15-463 (15-862): Computational Photography

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Staff

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Web Page

- http://graphics.cs.cmu.edu/courses/15-463/

Discussion Forum:

- googlegroups

Today

Introductions

Why Computational Photography?

Overview of the course

Administrative stuff

A bit about me

Alexei (Alyosha) Efros

- Assistant Professor in Robotics and CSD
- also work with colleagues in Paris and Oxford

Teaching

- The plan is to have fun and learn cool things, both you and me!
- Social warning: I don’t see well

Research

- Graphics, Vision

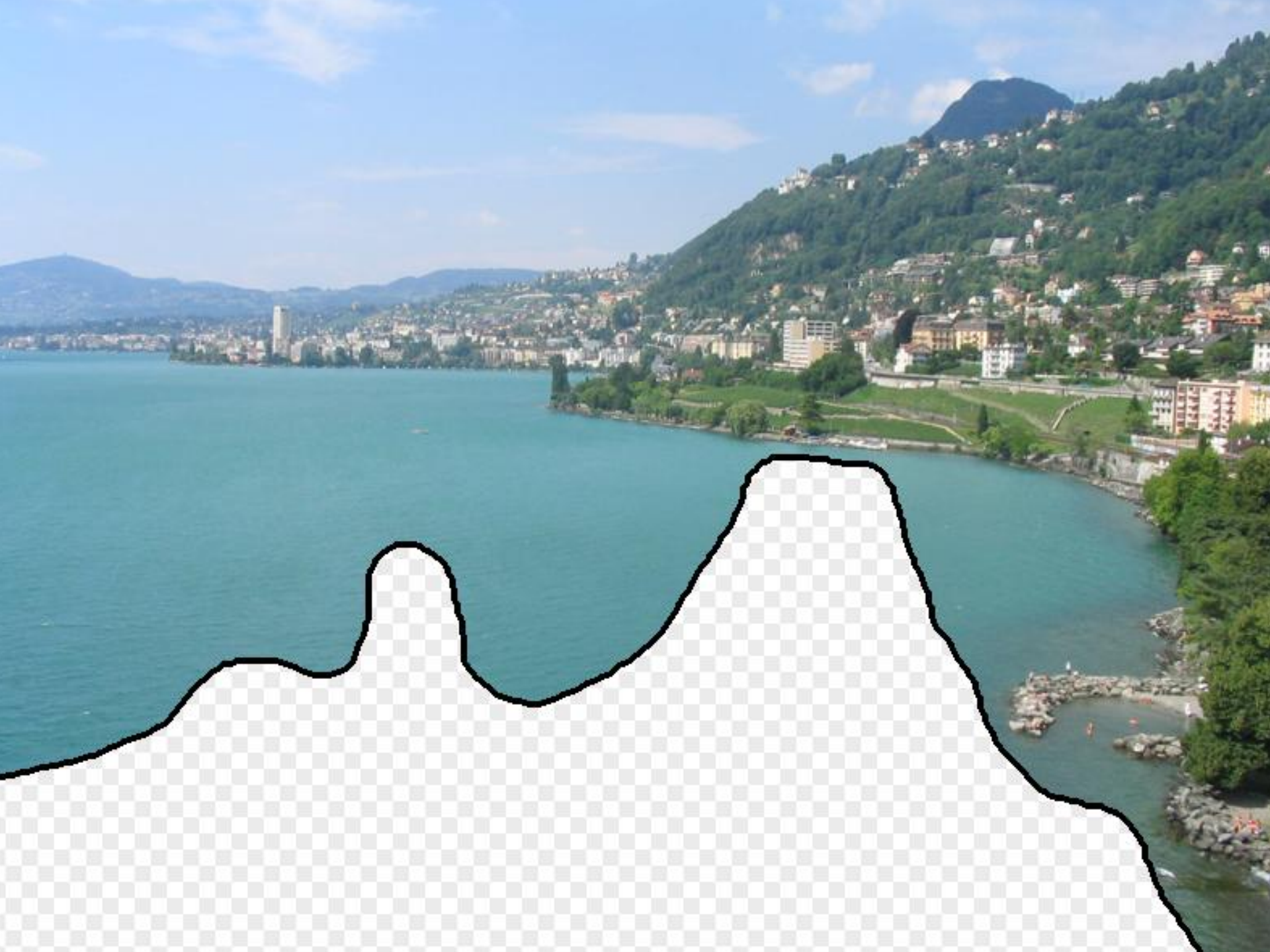
PhD Thesis on Texture and Action Synthesis

