

Non-Photorealistic Rendering (NPR)

==

stylization

In real-time rendering,

非照眞實感渲染

Non-Photorealistic Rendering (NPR)

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(fast and reliable) stylization

快速

可靠.

风格化.

Photorealistic Rendering

- Goal
 - Indistinguishable from photos
 - Focus: lighting, shadows, materials, etc.



Non-Photorealistic Rendeirng (NPR)

- Goal
 - Producing artistic appearances

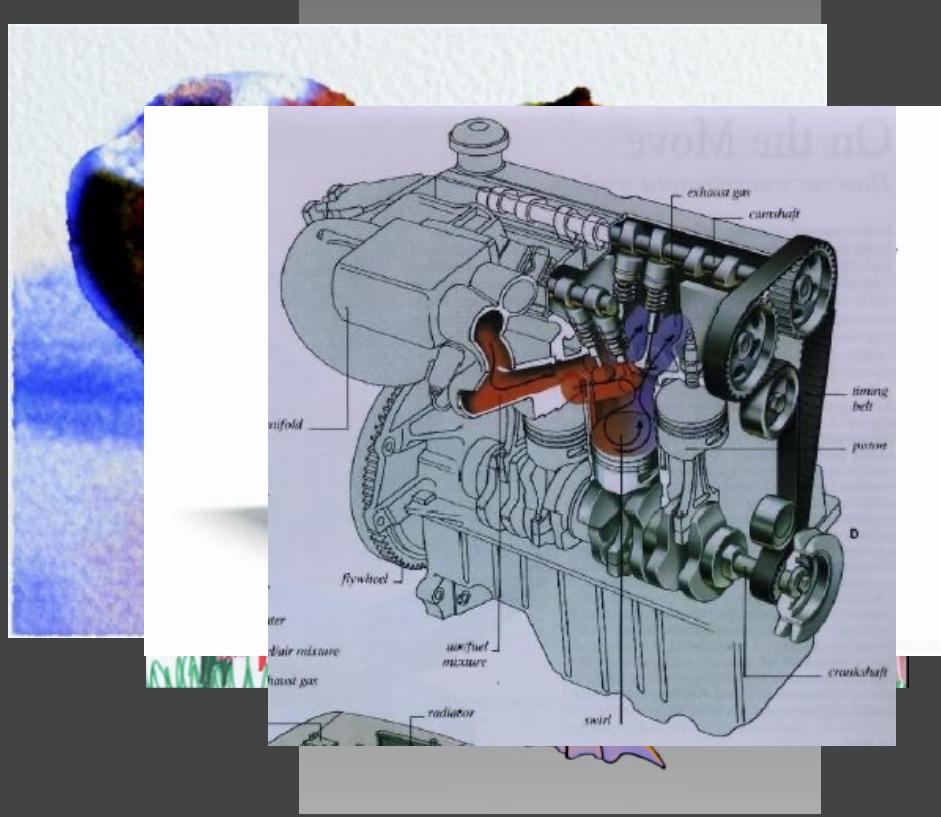


Characteristics of NPR

- Starts from photorealistic rendering
- Exploits abstraction 抽象
- Strengthens important parts 强化重要 parts.

Applications of NPR

- Art
- Visualization
- Instruction
- Education
- Entertainment
- ...



Applications of NPR



[Atelier Ryza 2: Lost Legends & the Secret Fairy]



[Attack on Titan, Season 4]

What are Styles?

- Can we summarize styles from this image?



[Xenoblade Chronicles 2]

What are Styles?

