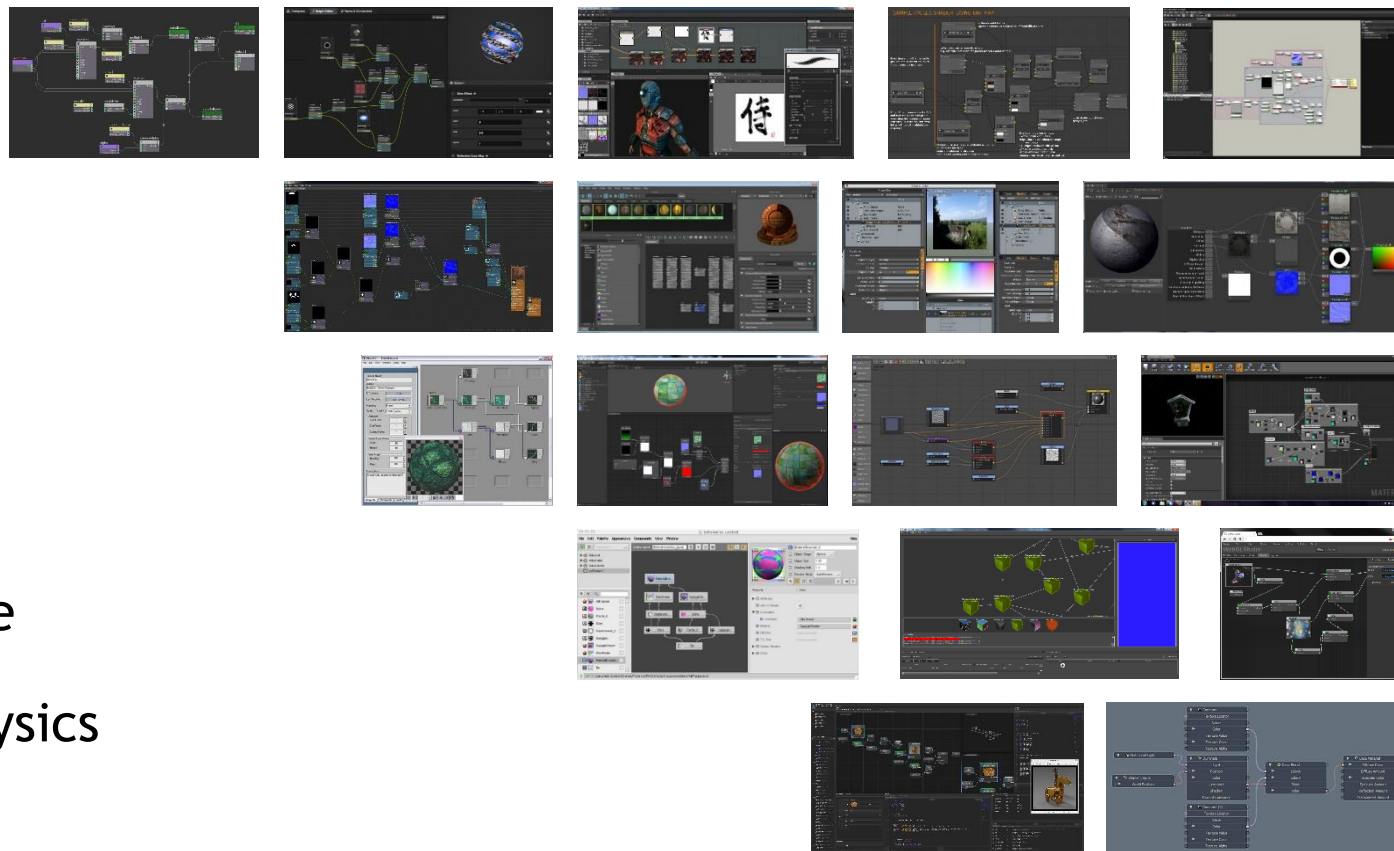
- Quantitative measurements
 - Building-blocks catalogs
 - No guess-work
 - Predictive rendering
- or...
- Combine & tweak for style