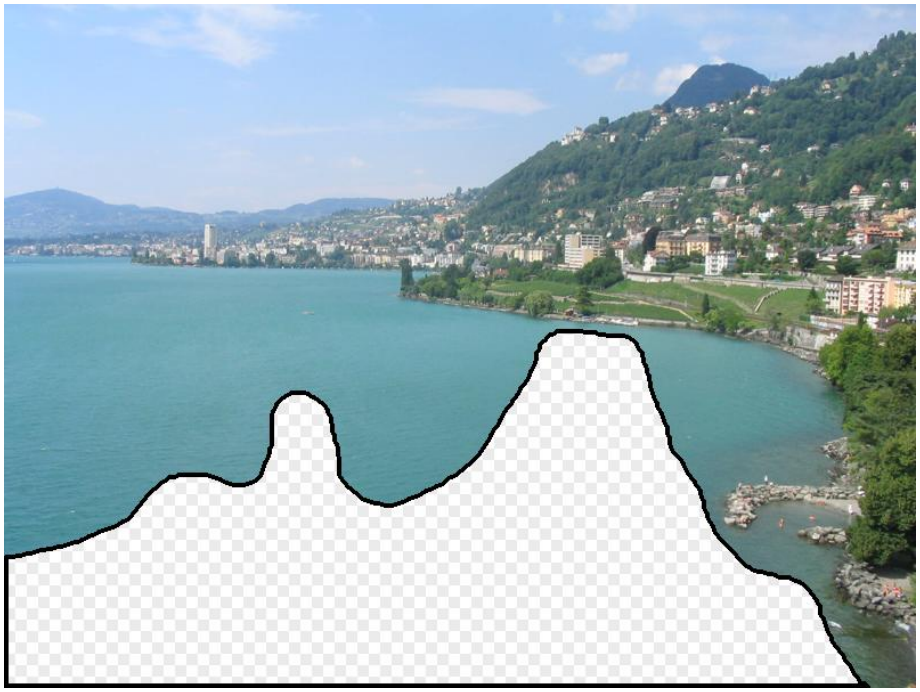
Smart Erase button in MS Digital Image Pro:

Antonio's son cannot walk but he can fly☺

More recent work

Derek Hoiem, Alexei Efros, Martial Hebert





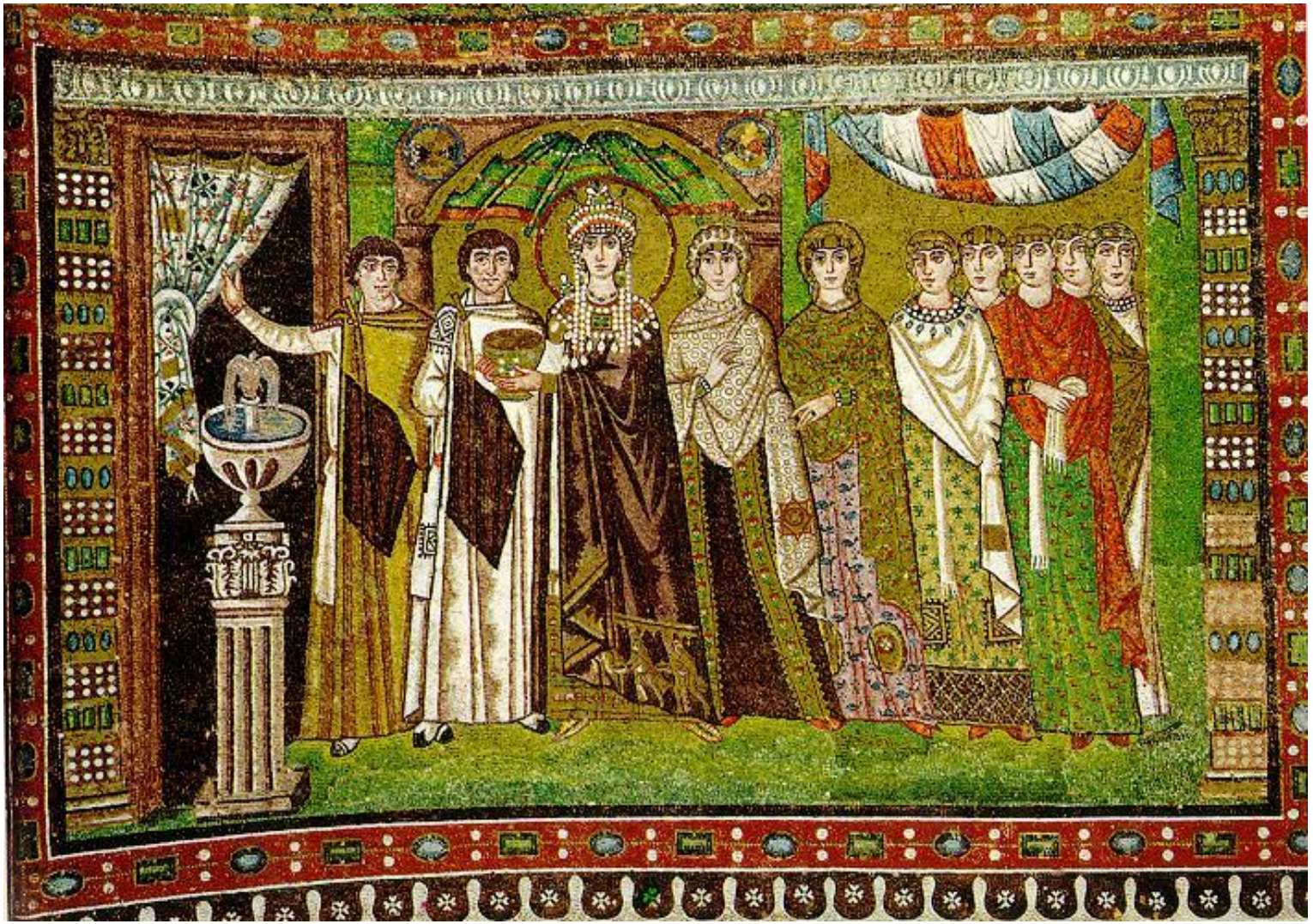
Why Computational Photography?

