

CS6640 Computational Photography

2. Intro to computational photography

Computational photography

- **Fundamental shift in photography is complete**
silicon sensors + digital recording
- **Today: (mostly) do what we did with film, but digitally**
store and transmit images
share photos as stacks of images
image processing that replicates darkroom techniques
- **Tomorrow: what is possible with lots of computation?**
images need not be usable straight from sensor
cameras need not be like film cameras
sharing need not be via lists of images
new, improved, different image editing tools

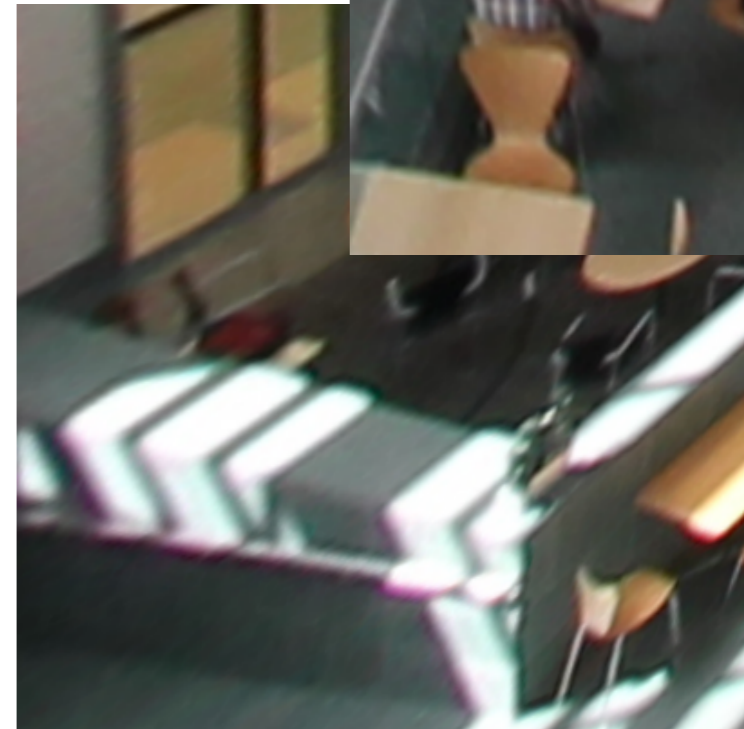
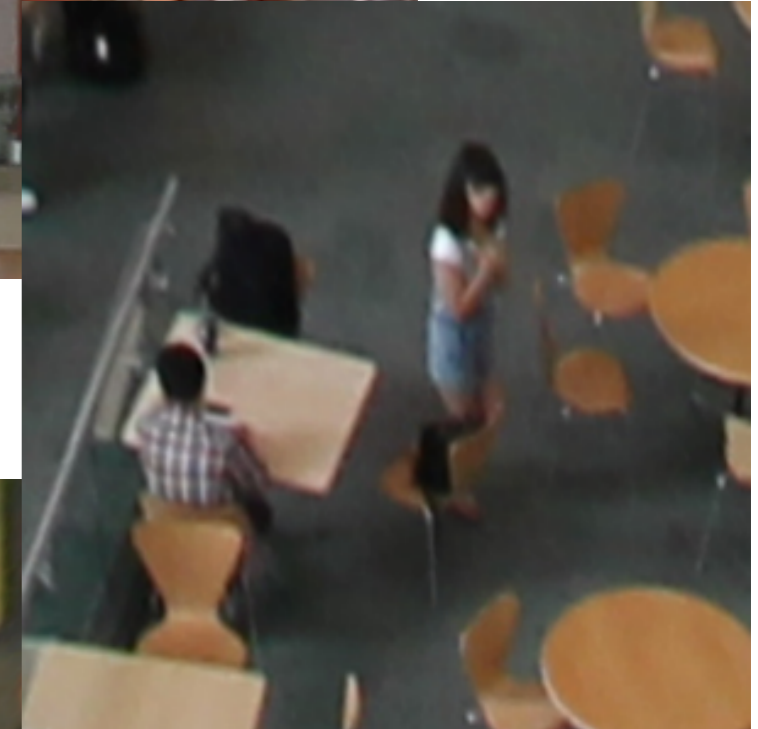
Do I need a wide angle lens?



