

15-463 (15-862): Computational Photography



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Staff

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- TA: Ronit Slyper (rys@cs)

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

Associate 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, Machine Learning, Visual Perception

PhD Thesis on Texture and Action Synthesis

Smart Erase button in MS Digital Image Pro:



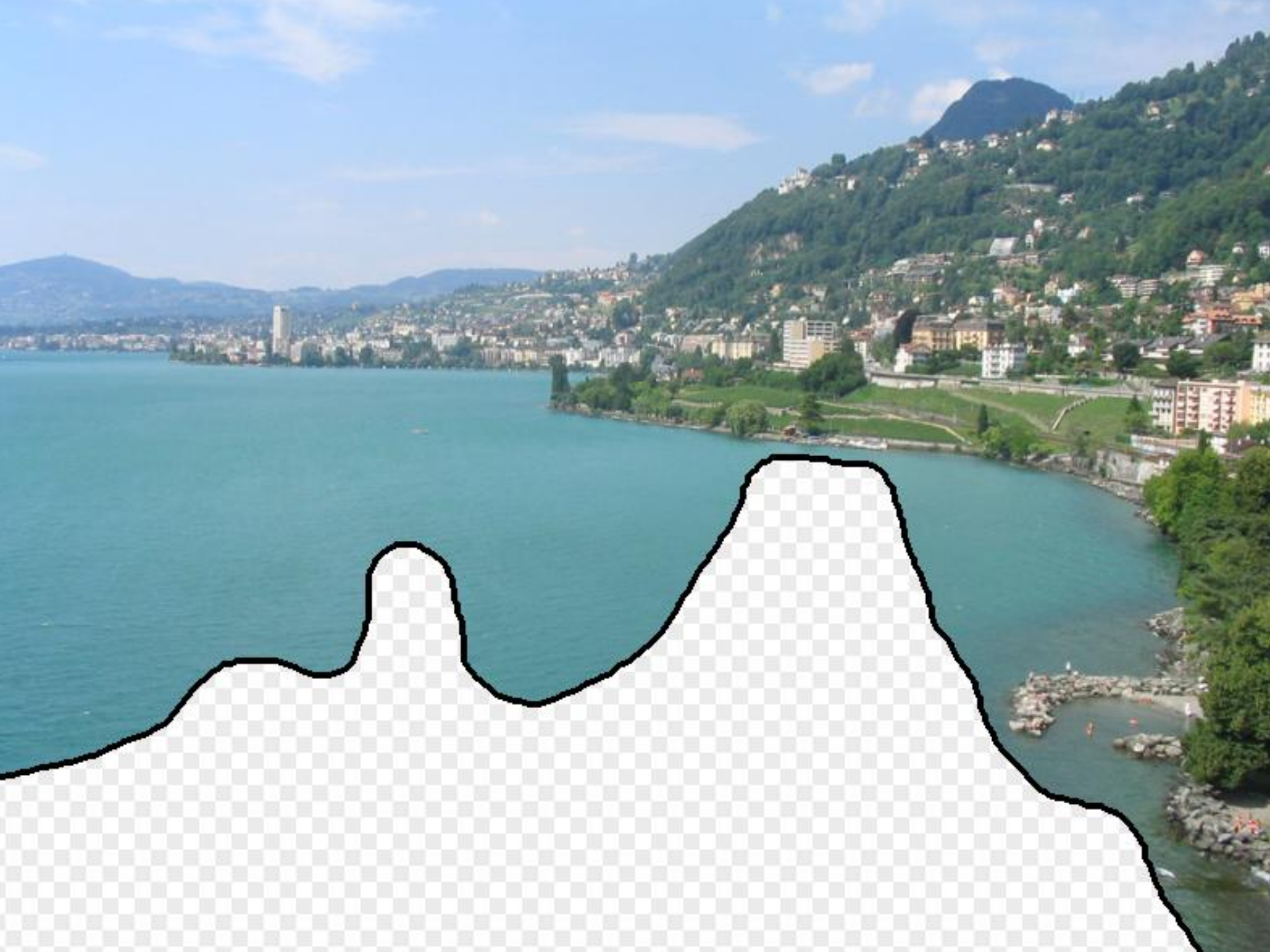
Antonio's son cannot walk but he can fly☺

More recent work

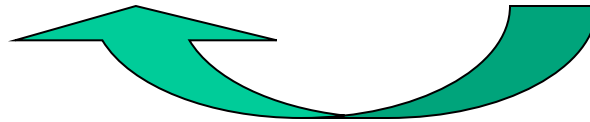
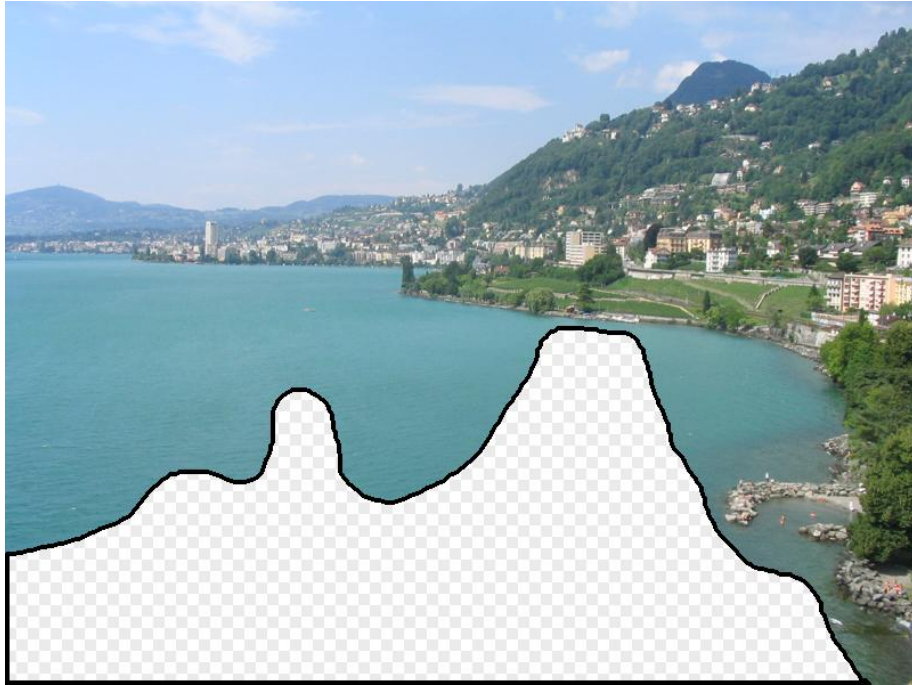