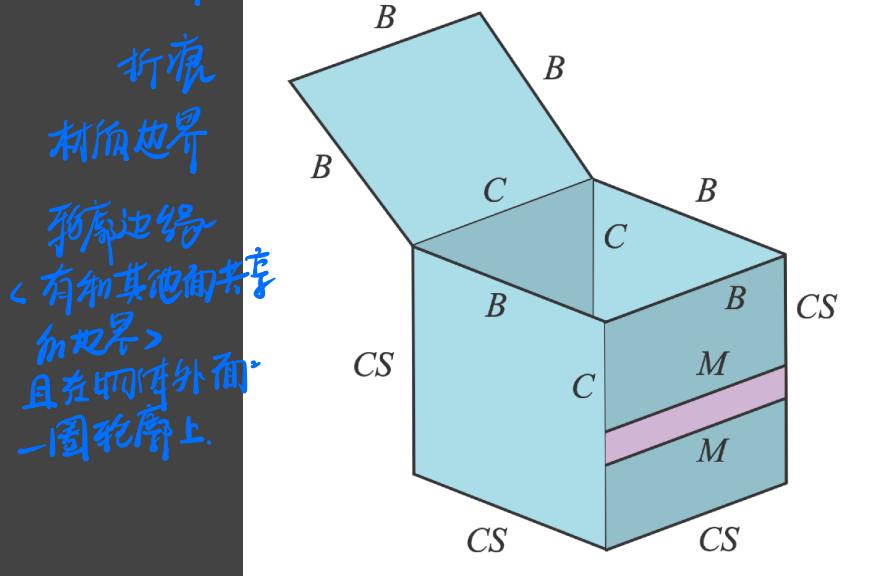
- Can we summarize styles from this image?
 - Bold contours (actually, outlines)
 - Blocks of colors
 - Strokes on surfaces



Outline Rendering

- Outlines are not just contours

- [B]oundary / border edge **边界** < 没有和其他面共享的边界>
- [C]rease **折痕**
- [M]aterial edge **材质边界**
- [S]ilhouette edge **轮廓边缘**
< 有和其他面共享
的边界>
且在物体外面
一圈轮廓上.

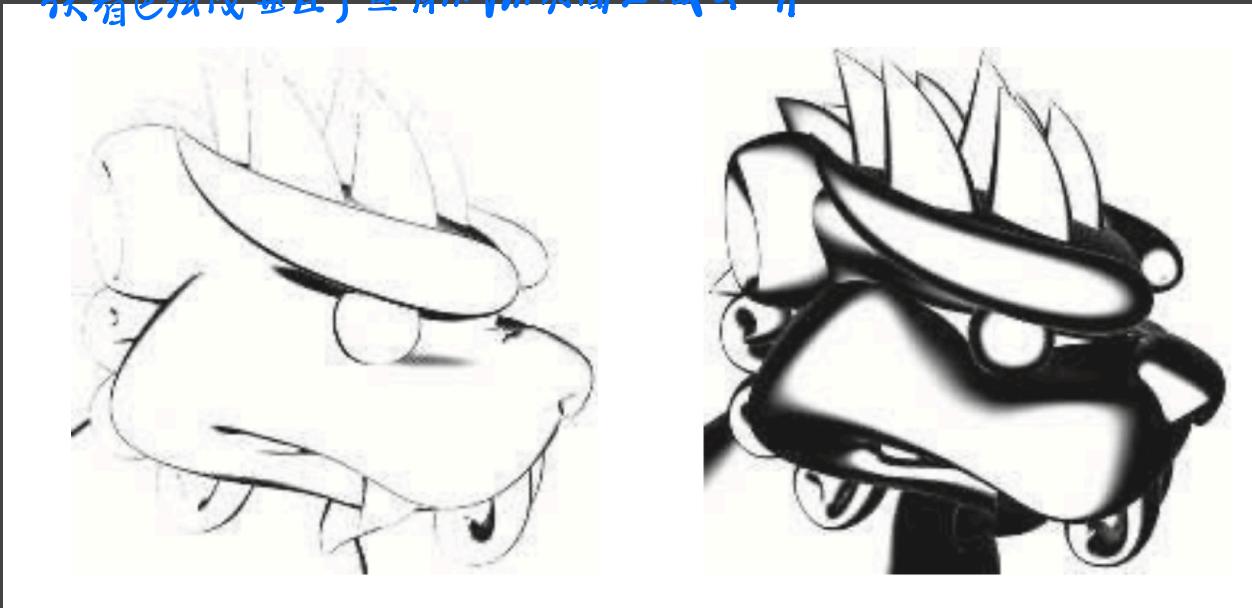


Outline Rendering -- Shading

着色

- Shading normal contour edges 着色法线轮廓边
 - Darken the surface area where the shading normal is perpendicular to viewing direction

