

Evolutionary Design of BRDFs

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Outline

- Genetic Art
- Application to BRDFs
- Examples
- Implementation

Genetic Art

Genetic Algorithms ...

- to create graphics, sounds, etc.
- with a human in the loop to evaluate the results

Genetic Art: Karl Sims

Artificial Evolution
for Computer Graphics,
SIGGRAPH 1991



```
(round (log (+ y (color-grad (round  
(round (+ y (log (invert y) 15.5)) x)  
x)) (log (invert y) 15.5)) x) 3.1 1.9
```



Genetic Images,
1993

Genetic Art: Kai Krause

MetaTools Kai's Power Tools 2.1:
Texture Explorer, 1994



Evolutionary Design

- explore a vast space of possibilities
- no complex parameters to control (and learn)
- learn what is possible and be inspired by the things found on the way
- no clear idea needed in advance

Application to BRDFs

Genetic programming of $f(\omega_{\text{out}}, \omega_{\text{in}})$ as pixel shader on a graphics card

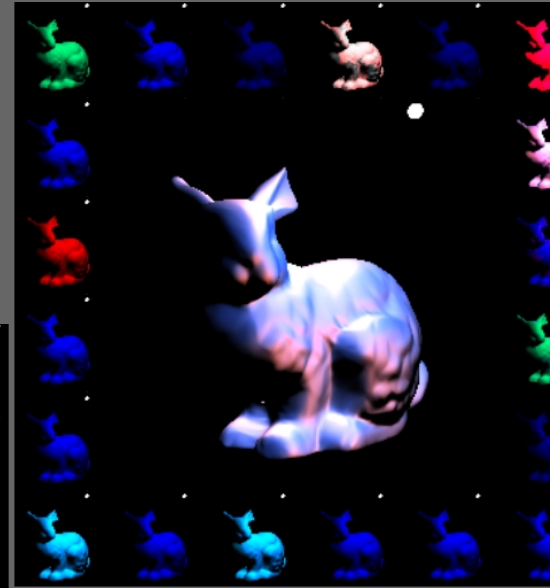
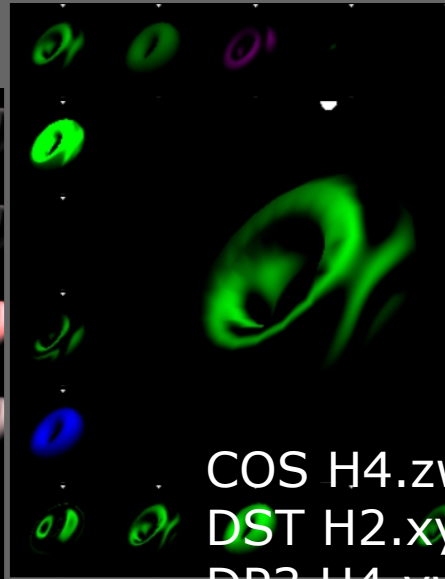
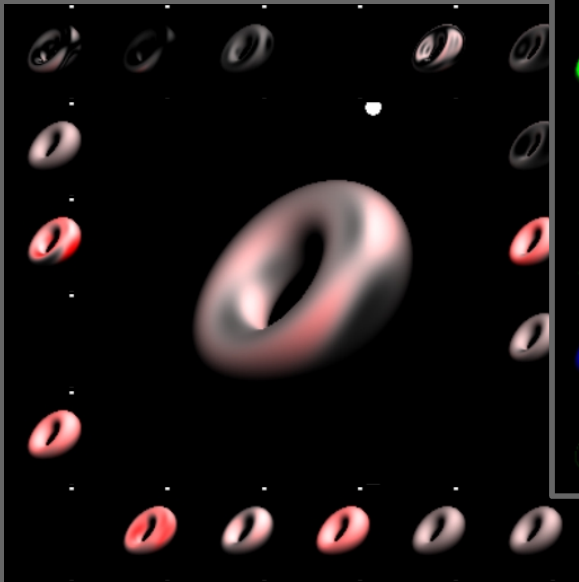
Intuitively generate complex “looks”...

- without dozens of parameters
- that nobody has conceived before, no Phong/Blinn/Cook-Torrance + x

Examples

100 genetic instructions

→ Videos



COS H4.zw, -H2.x;
DST H2.xyz, H4.zxyy, -H1.yxxz;
DP3 H4.yw, -H2.xyxz, H6.yzzx;
COS H4.xw, -H5.y;
FY26 H3.yzw, -H6.z;

Implementation

Surround the genetic code with other code to ensure that:

- result is physical
(non-negative, reciprocal)
- result depends smoothly on direction (can't use simply ϕ, θ)

Optimize against code bloat.

Questions?