

Graphics Courses this Spring

- 15-505: Animation Art and Technology,
Hodgins/Duesing
- 15-493: Computer Game Programming,
Hodgins/??? (lead developer on a game)



Texture Synthesis

Thanks to James Hays

Problem Statement







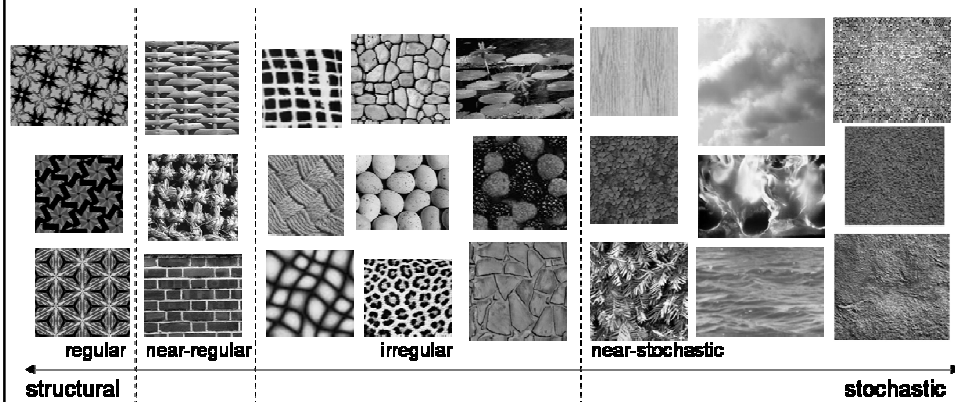




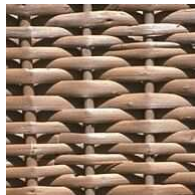
Problem Statement

- No easy fix
- Limited by texture memory and artist man hours

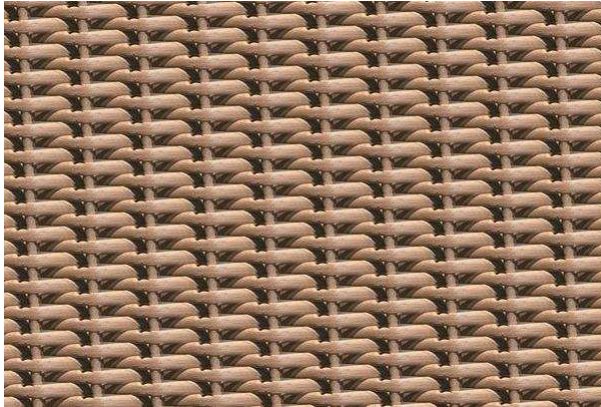
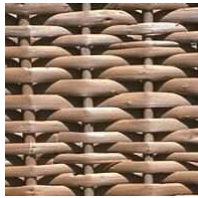
Texture Spectrum



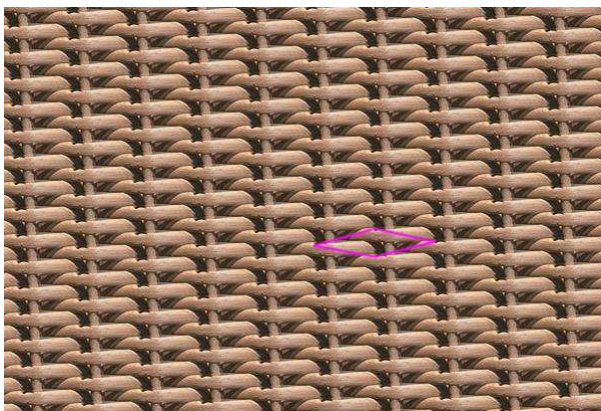
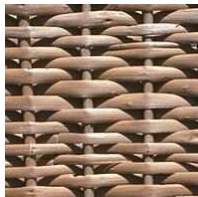
Real world texture