A super-brief History of Art
and its futile Search for Realism

Depicting Our World: The Beginning

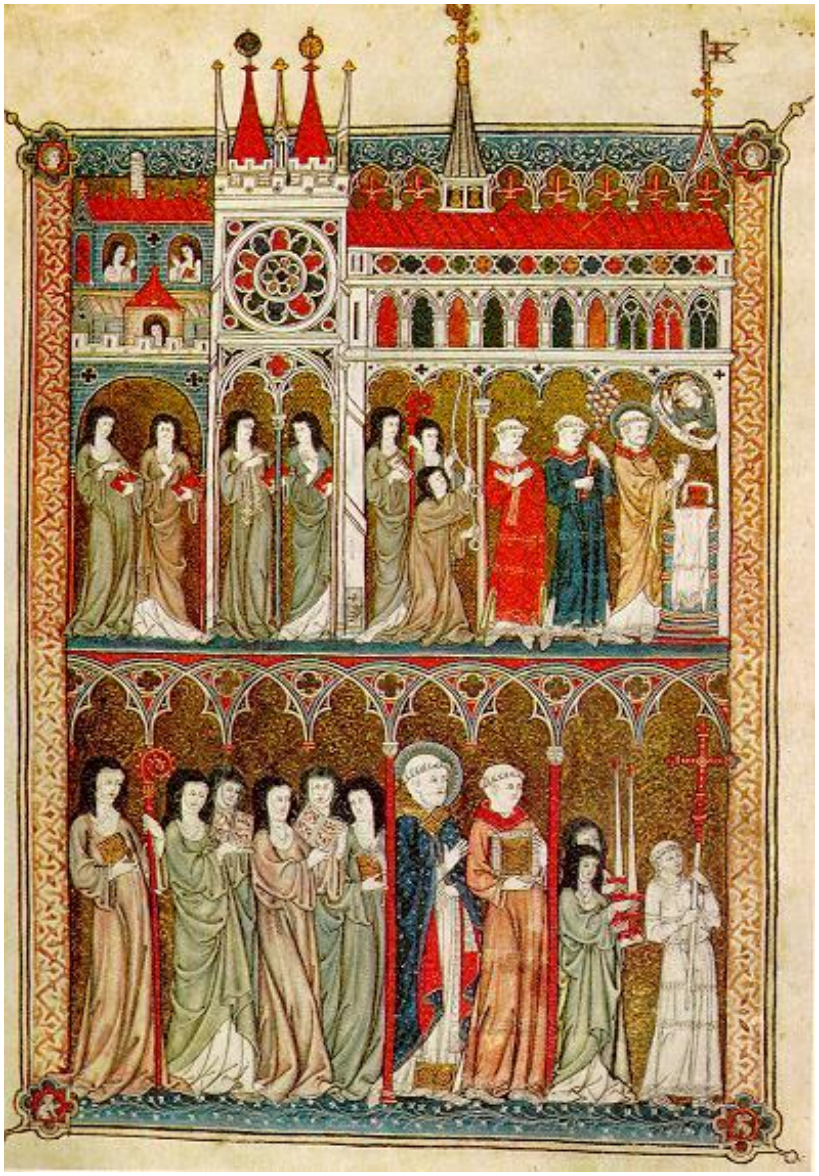
Prehistoric Painting, Lascaux Cave, France
~ 13,000 -- 15,000 B.C.

Depicting Our World: Middle Ages



The Empress Theodora with her court.
Ravenna, St. Vitale 6th c.

Depicting Our World: Middle Ages



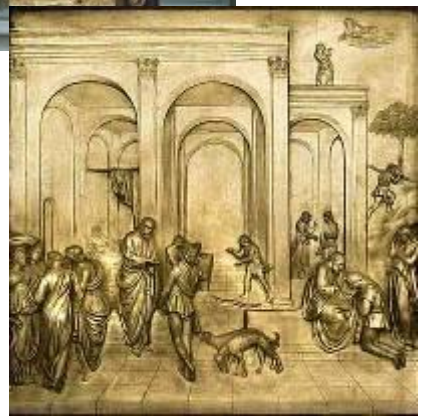
Nuns in Procession. French ms. ca. 1300.