Derek Hoiem, Alexei Efros, Martial Hebert

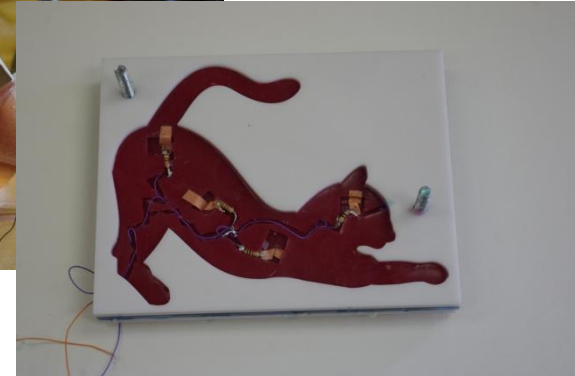
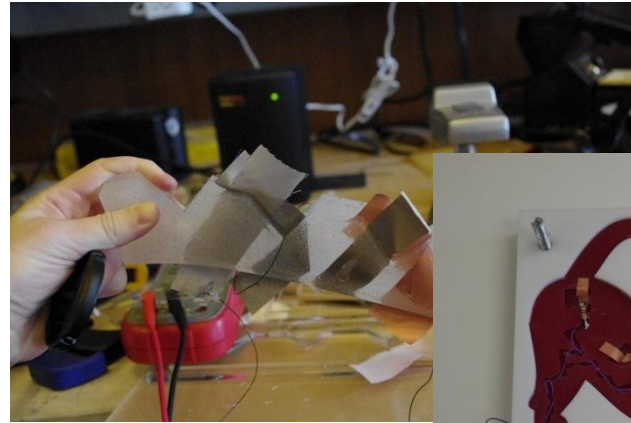












Ronit (row-neat)



What is Computational Photography?

- “computational techniques that enhance or extend photography”
- Another medium for visual expression

Depicting Our World: The Beginning



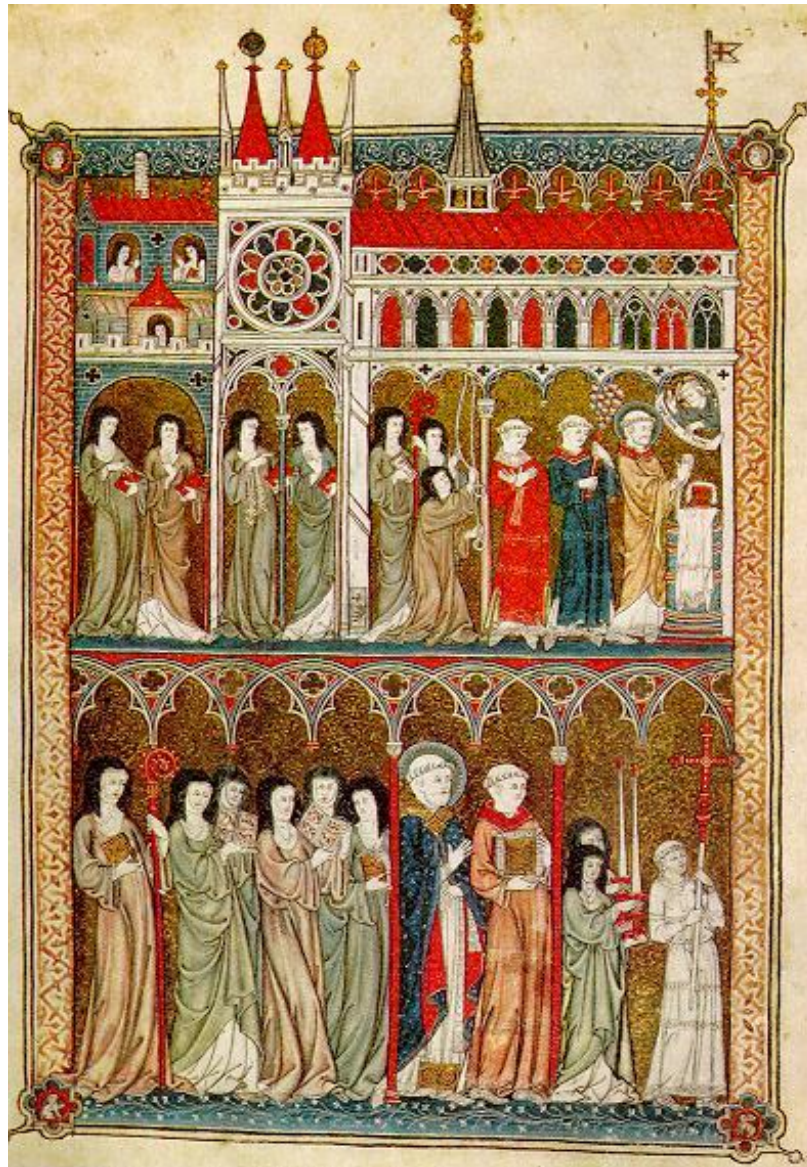
Prehistoric Painting, Lascaux Cave, France
~ 13,000 -- 15,000 B.C.