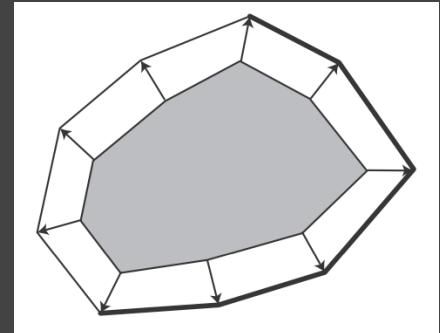
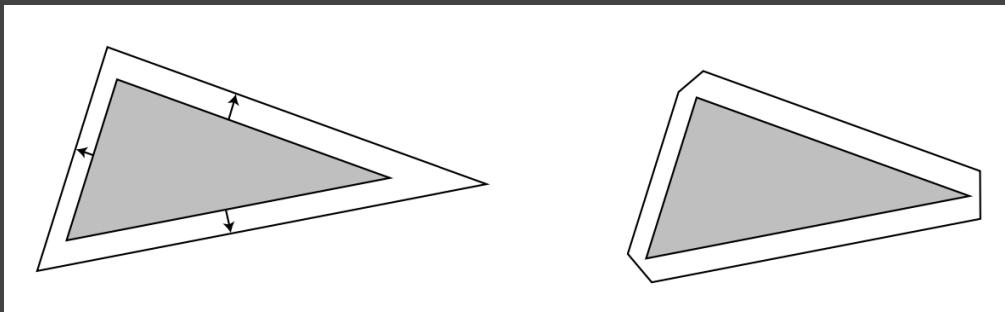
便着色法线 垂直于查看方向的表面区域变暗



Outline Rendering -- Geometry

几何

- Backface flattening
 - Render frontface normally 正常渲染正面
 - “Fatten” backfaces, then render again 使反面(背面)变大一圈,再次渲染
 - Extension: flatten along vertex normals <沿顶点法线变大>



Outline Rendering -- Image

- Edge detection in images

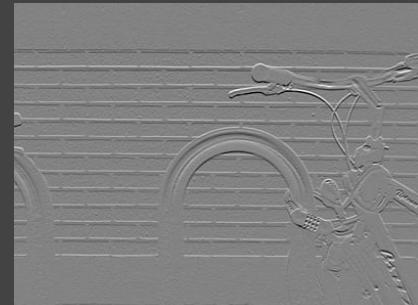
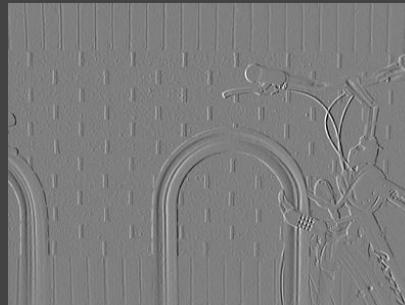
- Usually use a Sobel detector

一种边缘检测器

1	0	-1
2	0	-2
1	0	-1



-1	-2	-1
0	0	0
1	2	1



Outline Rendering -- Image

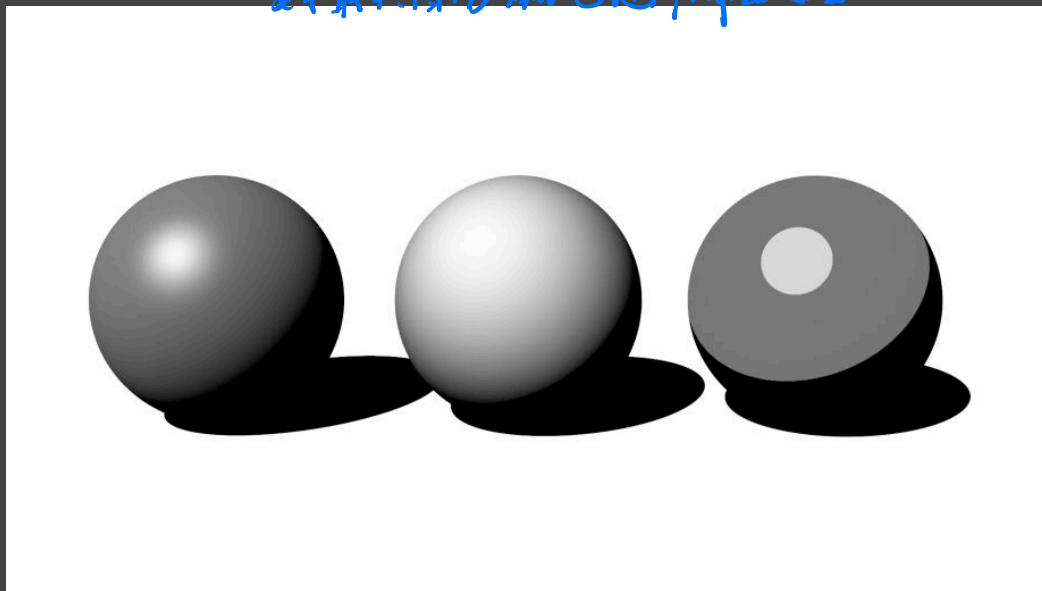
- Edge detection in images
 - May work on different information