Depicting Our World: Renaissance

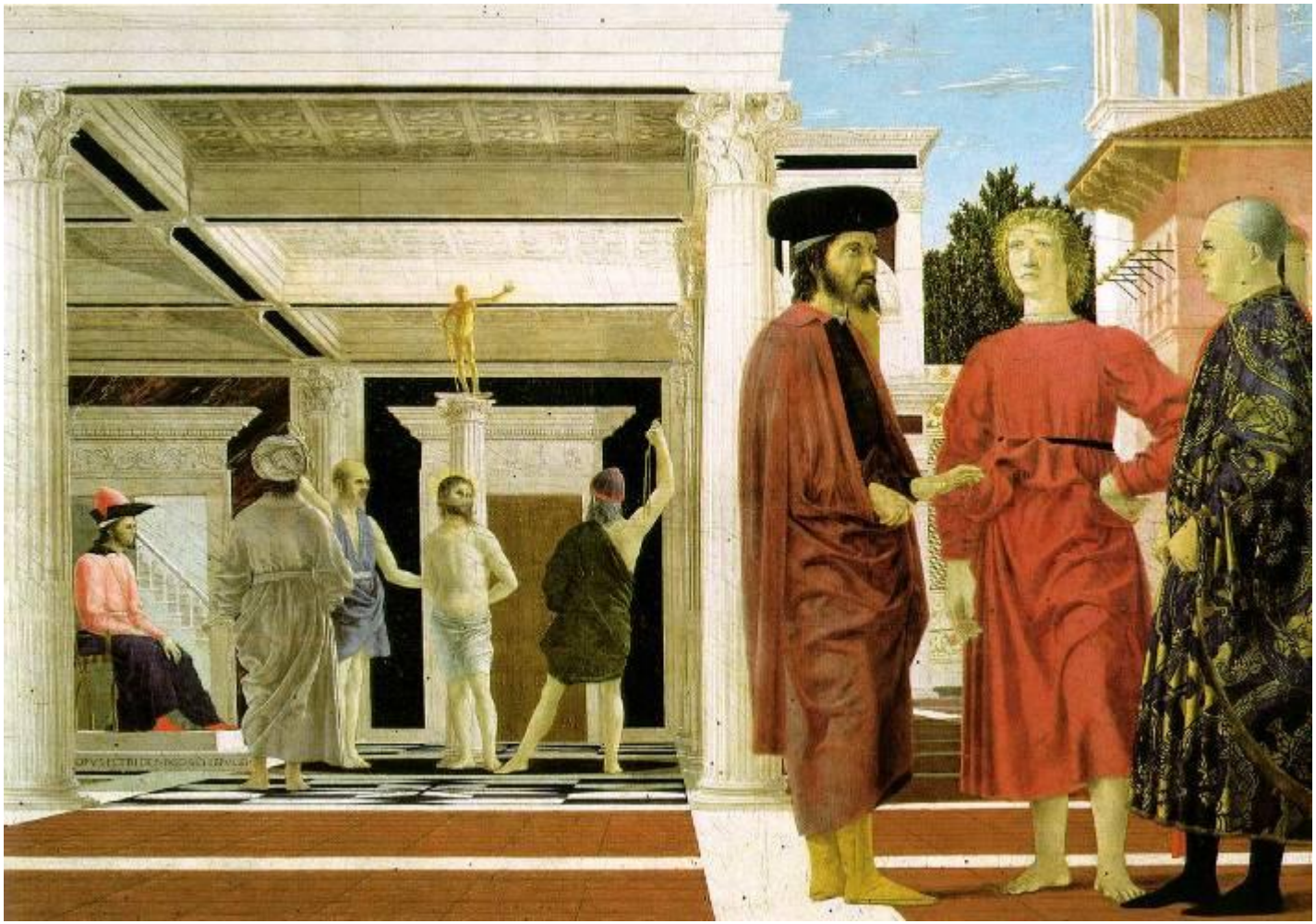
North Doors (1424)

Lorenzo Ghiberti (1378-1455)

East Doors (1452)