PBR IN PRODUCTION

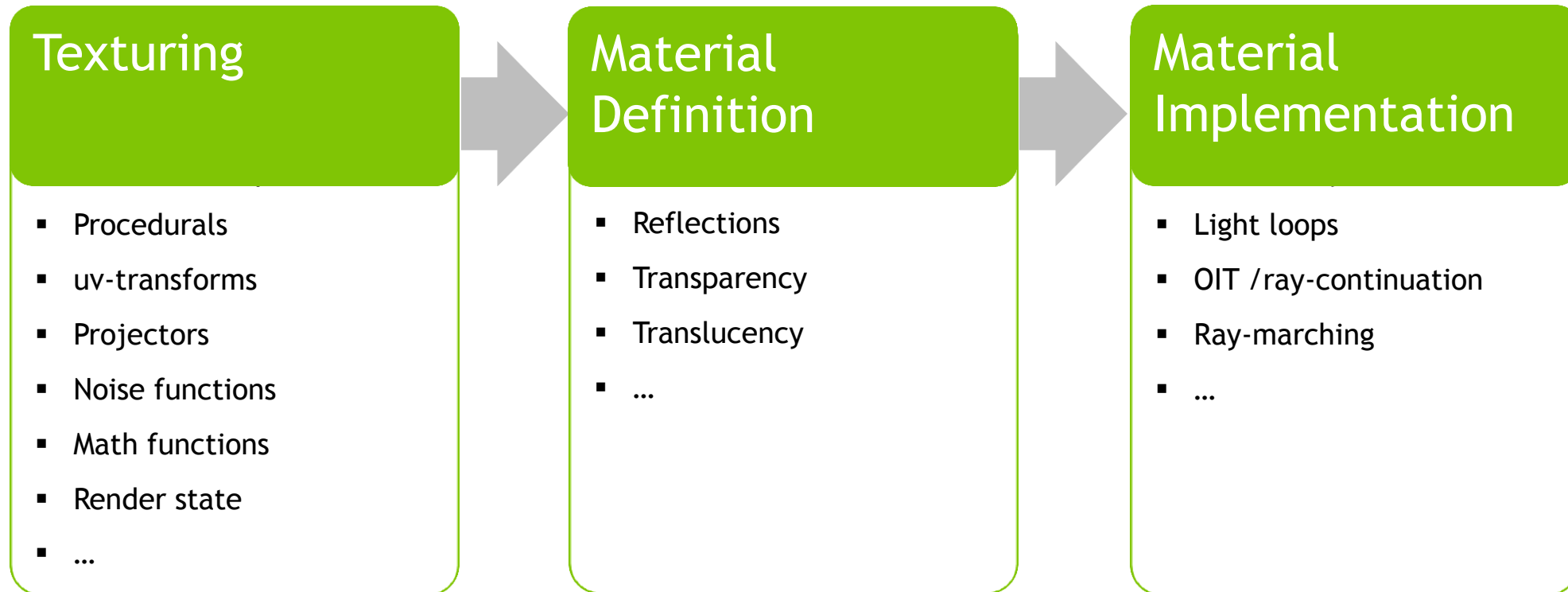
The need for standardization...

- We want:
 - Image Quality
 - Portability
 - Simplicity
- We have:
 - Proprietary GPU code
 - Different Maths / Physics



PROGRAMMABLE GPU SHADING

The shading “pipeline”



DIFFERENT SKILL-SETS

The skill gap



Programmer

- Define how parameters & functions are interpreted by the renderer

Implementation
(Renderer)



Material Specialist

- Define materials construction
- Define which parameters should be exposed to users

Definition
(ISV)



End-User

- Tweak & customize the look
- Make variations
- Define the assignments

Customization
(End Users)