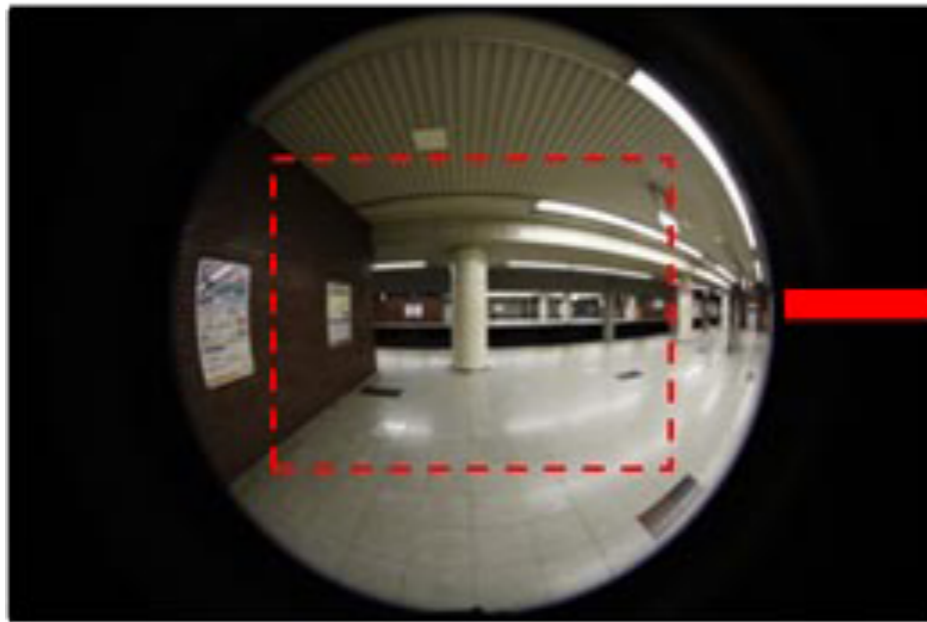




Do I need a pan-tilt mount?



Do I need a pan-tilt mount?



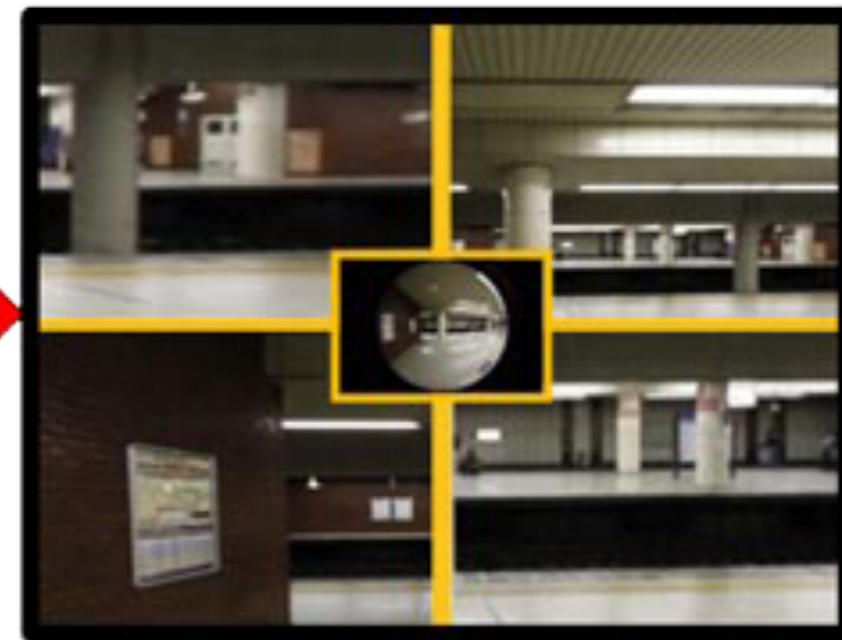
Original Image



Corrected Image(s)