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)



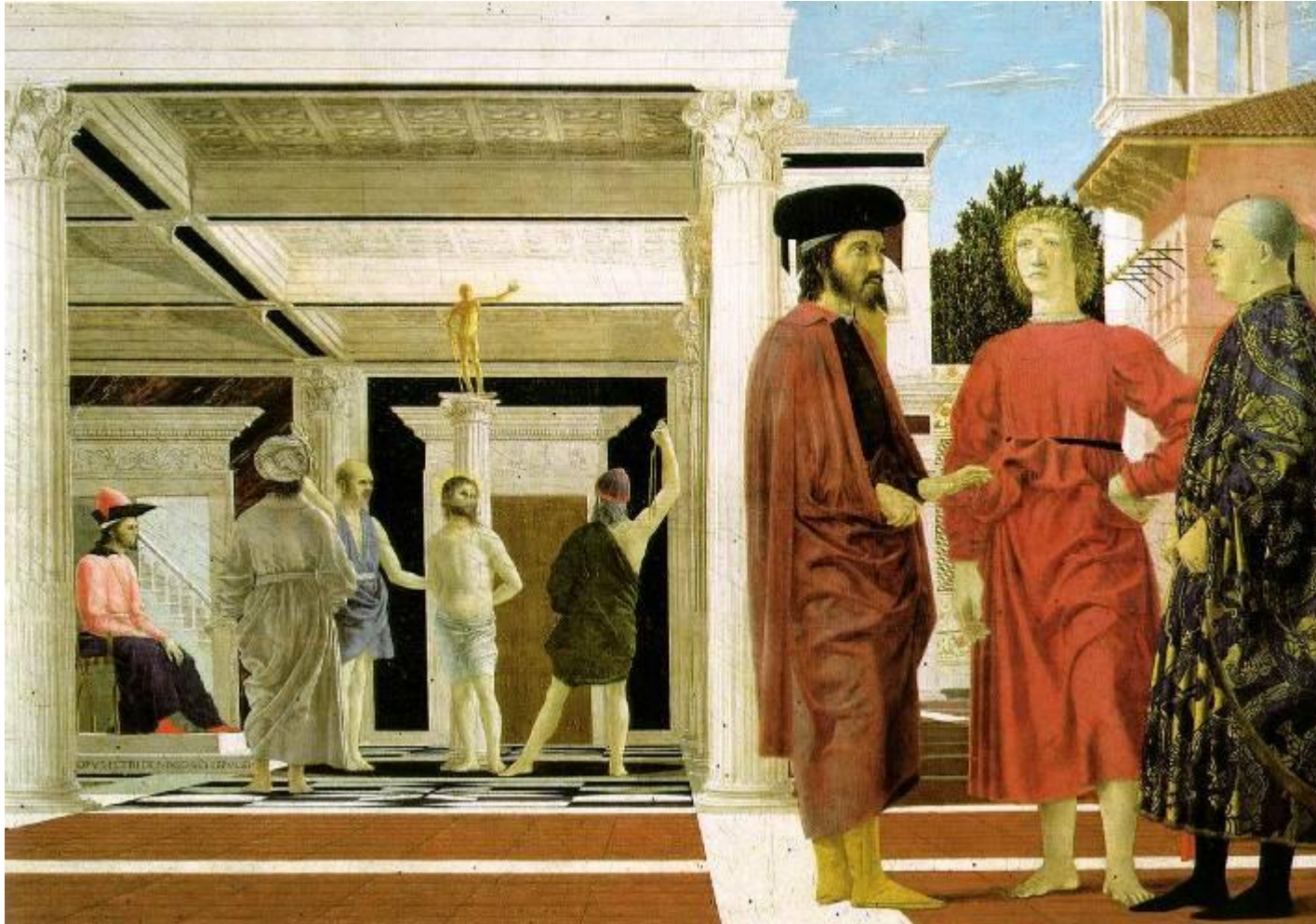
Lorenzo
Ghiberti
(1378-1455)



East Doors (1452)