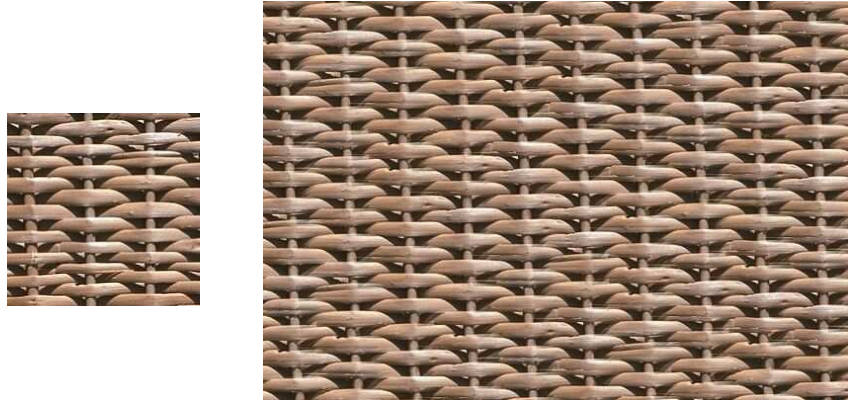
Tiling



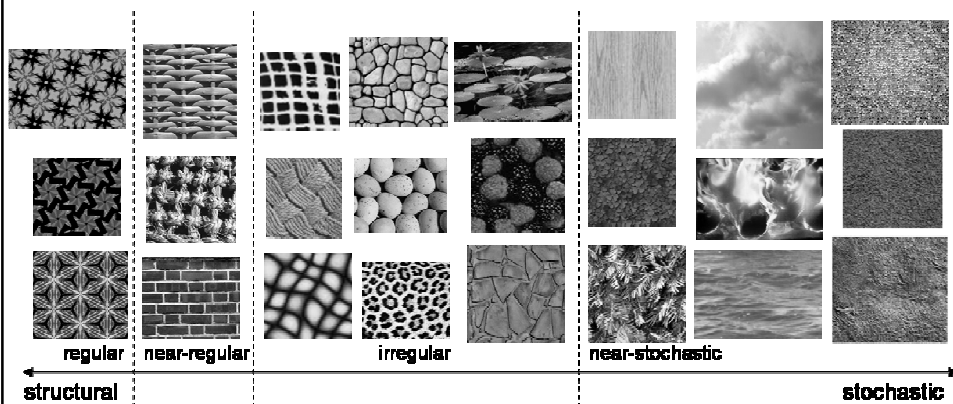
Tiling



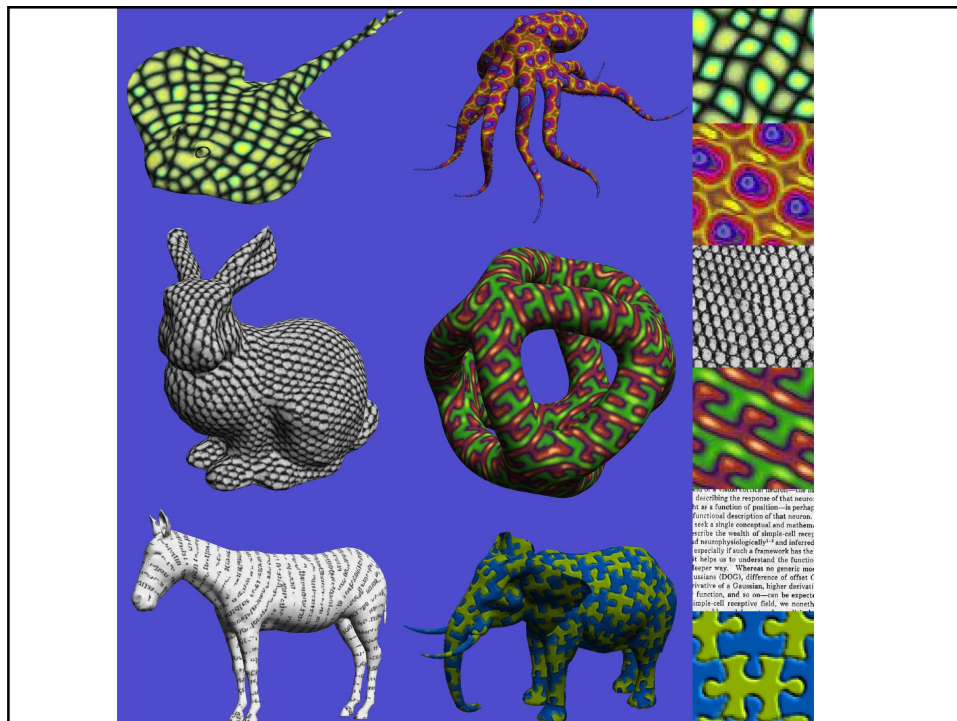
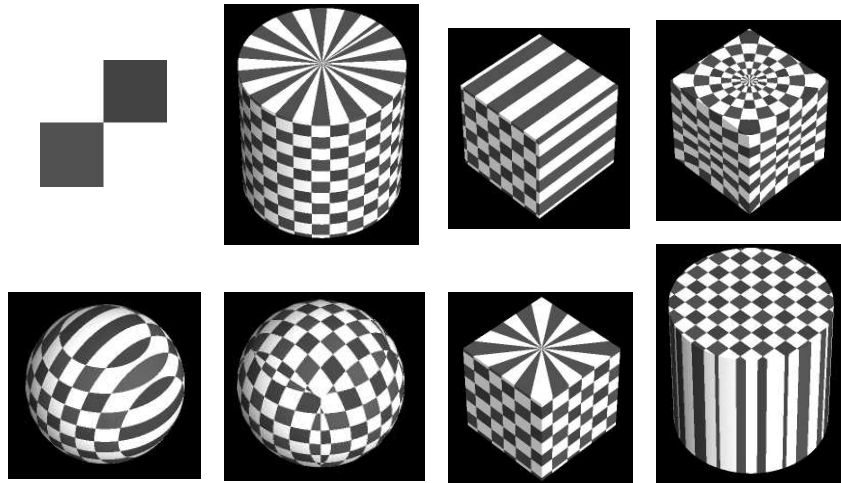
Texture Synthesis Result