Intersil, Inc. fisheye video processor



Do lenses have to get everything right?



everydayhdr.com



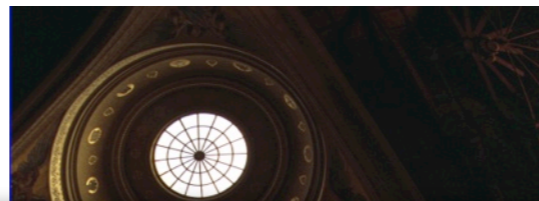
Dynamic range



Common
problem:
Sky is too
bright!

Conventional
solution:
wait for it
to get darker

High dynamic range image capture



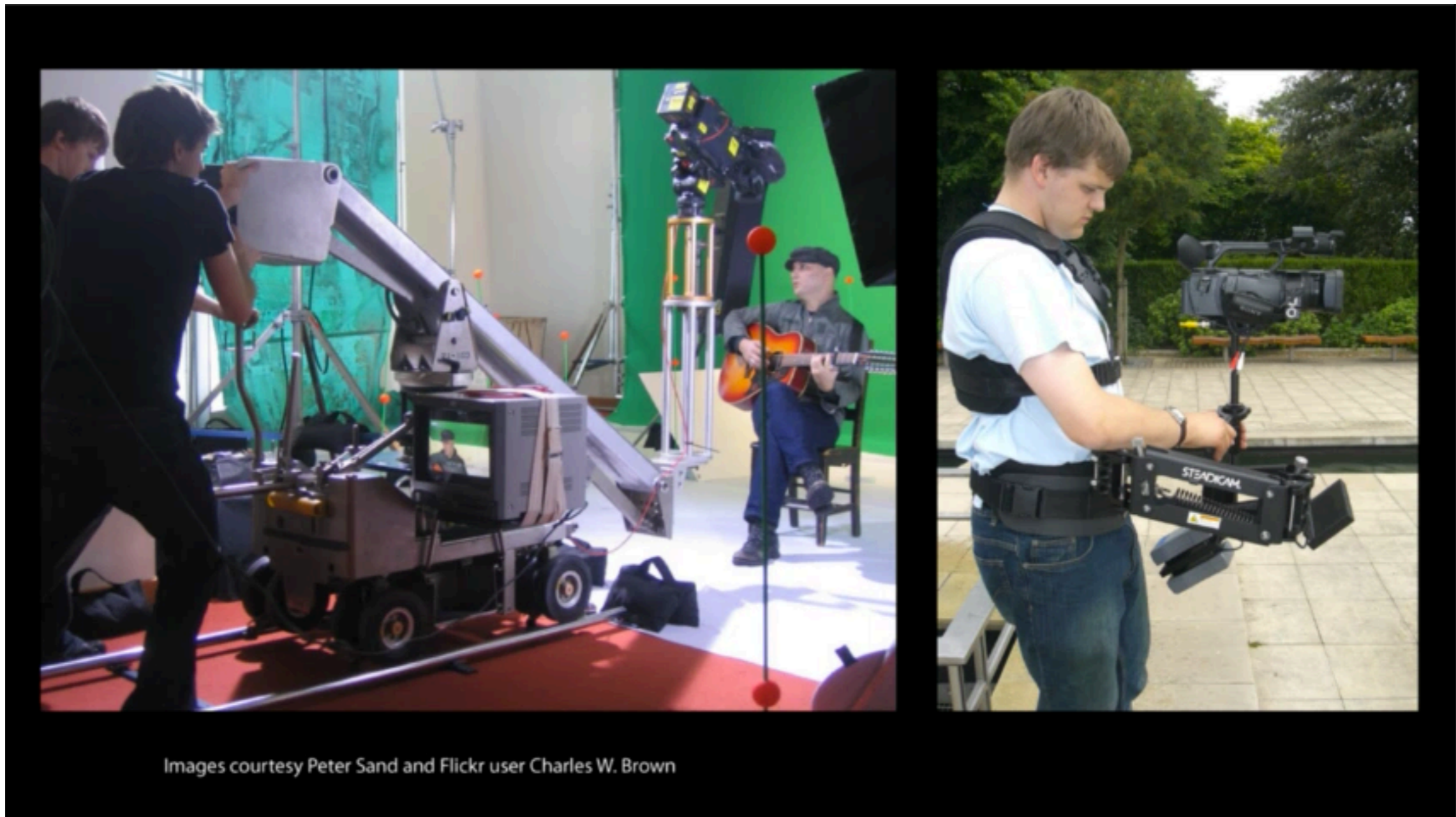
Debevec & Malik 1997

Dynamic range compression



Durand & Dorsey 2002

Do we need smooth camera motion?