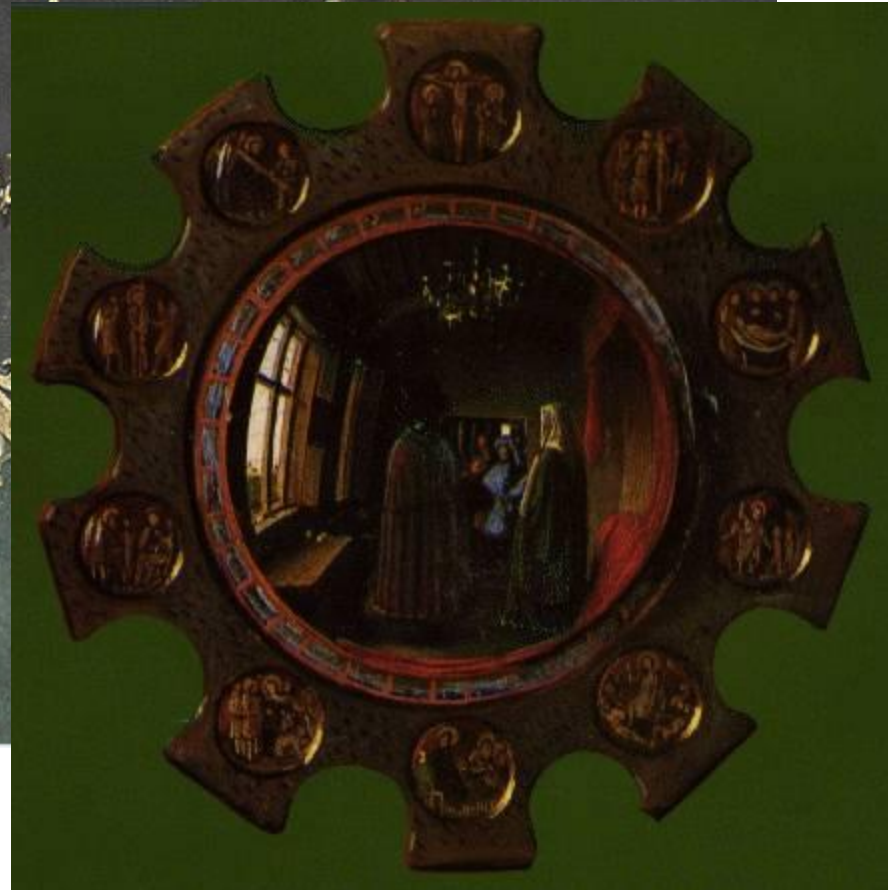


Depicting Our World: Renaissance



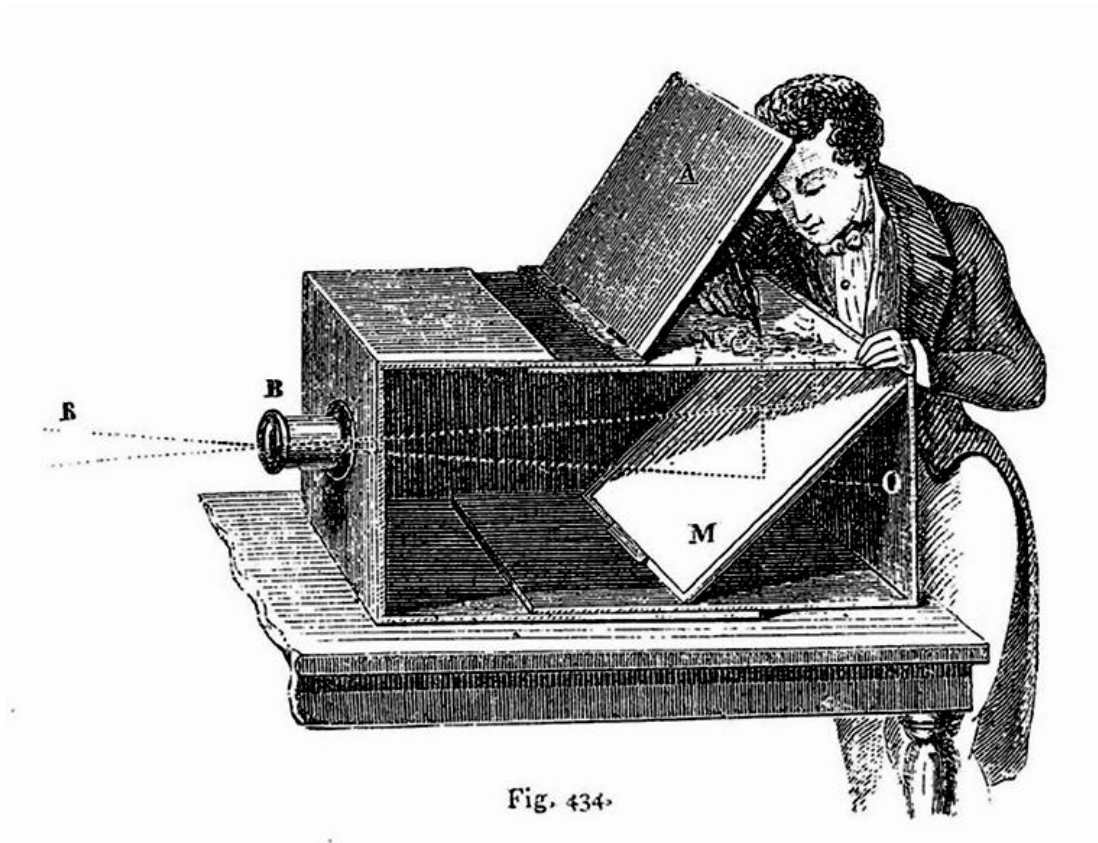
Piero della Francesca,
The Flagellation (c.1469)