Color blocks

- Two different ways
 - Hard shading: thresholding on shading
 - Posterization: thresholding on final image color

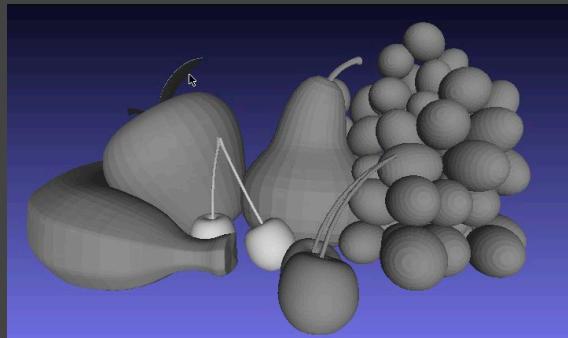
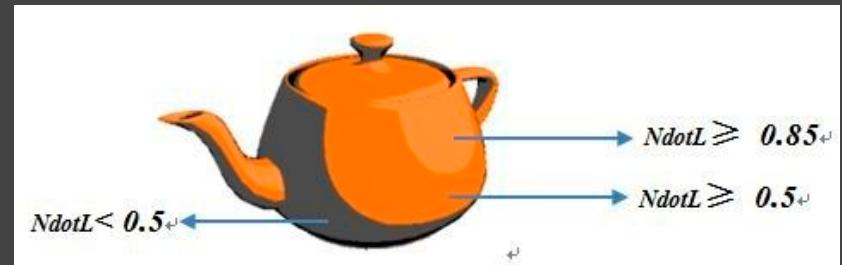
对最终图像颜色进行阈值处理。



Color blocks

- May not be binary
 - Quantization

量化.



Color blocks

- Different styles on different components



Strokes Surface Stylization

笔划曲面样式化.

- Sometimes you do not want color blocks

模仿素描

- Instead you want to mimic sketching

- Idea

用预生成的笔触纹理替换块状
shading with pre-generated stroke textures

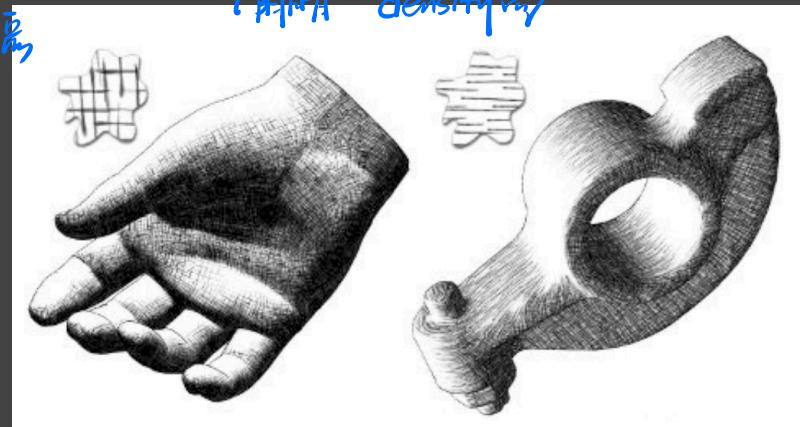
- Replace point-wise shading with pre-generated stroke textures

- Density?

强度

- Continuity?