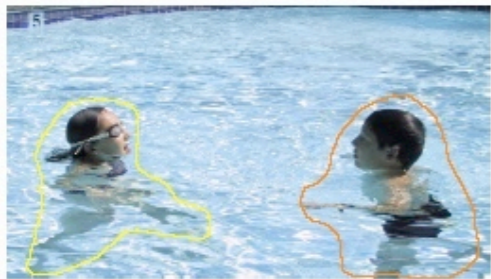
Liu et al. 2009

Camera motion stabilization



Liu et al. 2009

Image editing tools



sources/destinations

Pérez et al. 2003

Organizing photo collections

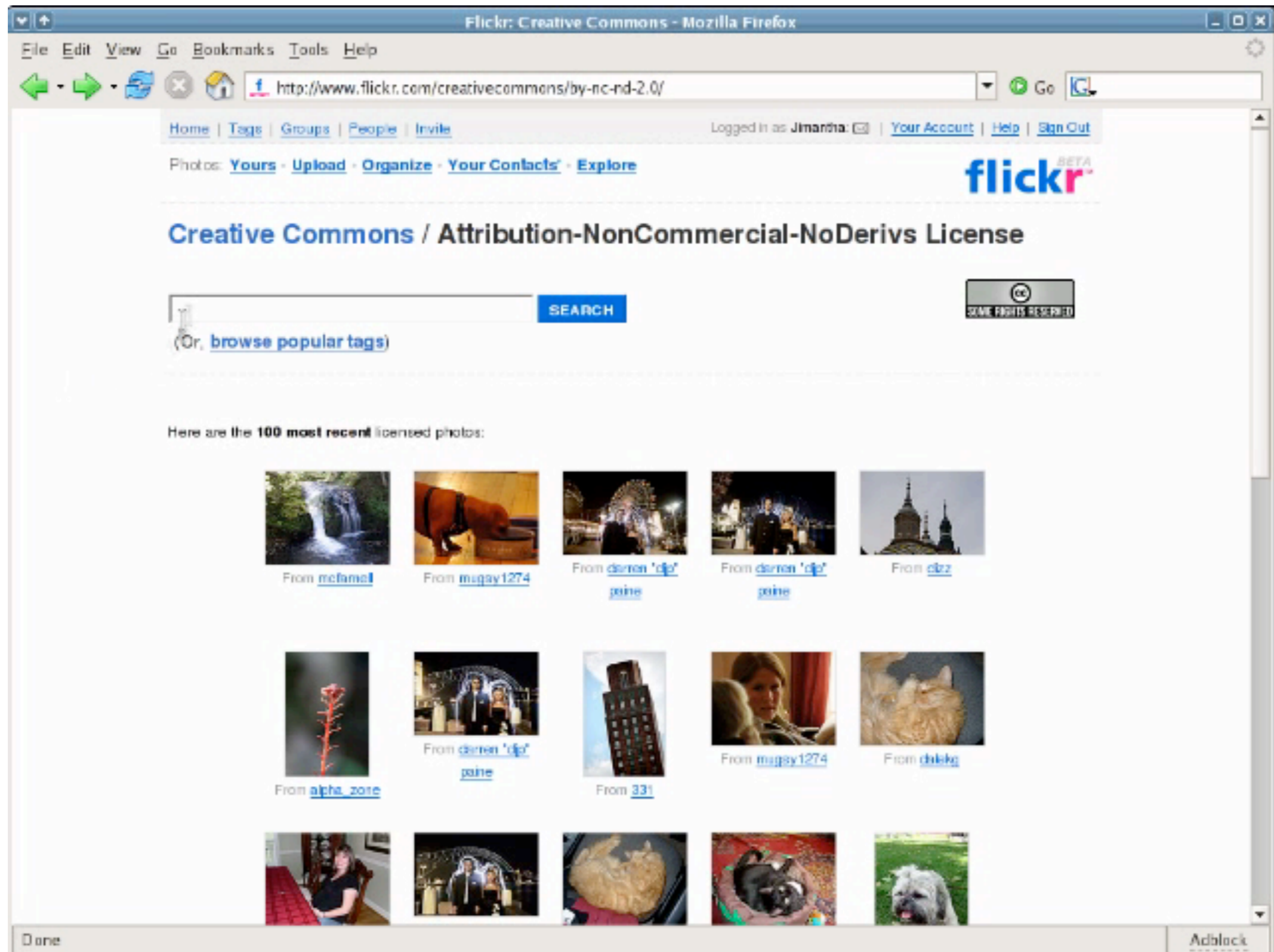


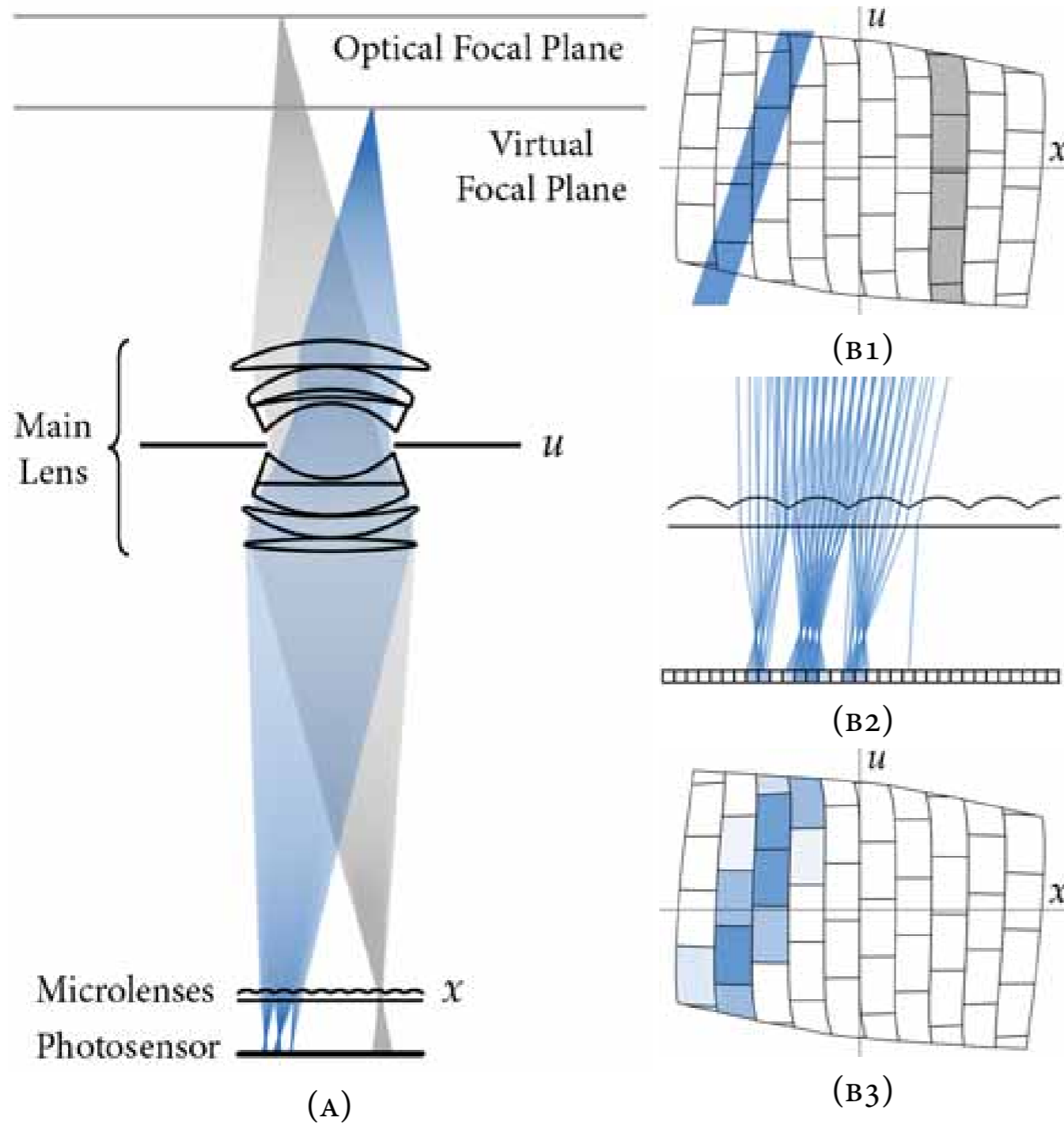
Photo Tourism—Snavely et al. 2006