Depicting Our World: Toward Perfection



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

Depicting Our World: Toward Perfection



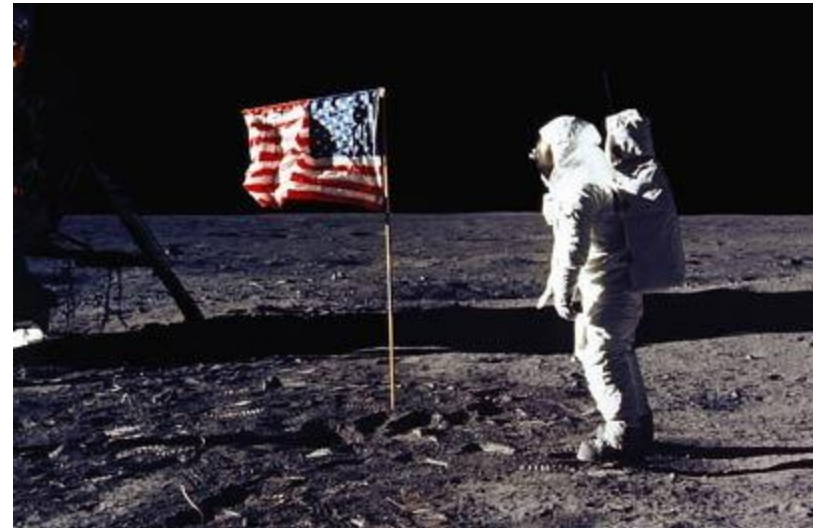
Lens Based Camera Obscura, 1568

Depicting Our World: Perfection!

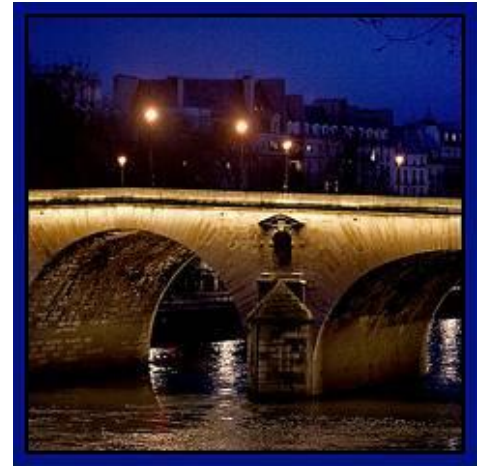


Still Life, Louis Jaques Mande Daguerre, 1837

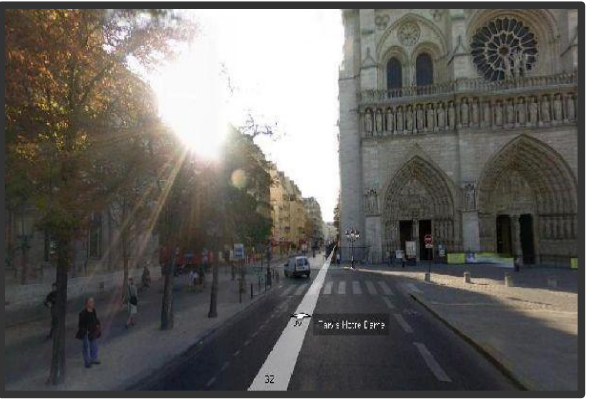
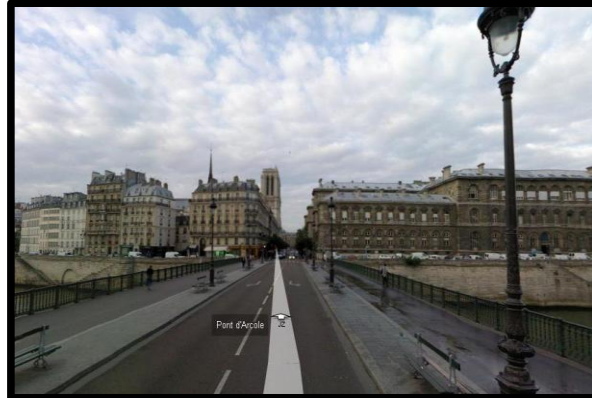
Depicting Our World: Realism?



