

### Today:

- Course Critique?
- Review exposure
- Resolution
  - Spatial
  - Temporal

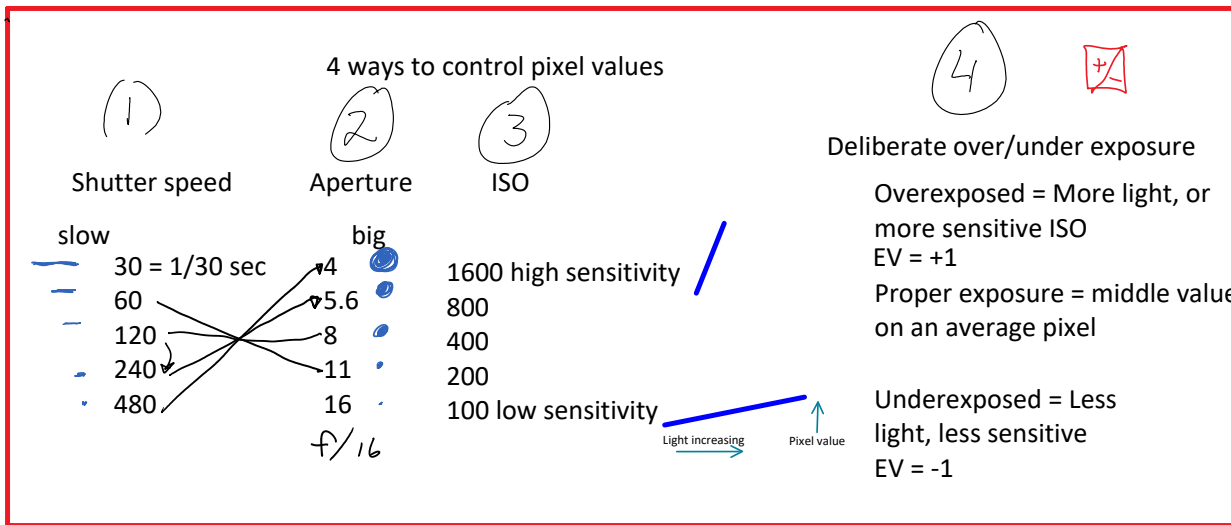
Weds will talk about Measurand, aka Dynamic range, then on to Specific Flow Vis Techniques, starting with Dyes

Google yourself now.

- Does your online presence show you as you want it to?
- Does your Flow Vis work show up on the first page?
- Do your grades?
- Which do you think will be more important to you in 3 years time?

**Course Critique:** We used the Critical Response Process, same as for student images. Lots of great suggestions. Behruz is transcribing the audio recording, and we'll put out a survey to see how popular some of the suggestions are, and get more implementation ideas. Meanwhile, a change to be implemented immediately is to reduce your 'quick feedback' load to only the images that you see during critique.

### Review of Exposure Choices



$$f\# = \frac{f}{D}$$

Quiz: You want to increase brightness in your raw image. List the side effects of each method, beyond the effect on exposure:

- 1) Shutter speed
- 2) Aperture
- 3) ISO
- 4) Deliberate overexposure

Shutter speed: motion blur at slow speeds

Aperture: low depth of field at large aperture. Diffraction will reduce sharpness at small apertures

ISO: Noise at high ISO

Deliberate under/over: Camera will change one or more of the other three settings, with attendant side effects. With underexposures, get loss of detail in shadows. Worse, at high overexposure, lose detail in highlights.

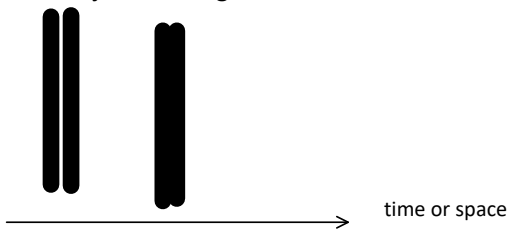
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## Resolution

Any measurement requires 3 types of resolution: spatial, temporal, measurand (dynamic range)  
Making an image is equivalent to making a measurement of light (measurand)

### Resolution: Spatial

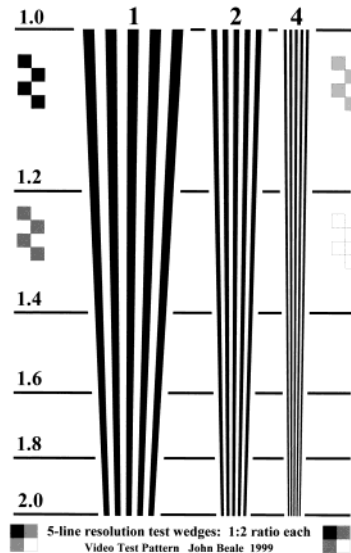
Can two adjacent things be resolved?



Resolution = minimum distance between two objects for them to be recognized as separate. Applies to objects (spatial resolution) and events (temporal or time resolution) and any quantity being measured (measurand)

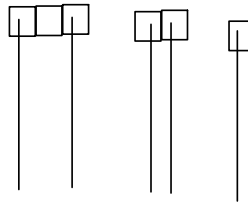
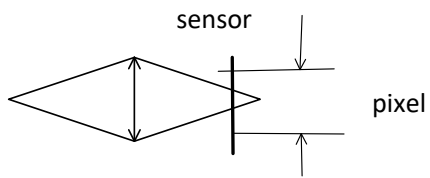
**Spatial resolution** can be DEGRADED by

- Low contrast
- Compression artifact (in jpegs)
- ISO noise
- Bad focus
- Rastering, pixelation
- Diffraction effects
- Motion blur, interacts with time resolution

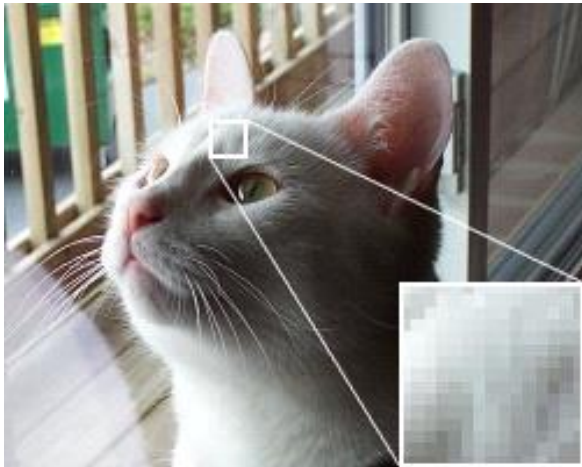


"Large resolution" = meaningless  
"Fine resolution" or "Highly resolved"  
= well - resolved.

- **Bad focus: is circle of confusion > pixel?**



- **Rastering, pixelation**



<https://en.wikipedia.org/wiki/Pixelation>



$$\begin{aligned} 10^8 &= 2^x \\ 8 \ln 10 &= x \ln 2 \\ x &= 8 \frac{\ln 10}{\ln 2} \\ &= 26.6 \end{aligned}$$