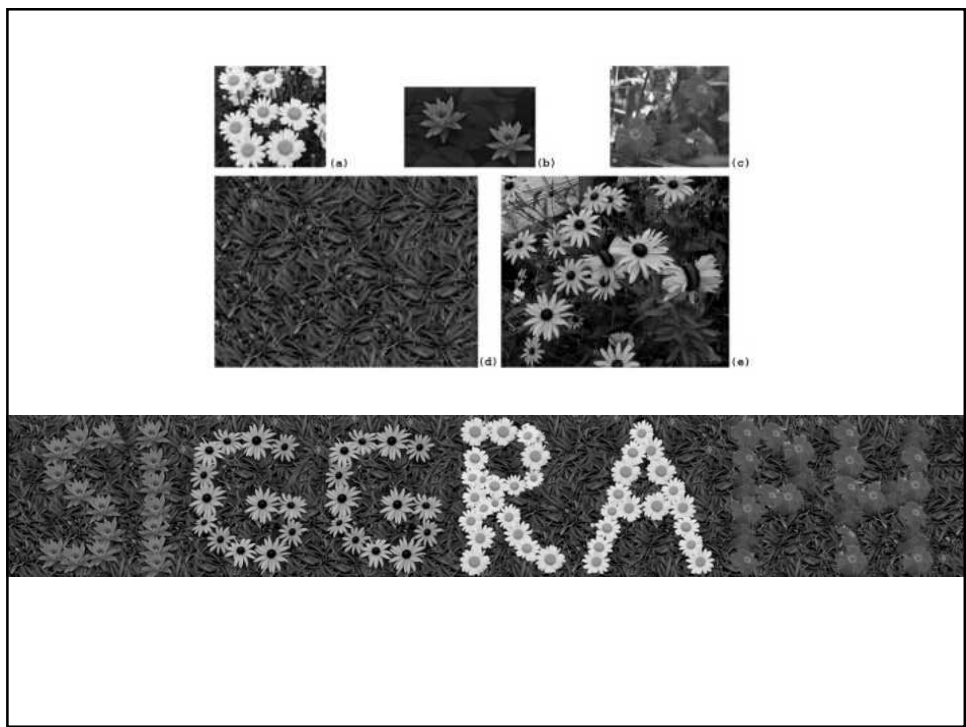


Texture Spectrum



Another Justification





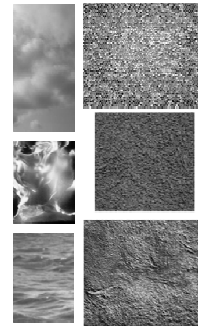


Approaches

- First approach – toy with some noise image until it matches the statistics of the input image.