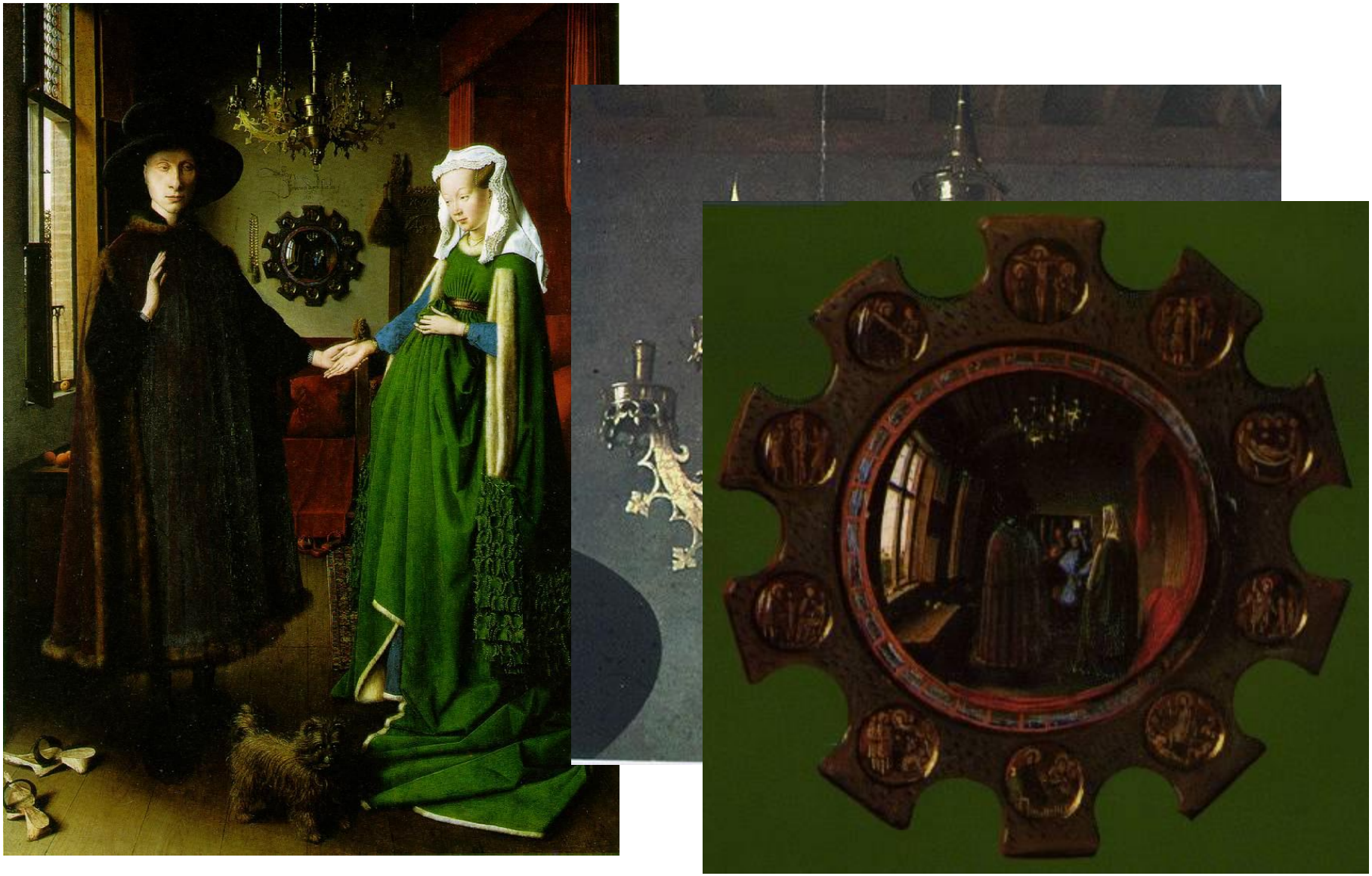


Depicting Our World: Renaissance



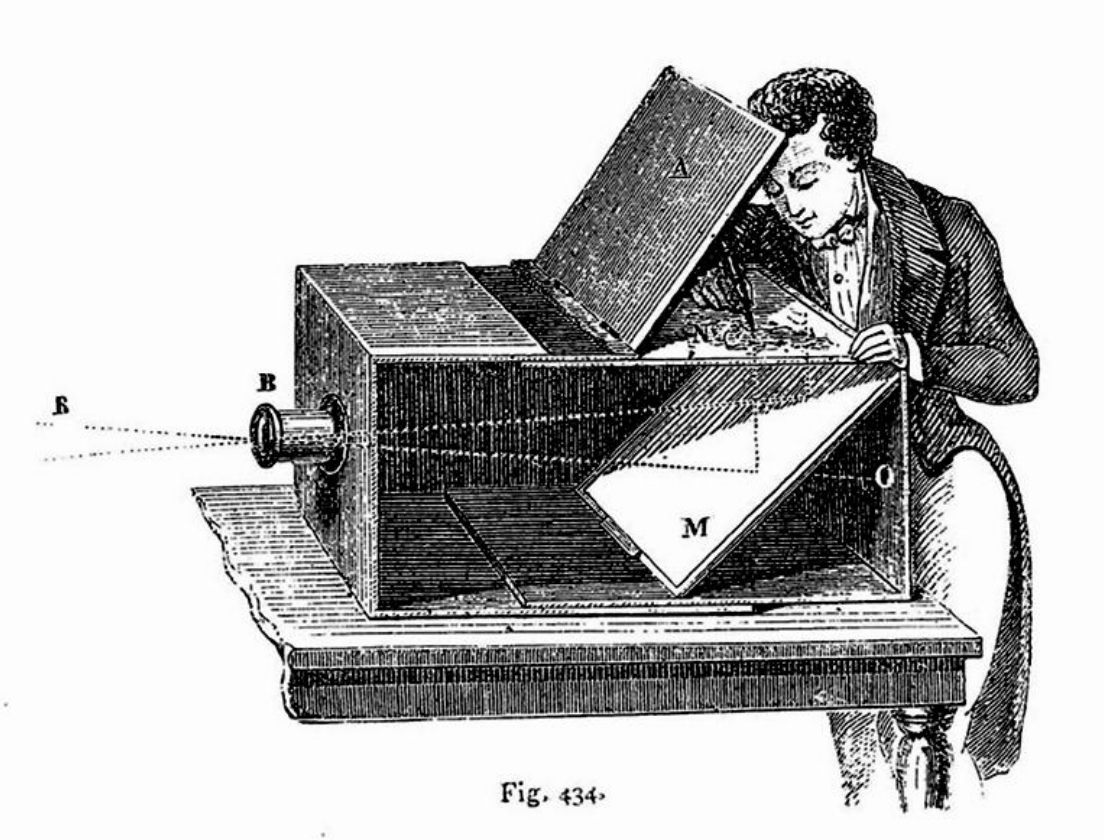
Piero della Francesca,
The Flagellation (c.1469)