Programming

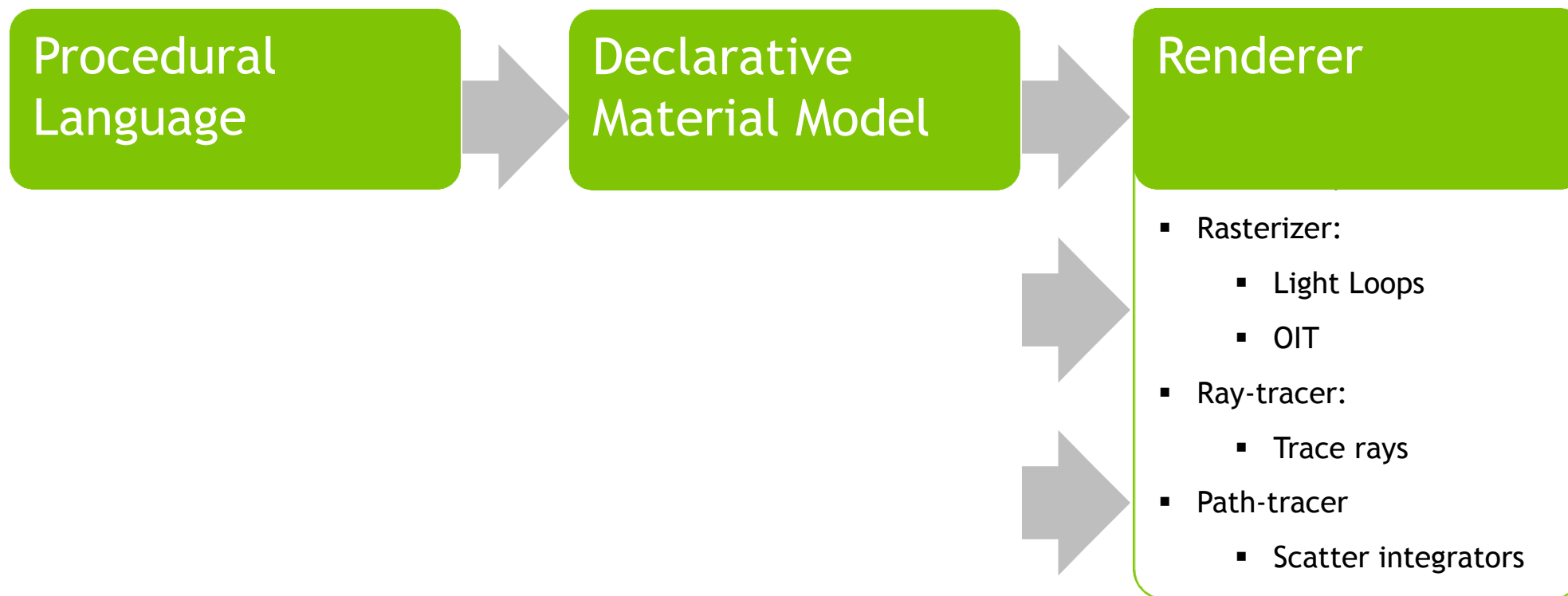
Materials

Design



MATERIAL DESCRIPTION LANGUAGE

Abstracting the API



MATERIAL DESCRIPTION LANGUAGE

MDL is not a Shading Language

- MDL defines *what* to compute...
... not *how* to compute it
 - no programmable shading
 - no light loops or access to illumination
 - no trace call
 - no sampling
 - no camera dependence



