Gamma

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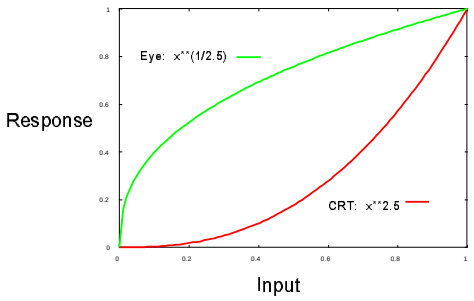
How do things respond to energy?

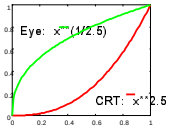
- Sensors:
  - Typically linear response
  - Special designs are nonlinear
- Eyes:
  - Typically nonlinear
  - Small increases in energy noticeable in low light, but not noticeable in bright light
  - People can detect about 1% change in energy
- Displays:
  - CRTs are nonlinear (surprisingly convex)
  - Newer technologies vary

Eye & CRT Response



Role of Gamma Correction

- Traditionally, gamma correction has been applied to compensate for non-linearity of CRT response
- Correction is applied (green) before signal is sent to CRT
- CRT non-linearity (red) cancels out green for linear response

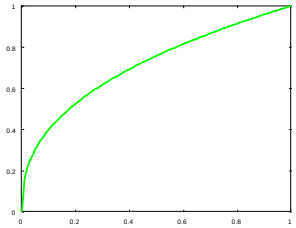


Sanity Check

- Q: Why do we want overall linear response?
- A: For authentic reproduction, we want reproduced outputs to be proportional to luminance in the original scene

Gamma and Bit Depth

- Gamma correction leads to a parsimonious use of bits
- More bits allocated to noticeable changes



- First 50% of bits cover ~75% of range
- Increasing amount of energy needed to consume bits

Practical Consequences

- We would need about 14 bits with linear encoding to capture full dynamic range of our eyes
- Non-linear encoding would require 9-10 bits
- 8-bit non-linear encoding is “pretty good”
  - Used for HDTV
  - DVDs
  - Most jpegs, etc.