Depicting Our World: Toward Perfection



Jan van Eyck, *The Arnolfini Marriage (c.1434)*

Depicting Our World: Toward Perfection

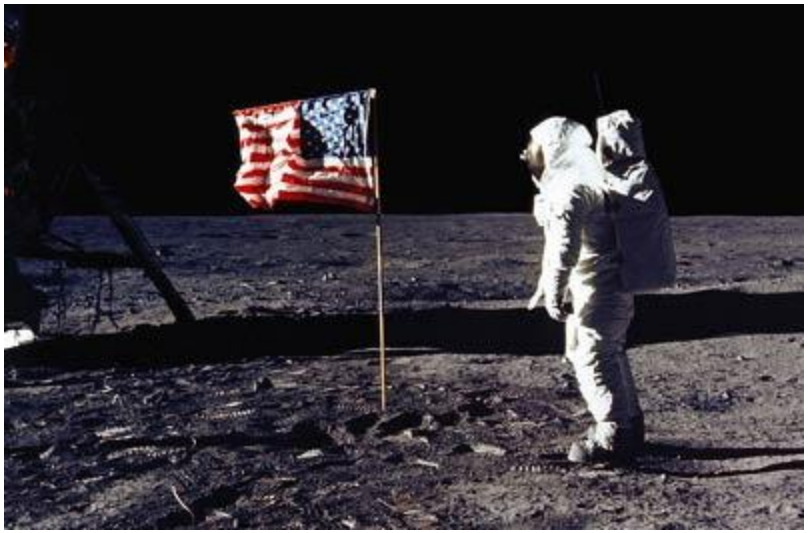


Lens Based Camera Obscura, 1568

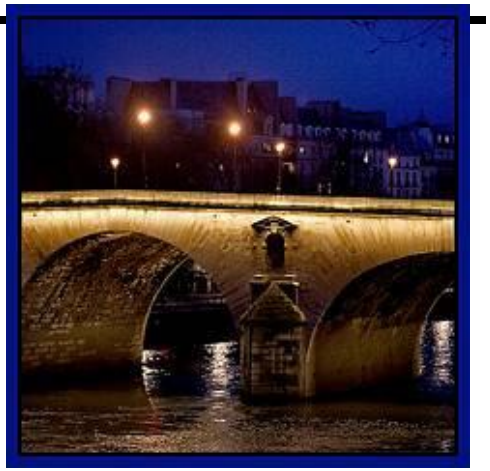
Depicting Our World: Perfection!

Still Life, Louis Jaques Mande Daguerre, 1837

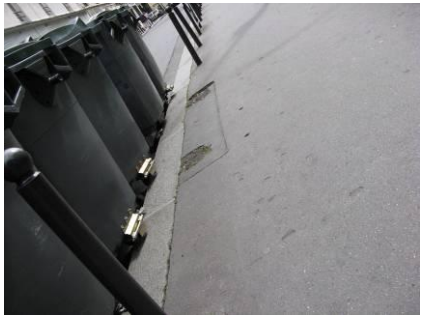
Depicting Our World: Realism?



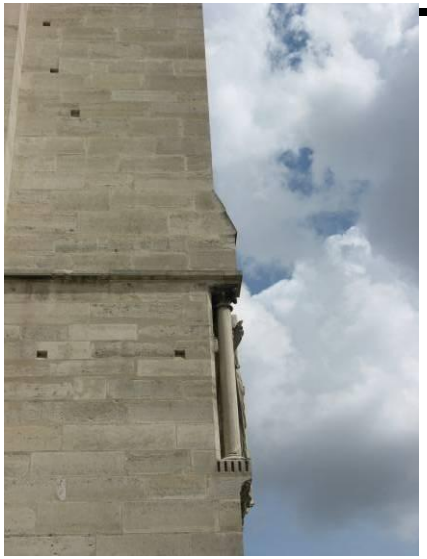
Flickr Paris



Real Paris



Real Notre Dame



Depicting Our World: Ongoing Quest

Pablo Picasso

David Hockney

Better than realism?

David Hockney, Place Furstenberg, (1985)

Which one is right?

Multiple viewpoints

David Hockney,
Place Furstenberg, 1985

Single viewpoint

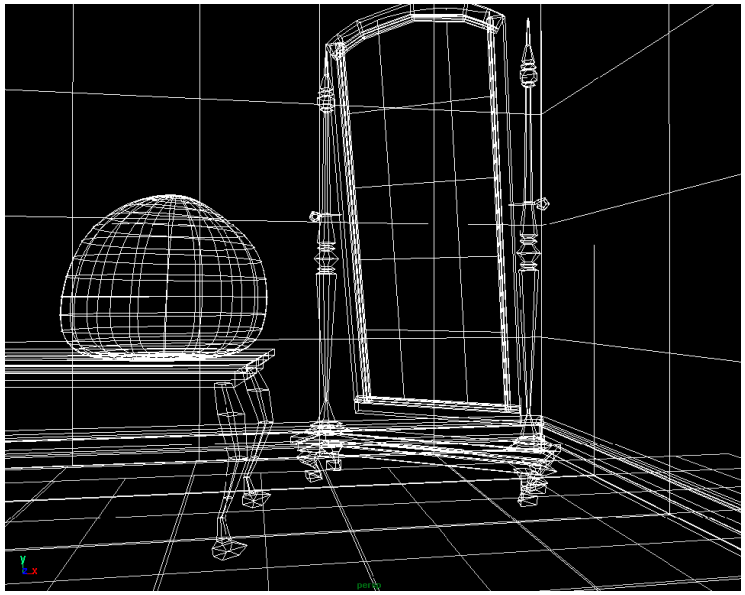
Alyosha Efros
Place Furstenberg, 2009

Depicting Our World: Ongoing Quest

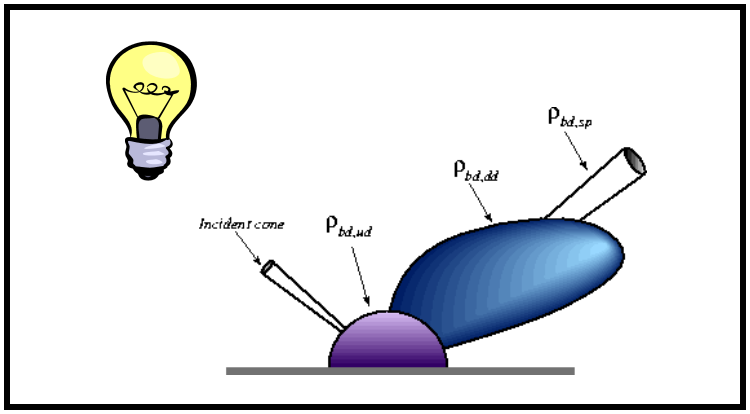
Antonio Torralba & Aude Oliva (2002)

Enter Computer Graphics...