Capturing more information



Stanford Multi-Camera Array

Capturing more information



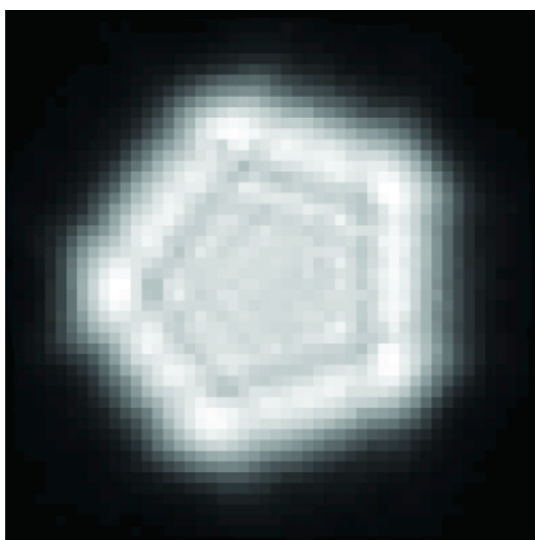
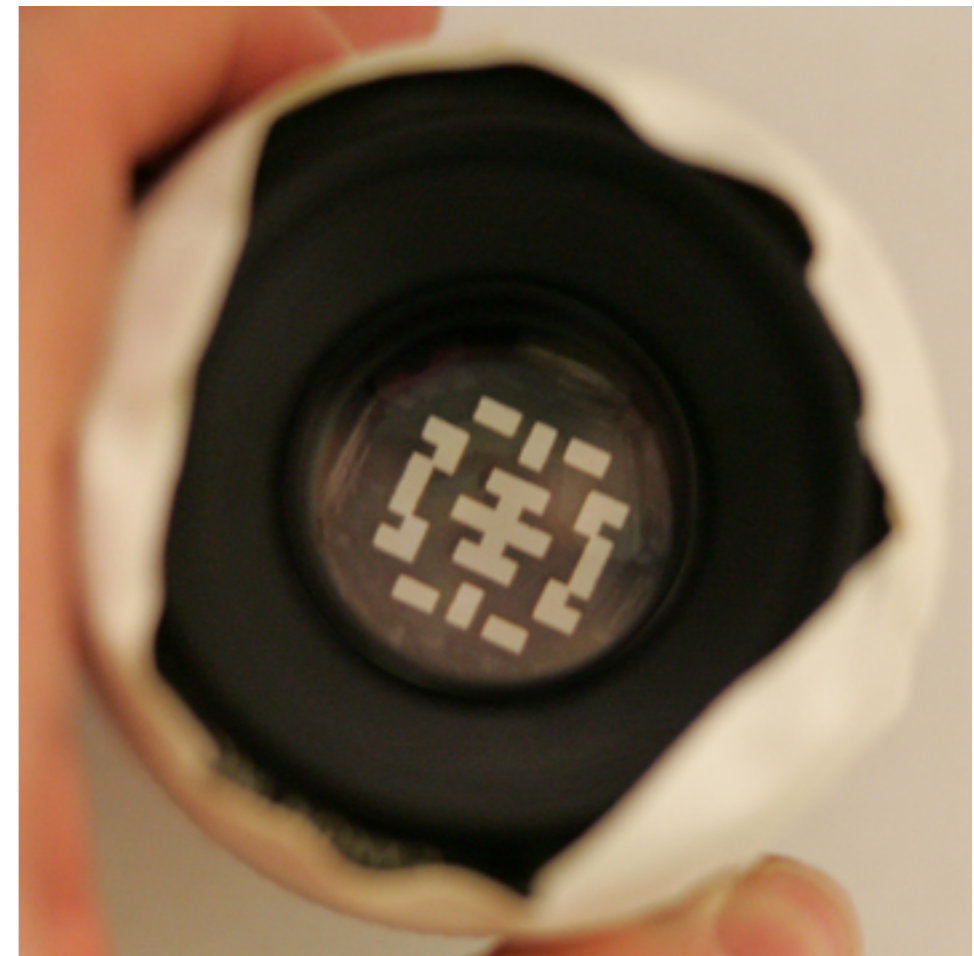
PC Magazine

Ren Ng thesis (2006)

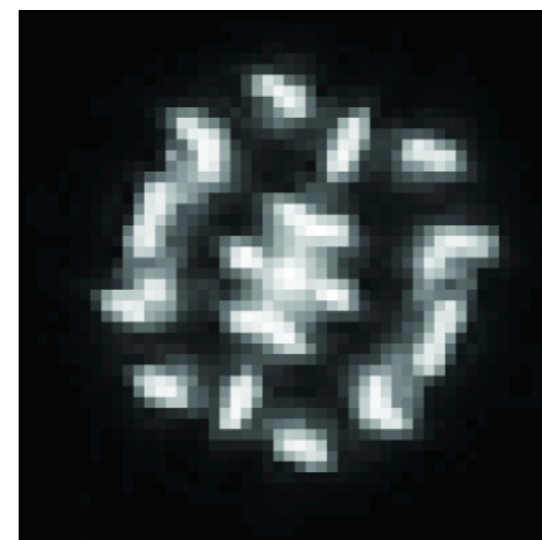
Deconvolution friendly capture



lens aperture shape



point spread function



Levin et al. 2007

This course...

...is about computational photography

starts with fundamentals of digital photography, goes from there

...will focus on image-level manipulations

arbitrary constraint to select smaller amount of material
(and to avoid colliding with vision classes)

...will have projects

with real cameras and real data
emphasis on great images

...will have homeworks

small and focused towards project topics

...will read and present research papers

to read about what is happening now

...will have a final project

tentative list:

- digital camera photofinishing pipeline
- light field image processing
- gradient-domain image editing
- video stabilization