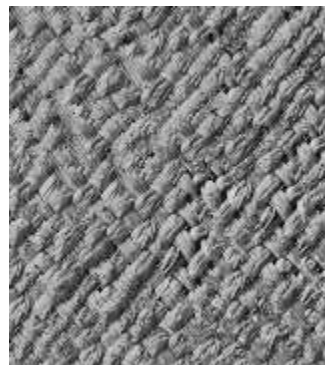
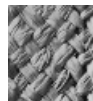
Texture Spectrum



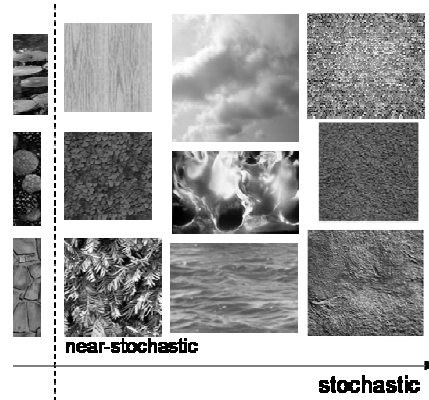
stochastic →

Approaches

- Newer approach – Copy pixels directly from the input. Search instead of model.



Texture Spectrum

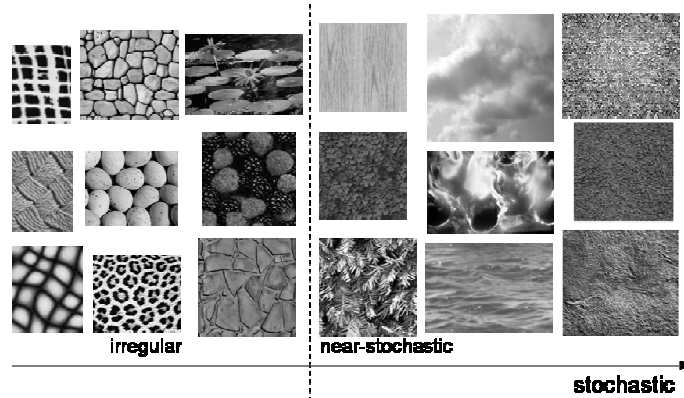


Approaches

- Newest approach – Copy patches directly from the input and worry about stitching them together

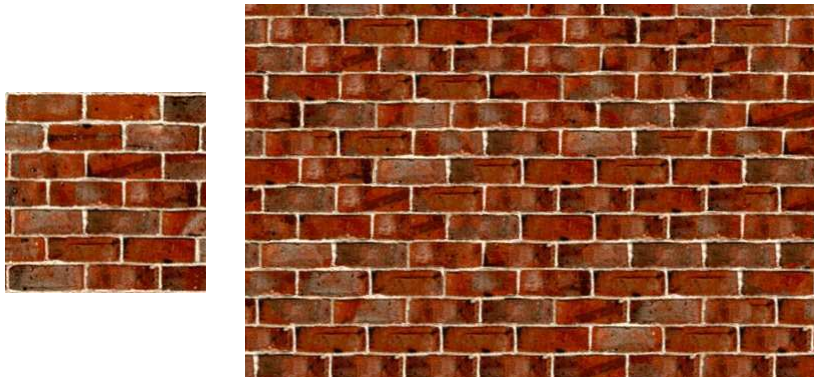


Texture Spectrum

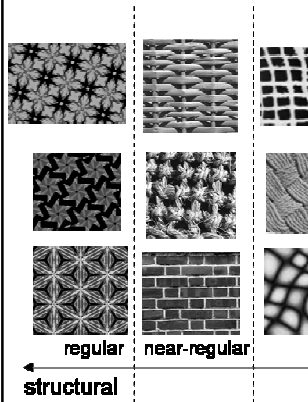


Approaches

- Newest approach – Copy patches directly from the input and worry about stitching them together while enforcing periodicity.



Texture Spectrum



Limitations



Neighborhood Based Methods

- This is what you will be implementing for homework 4.



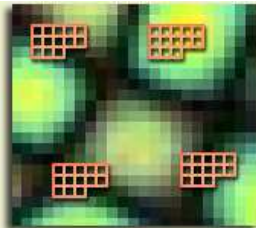
A

Neighborhood Based Methods

- This is what you will be implementing for homework 4.