Traditional Computer Graphics



3D geometry



physics

projection

Simulation

GRAPHICS

State of the Art

- Amazingly real
- But so sterile, lifeless, *futuristic (why?)*

The richness of our everyday world

Photo by Svetlana Lazebnik

Beauty in complexity

University Parks, Oxford

Which parts are hard to model?

Photo by Svetlana Lazebnik

People

From “Final Fantasy”

On the Tube, London

Faces / Hair

From “Final Fantasy”

Photo by Joaquin Rosales Gomez

Hyper-humans

Urban Scenes

Virtual LA (SGI)

Photo of l LA

Nature

River Cherwell, Oxford

The Realism Spectrum

Computer Graphics

+ easy to create new worlds

+ easy to manipulate objects/viewpoint

- Very hard to look realistic

Computational Photography

Realism
Manipulation
Ease of capture

Photography

+ instantly realistic

+ easy to aquire

- very hard to manipulate objects/viewpoint

Virtual Real World

Campanile Movie

http://www.debevec.org/Campanile/

Course Outline

Programming Project 0

The *Vertigo* Effect

Programming Project 1

Images of the Russian Empire -- colorizing the Prokudin-Gorskii photo collection

Programming Project 2

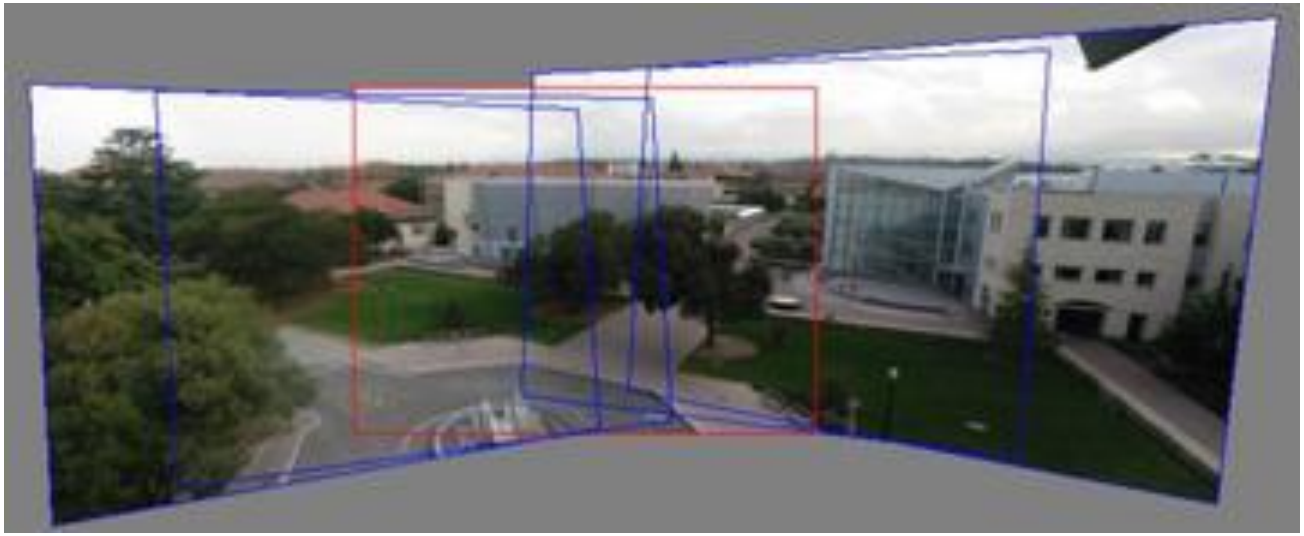