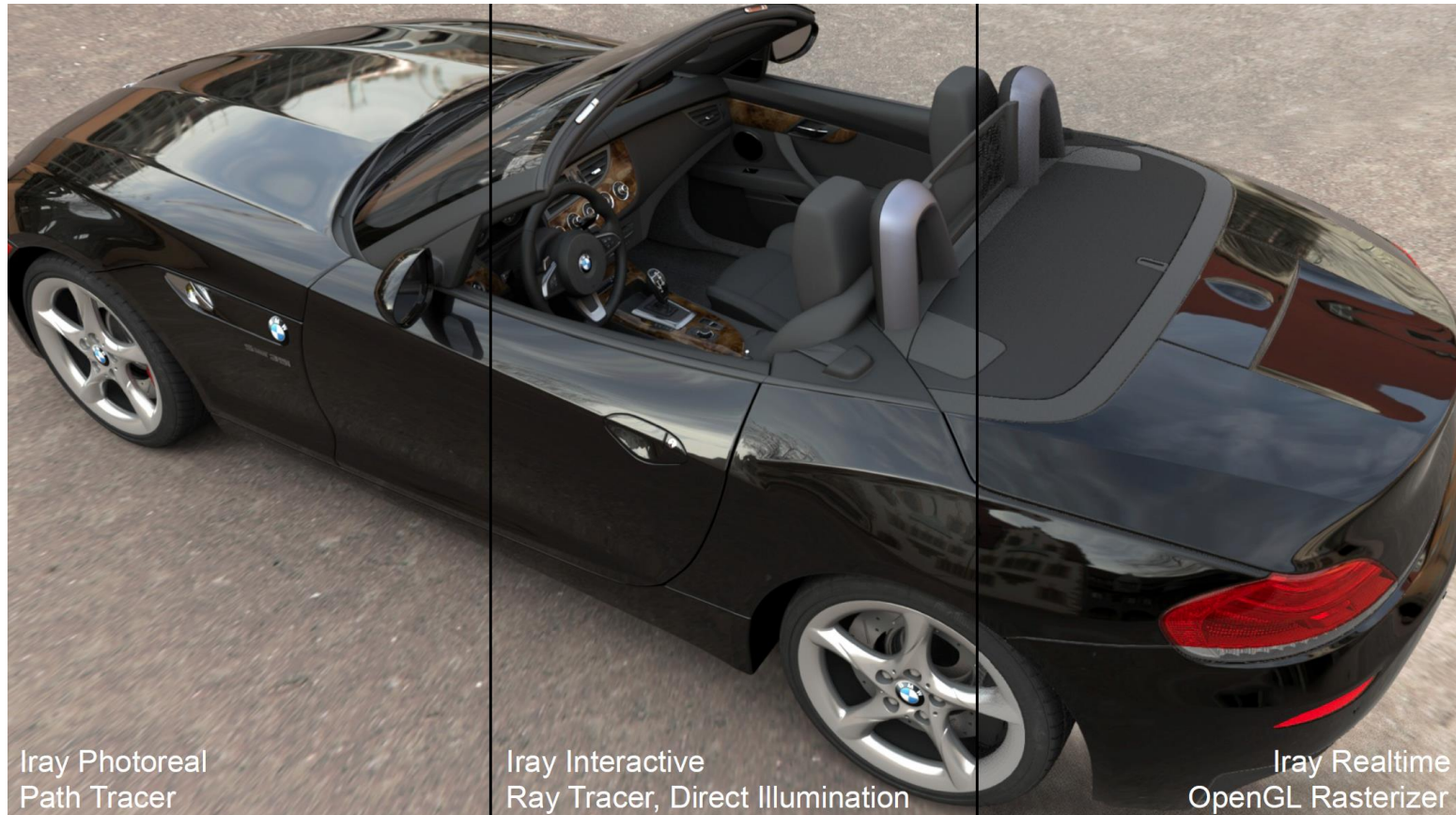
MDL IN **YOUR** GAME ENGINE ?

- Powerful
- Intuitive
- Flexible
- Open
- Portable



MDL IN IRAY

Beyond the engine



Iray Photoreal
Path Tracer

Iray Interactive
Ray Tracer, Direct Illumination

Iray Realtime
OpenGL Rasterizer

gameworks.nvidia.com

SUBSTANCE / MDL DEMO

Thanks to:

Jay Axe

Phillip Miller

Nikolaus Binder

Alexander Keller

John Spitzer

THE END