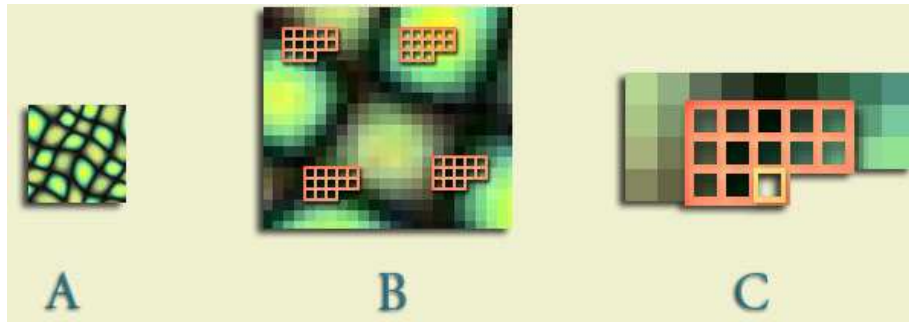
A



B

Neighborhood Based Methods

- This is what you will be implementing for homework 4.



Neighborhood Based Methods

- There is one significant parameter

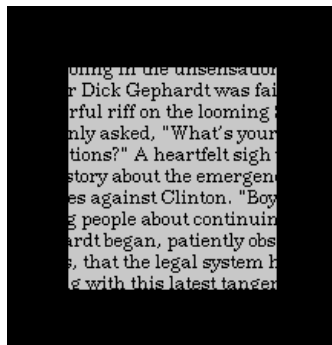


Neighborhood Based Methods

- Several meaningful extensions
 - Hole filling
 - Coherence Parameter
 - Targeted Synthesis
 - Multiresolution Synthesis
 - Analogy Based Synthesis
 - Acceleration
 - Your Brilliant Idea

Neighborhood Based Methods

- Hole filling

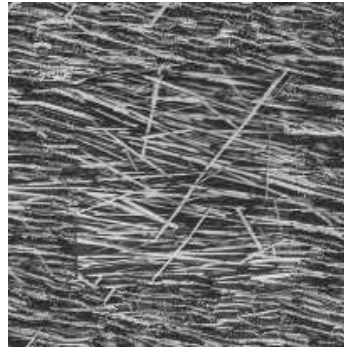
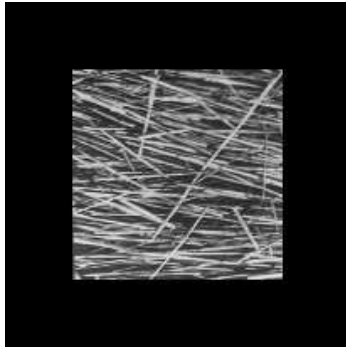


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Efros and Leung, '99

Neighborhood Based Methods

- Hole filling



Efros and Leung, '99

Neighborhood Based Methods

- Coherence Parameter



With C.P.



Without



With C.P.



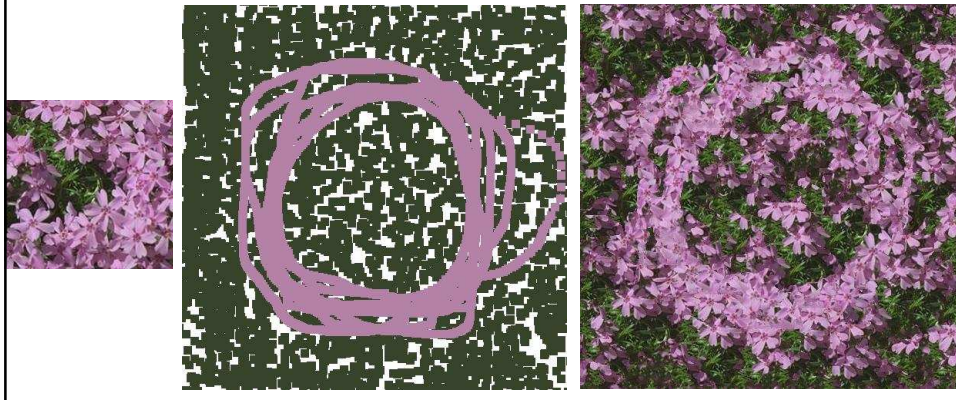
Without

Ashikhmin, 2001

Neighborhood Based Methods

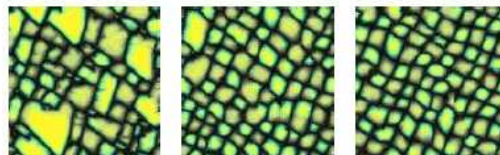
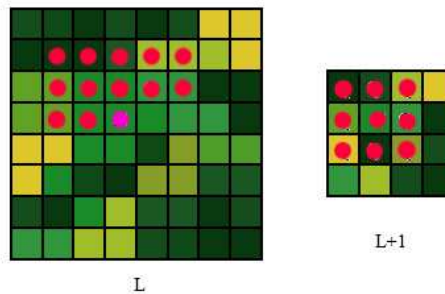
- Coherence Parameter
 - Targeted Synthesis