Paris, according to Flickr



Paris, according to Google StreetView



Paris, according to me



Depicting Our World: Ongoing Quest

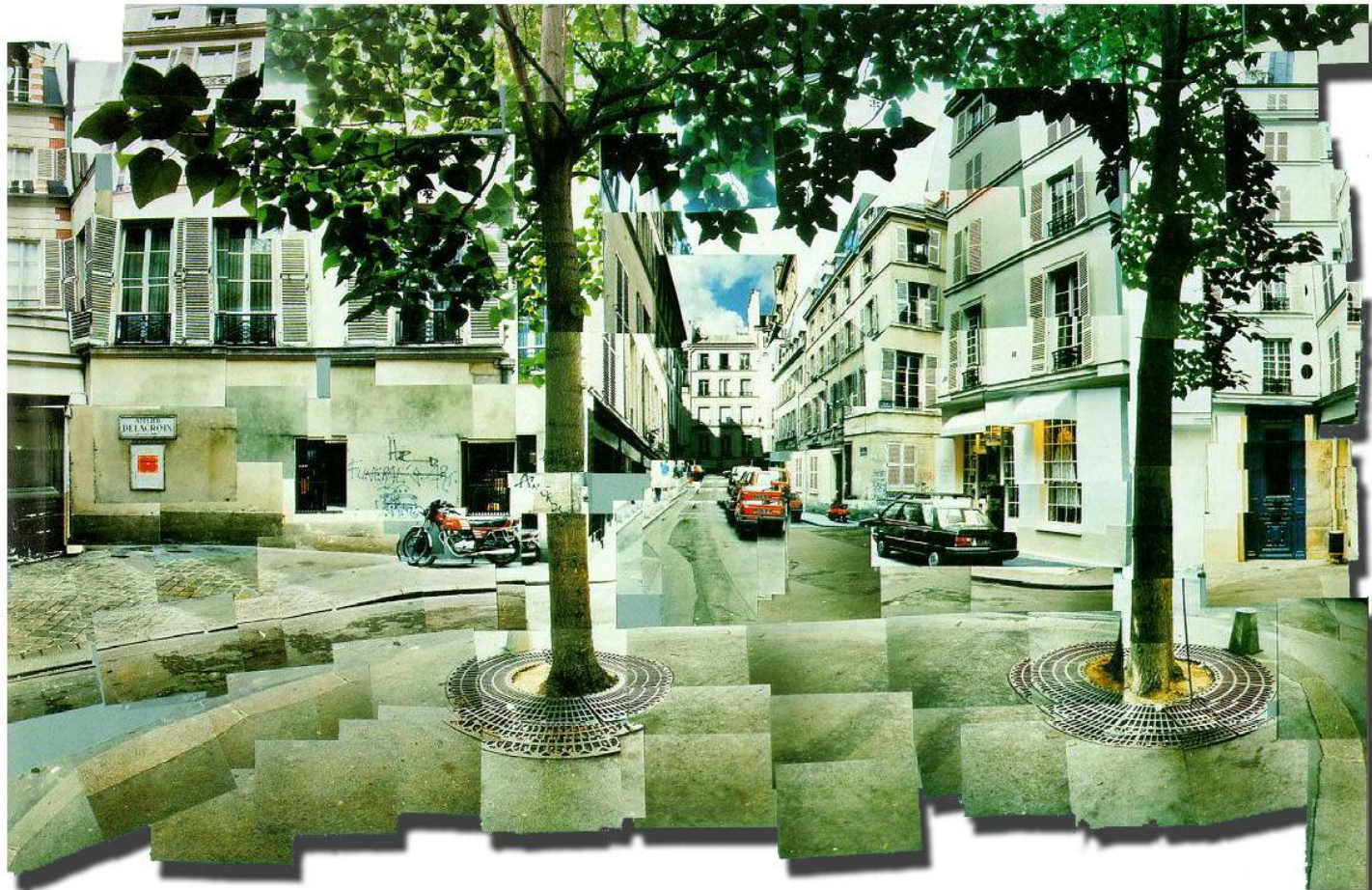


Pablo Picasso



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

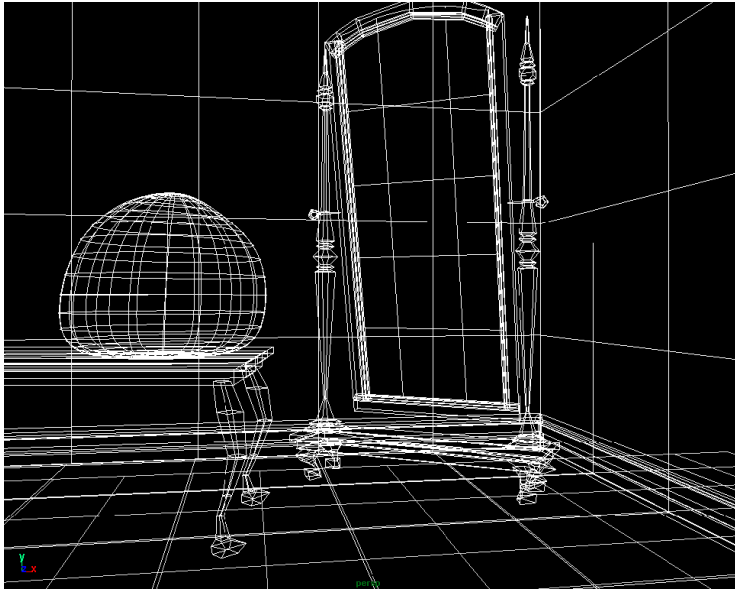


Antonio Torralba & Aude Oliva (2002)

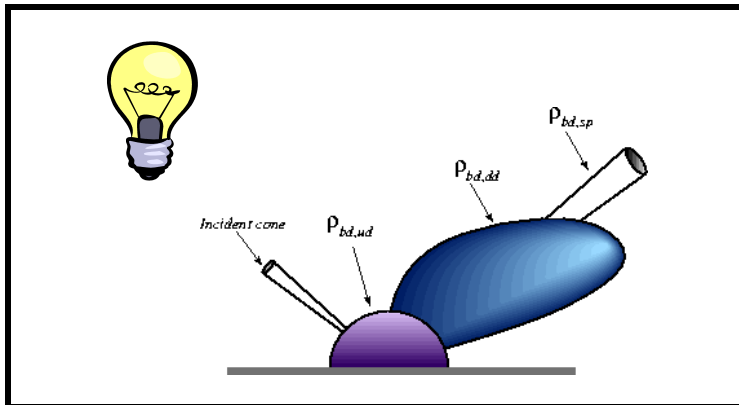


Enter Computer Graphics...