Image Resizing by Scene Carving

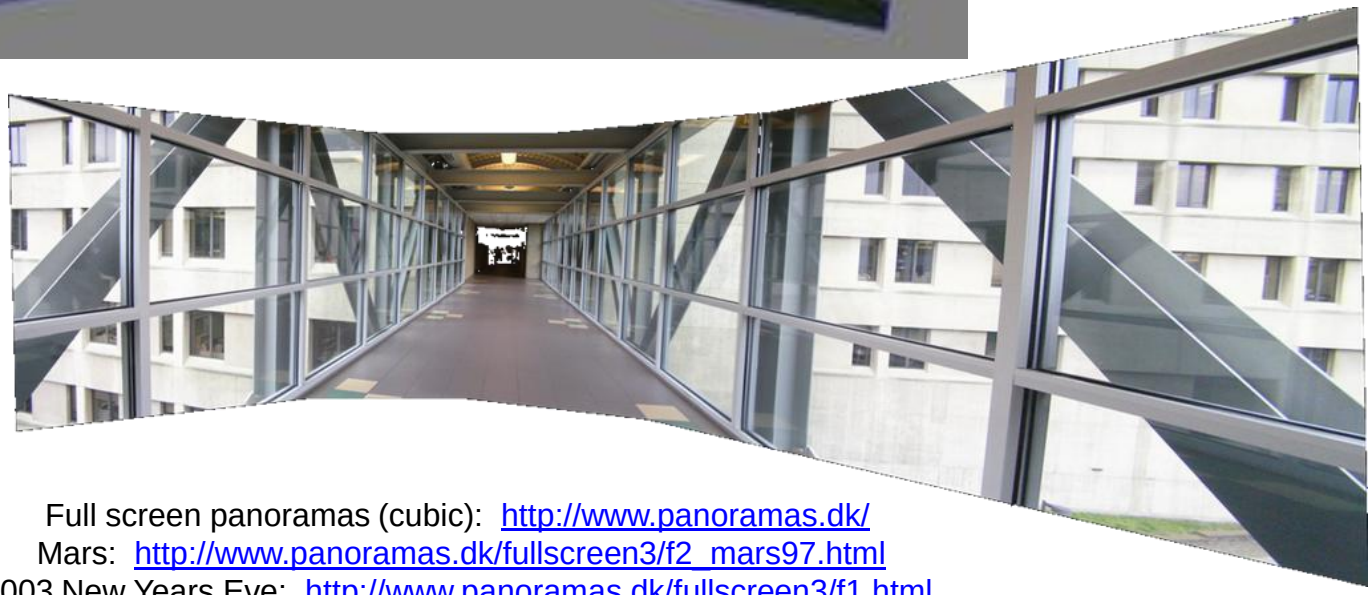
Programming Project 3

Face warping and morphing

Programming Project 4

Photo Mosaics

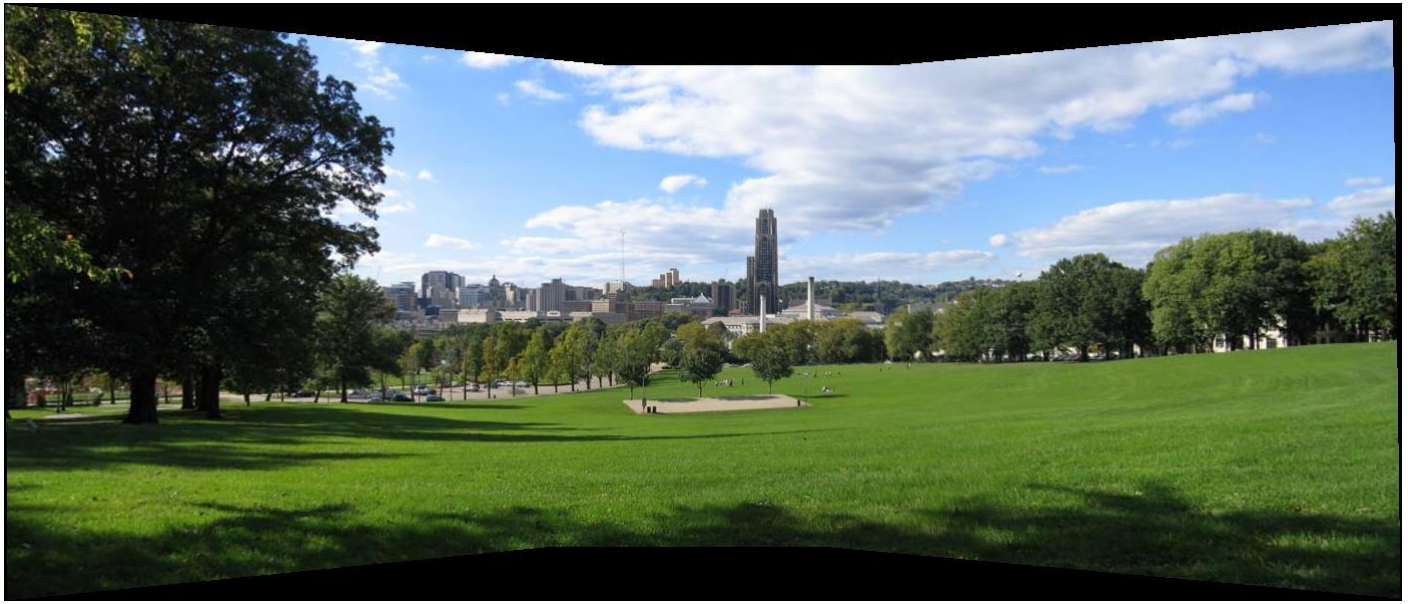




Full screen panoramas (cubic): http://www.panoramas.dk/
Mars: http://www.panoramas.dk/fullscreen3/f2_mars97.html
2003 New Years Eve: http://www.panoramas.dk/fullscreen3/f1.html

Programming Project 4

Automatic Mosaic Stitching



Programming Project 5

Tour Into the Picture

Final Project

Something cool!!!

Administrative Stuff

Grading

- Written and Programming Assngments (60%)
- Exam (20%)
- Final Project (20%)
- Class Participation: priceless

Late Policy

- Five late days total, to be spent wisely
- 20% off from each extra late day

Cheating

- Let’s not embarrass ourselves

Hardware/Software

- CMU clusters
- MATLAB!!!

General Comments

Prerequisites

- Linear algebra!!!
- Some computer graphics, vision, or image processing is useful, but not required.

Emphasis on programming projects!

- Building something from scratch (Matlab!)

Why you should not take this class?

plenty of reasons…

Cameras

Really cool

Not too expensive nowadays (<$150)

e.g. Canon A1100