Ashikhmin, 2001



Neighborhood Based Methods

- Multiresolution Synthesis



Wei and Levoy,
2000

Neighborhood Based Methods

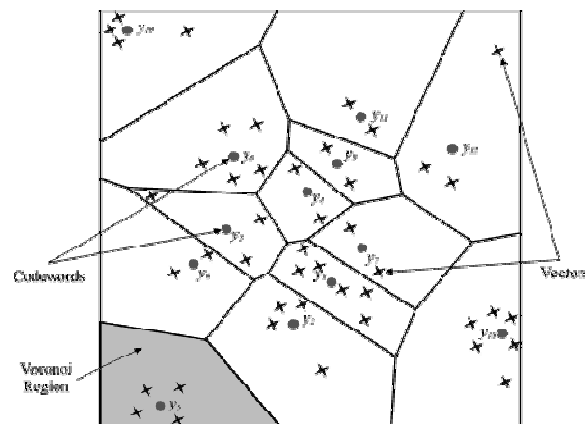
- Analogy Based Synthesis

Hertzmann, Jacobs, Oliver,
Curless, and Salesin, 2001.



Neighborhood Based Methods

- Acceleration – vector quantization



Hertzmann, Jacobs, Oliver,
Curless, and Salesin, 2001.

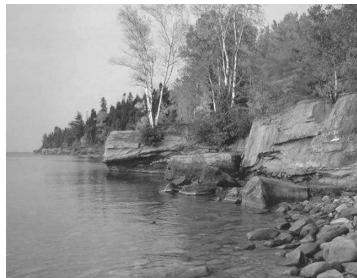
Non-photorealistic rendering



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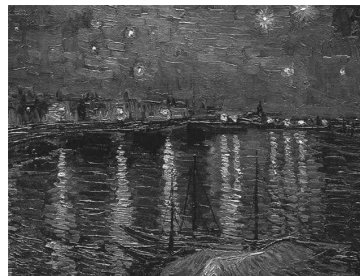


Hertzmann, Jacobs, Oliver,
Curless, and Salesin, 2001.

Non-photorealistic Rendering



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Hertzmann, Jacobs, Oliver,
Curless, and Salesin, 2001.

Paint by numbers



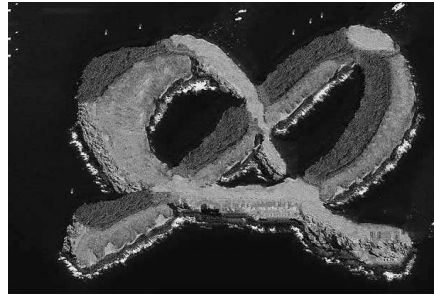
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Hertzmann, Jacobs, Oliver,
Curless, and Salesin, 2001.

Colorization



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Perspective synthesis



Kwatra et al., 2003

Perspective synthesis



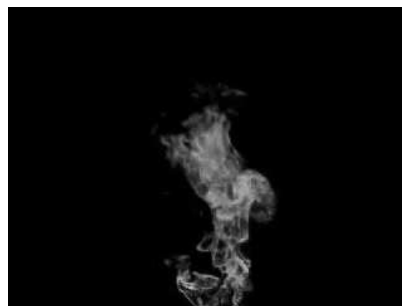
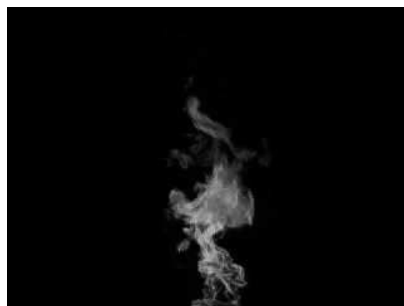
Kwatra et al., 2003

Rotation invariant synthesis



Kwatra et al., 2003

Movies



Wei and Levoy,
2000

More neat stuff

Near Regular Manipulation



Liu, Lin, and Hays, 2004