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 I 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 acquire
- 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

TBD

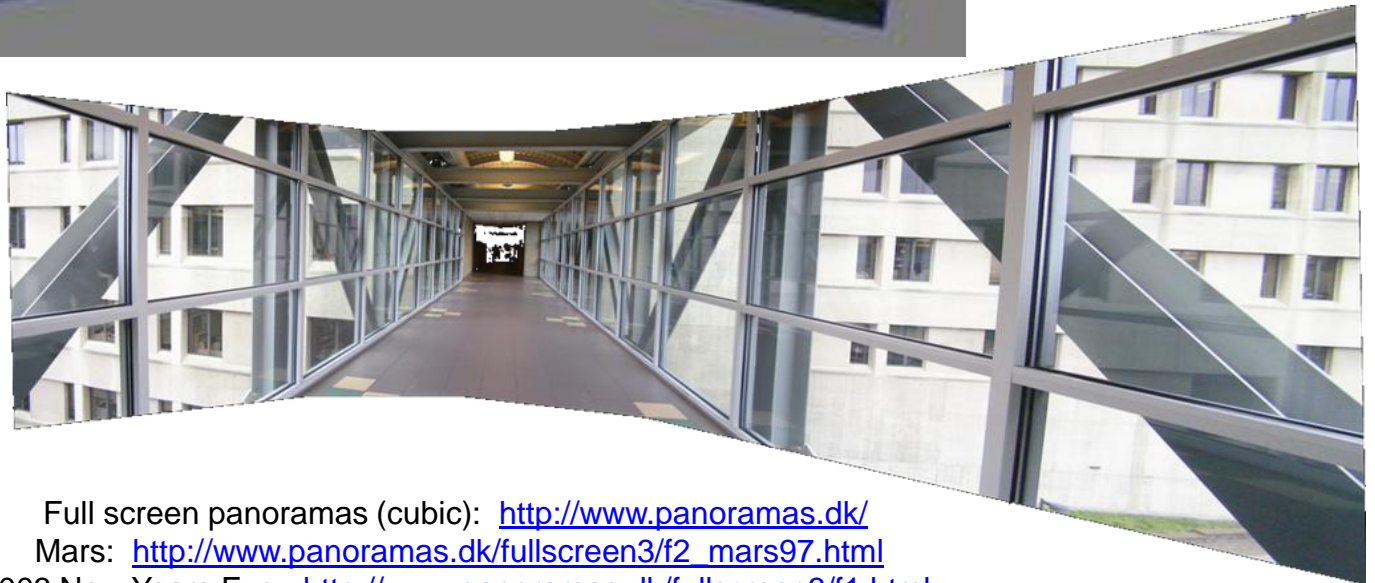
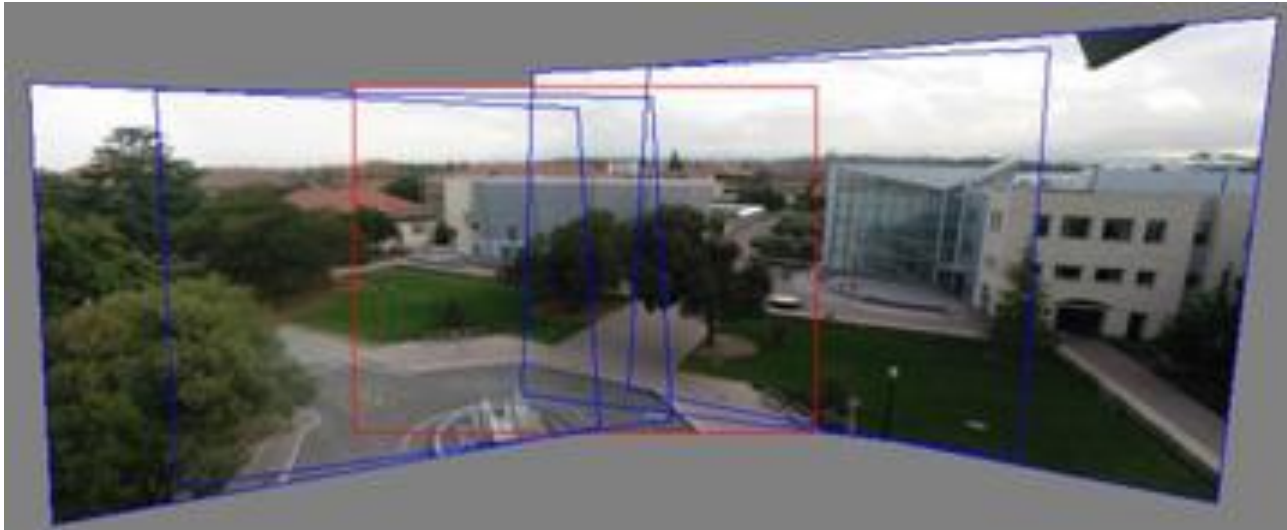
Programming Project 3