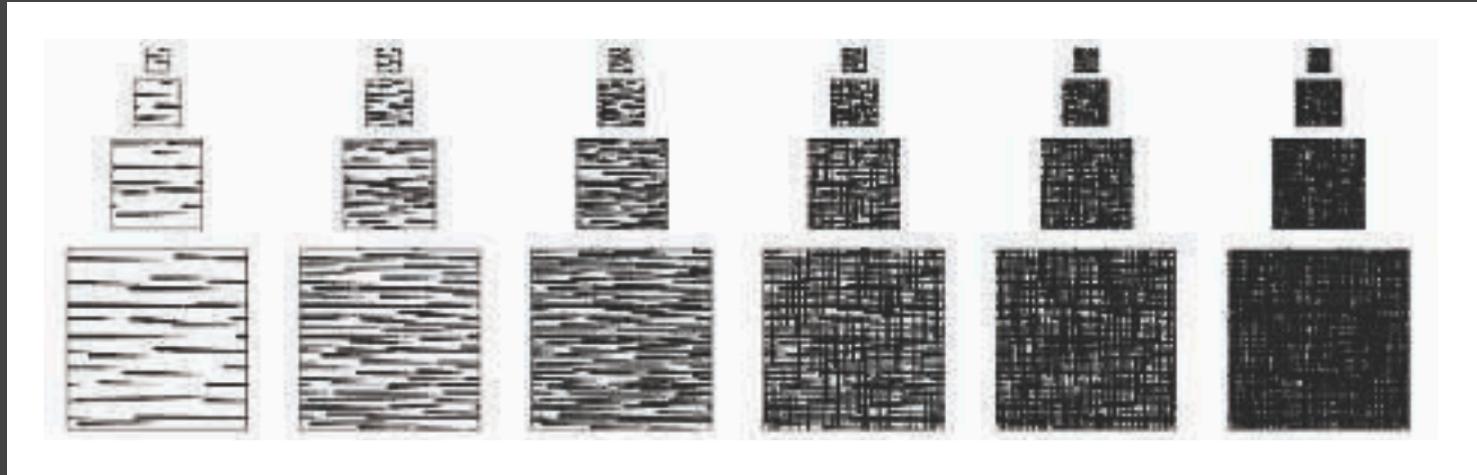
连续性



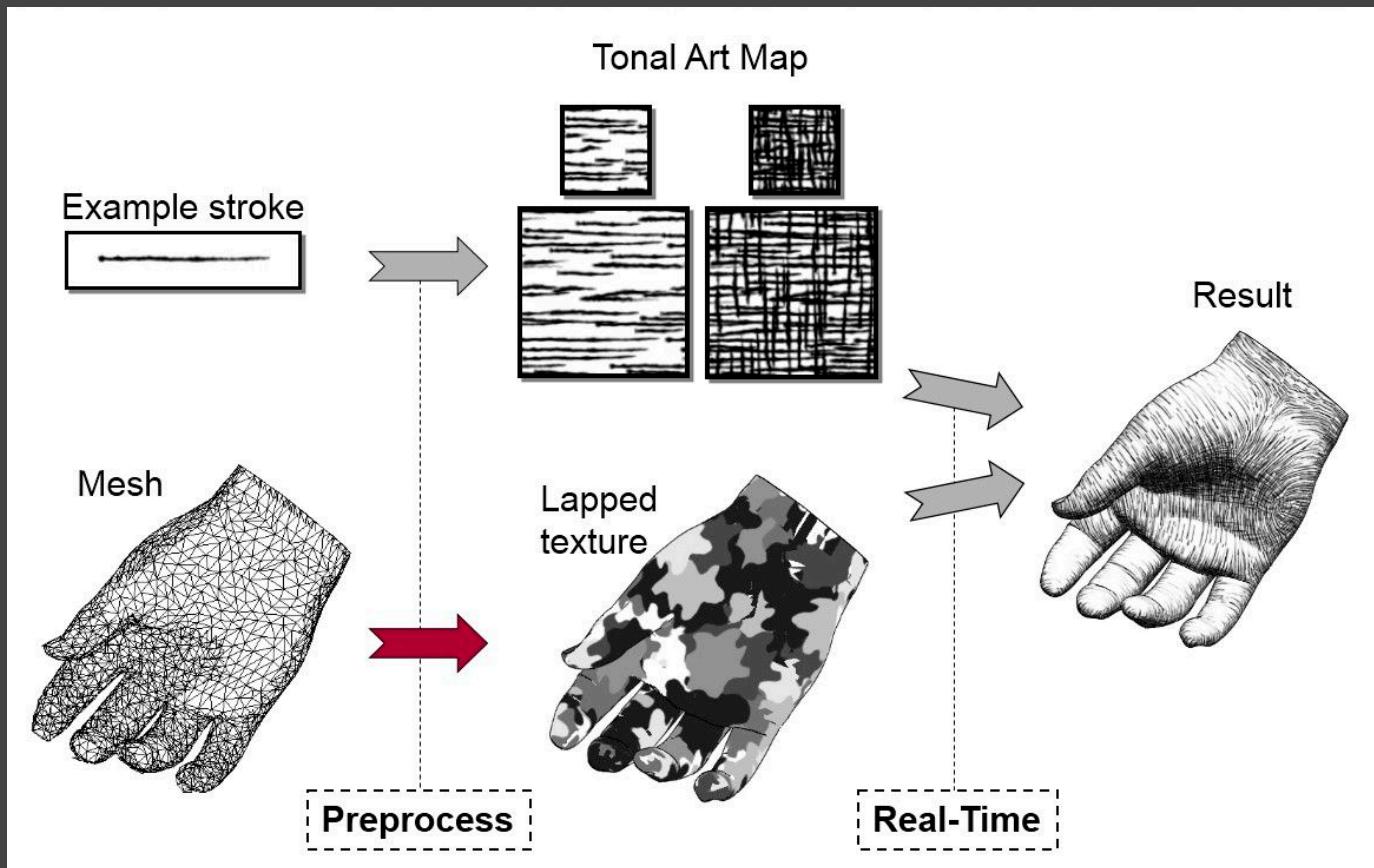
Strokes Surface Stylization

色调艺术图

- Tonal art maps (TAMs)
 - Strokes of different densities 不同密度的笔划
 - Each density has a MIPMAP 每个密度都有各自的MIPMAP.



Strokes Surface Stylization



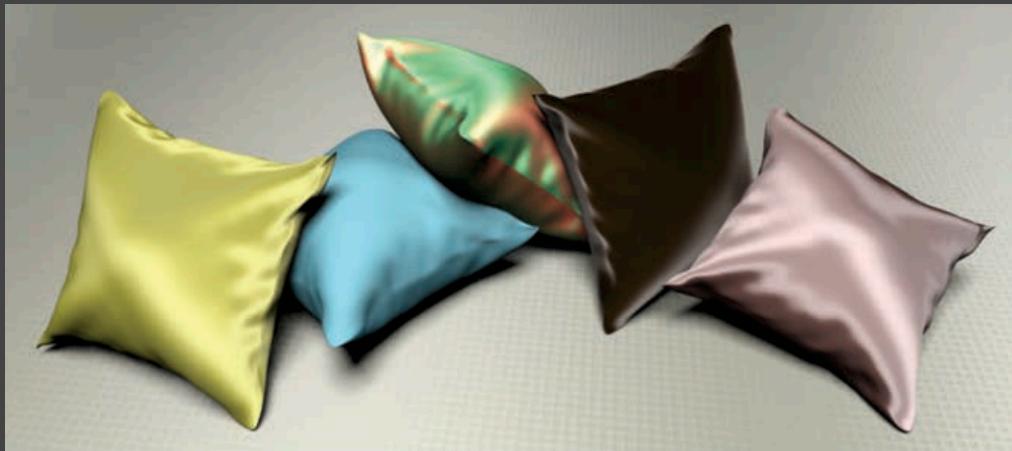
Some Notes

- NPR is art driven
- But you need the ability to “translate” artists’ needs into rendering insights
 - e.g. edge
- Communication is important
- Sometimes, per character, even per part

Key Observations

- Something people still haven't paid much attention to
 - Photorealistic models are super important in NPR
- Example: cloth

[Sadeghi et al.]



Next Lecture

- Real-Time Physically-Based Materials (scattering models)



<https://docs.unrealengine.com/en-US/WorkingWithContent/Hair/index.html>

Thank you!

(And thank Prof. Kun Xu for some of the NPR slides)