Face warping and morphing



Programming Project 4

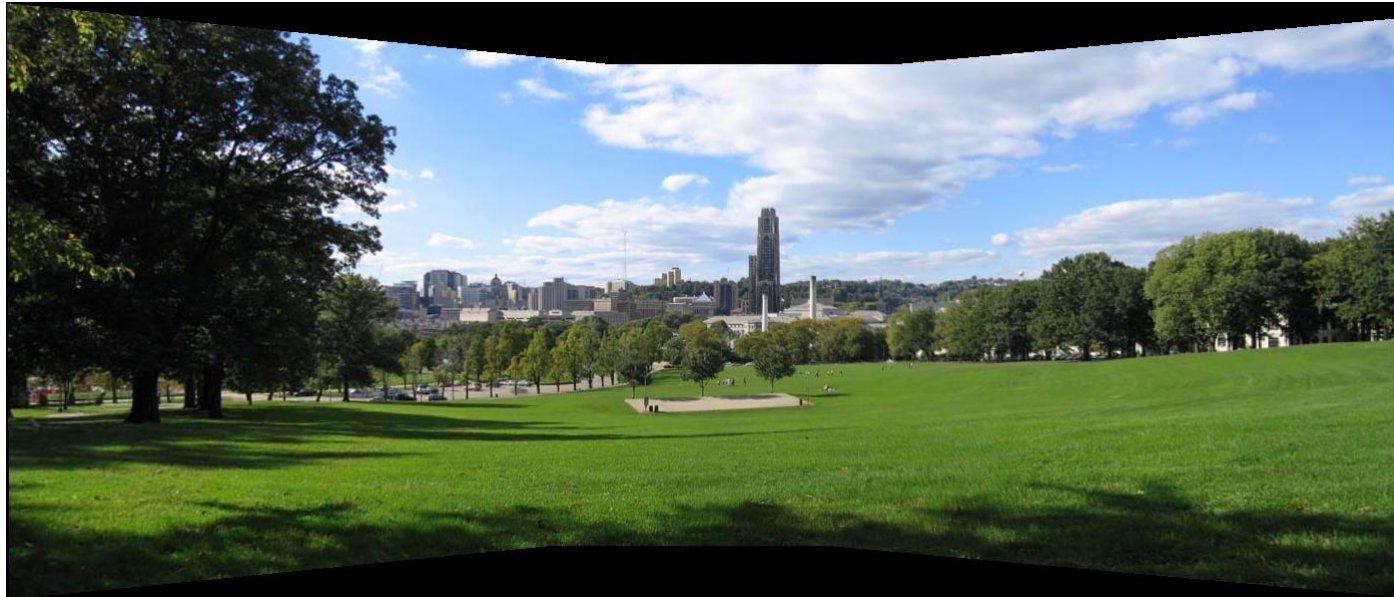
Photo Mosaics



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>

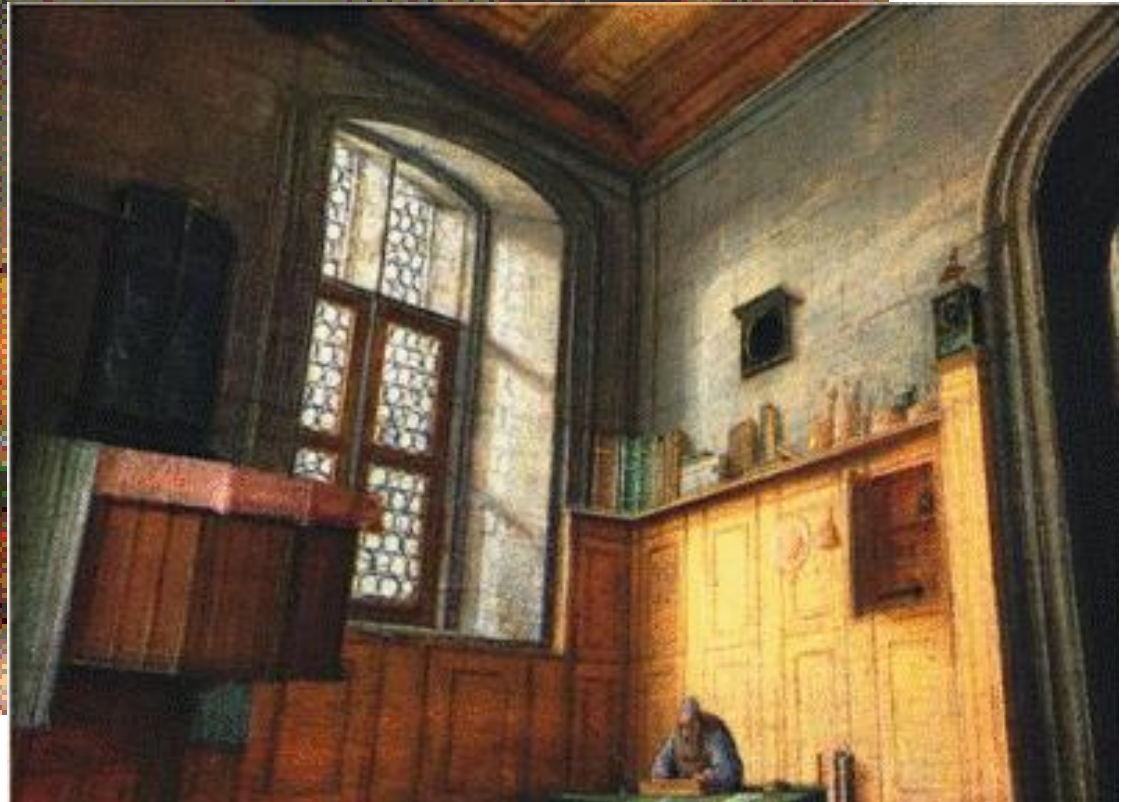
Programming Project 4

Automatic Mosaic Stitching



Programming Project 5

Tour Into the Picture



Final Project

Something cool!!!

Administrative Stuff

Grading

- Written and Programming Assignments (60%)
- Exam (20%) ← Nov 16
- 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

Graduate Version:

- Need to do more on each project, plus a final paper

Misc:

- No laptops, no cell phones, smartphones, etc.

A Fair Warning...

Reasons not to take the class:

- Lots of work
- Need time to think, not just follow instructions
- Not worth it if you don't enjoy it

Reasons to take the class:

- It's your reward after 3 grueling years 😊
- You get to create pictures, unleash your creative potential
- Interested in grad school?

Cameras

Really cool

Not too expensive nowadays (<\$150)



e.g. Canon A1100