

CS444/544: Midterm Review

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D3: DATA-DRIVEN DOCUMENTS

The essential idea

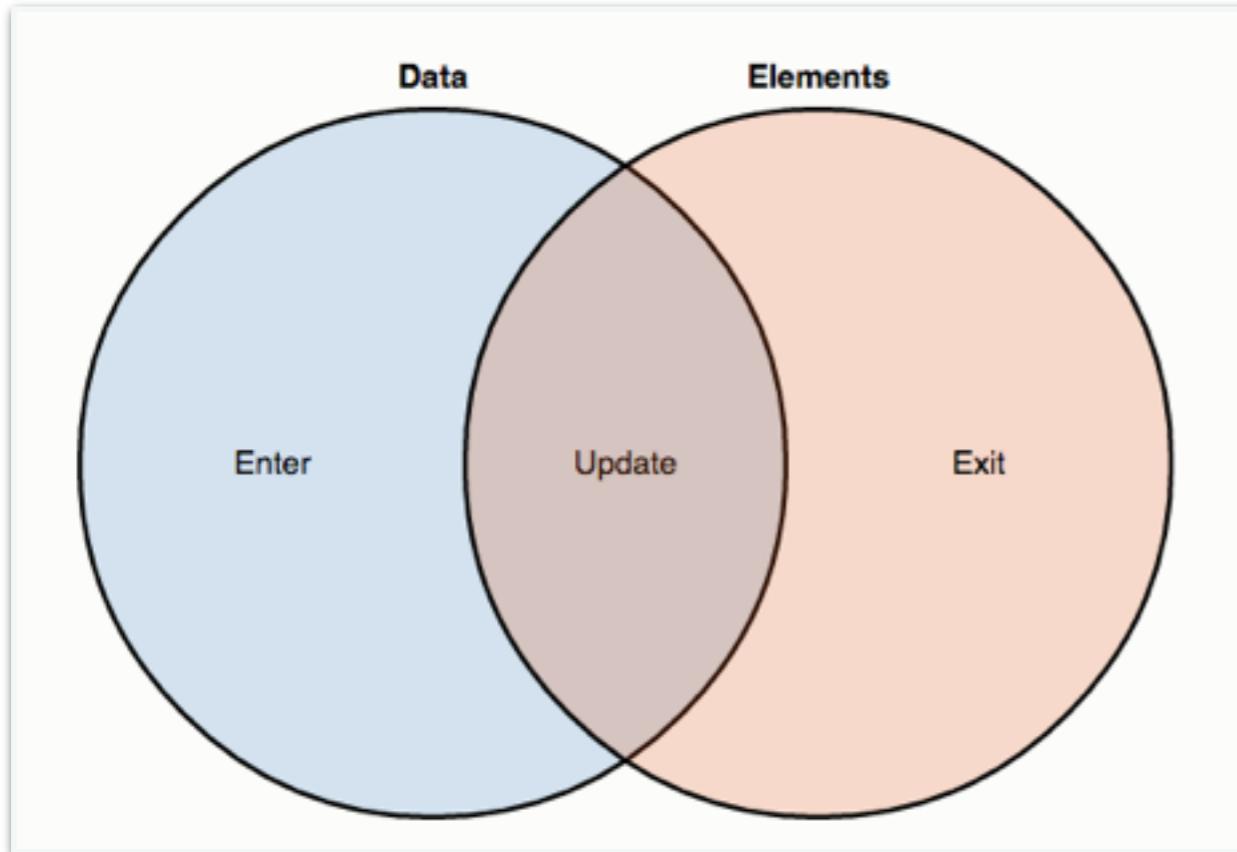
- D3 creates a two-way association between **elements of your dataset and entries in the DOM**
- D3 operates on **selections**
 - methods apply to all elements in the selection

Data Joins

- d3 associates data to a selection with the `data` method

```
d3.select("svg")
  .selectAll("circle")
  .data(inputData)
  .enter()
  .append("circle")
  .attr("r", function(d) {
    return d.age;
});
```

Join Selections



```
d3.select("svg")
  .selectAll("circle")
  .data(inputData)
  .enter()
  .append("circle")
  .attr("r", function(d) {
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});
```

<http://bostocks.org/mike/join/>

Selection methods

- `selection.method(accessor)`
- `selection`: which elements to change
- `method`: what to change about elements
- `accessor`: which aspect of the data

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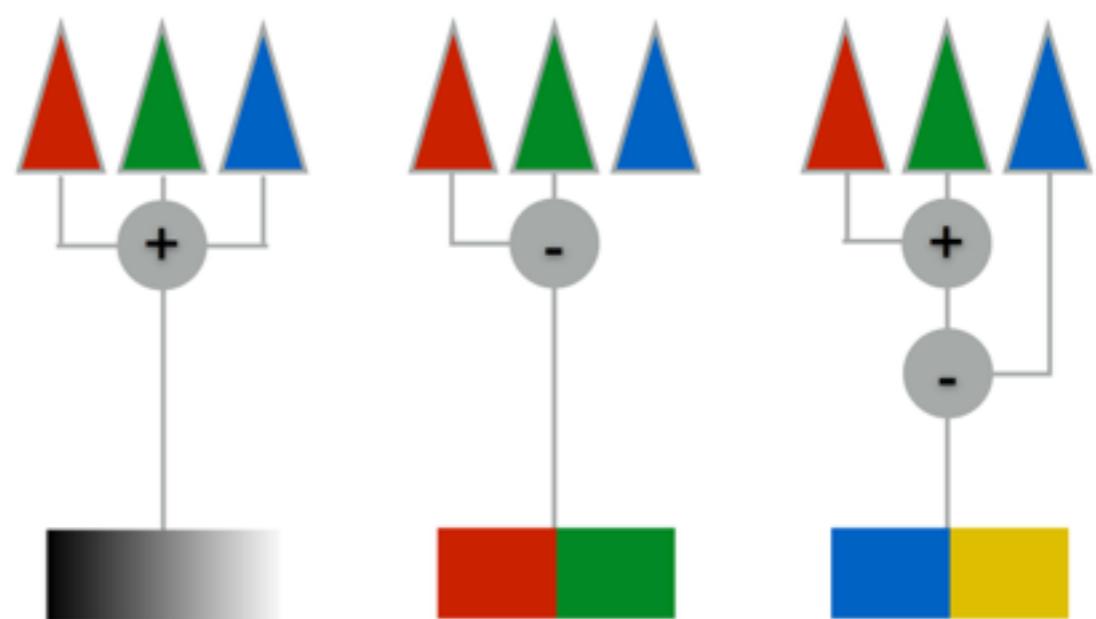
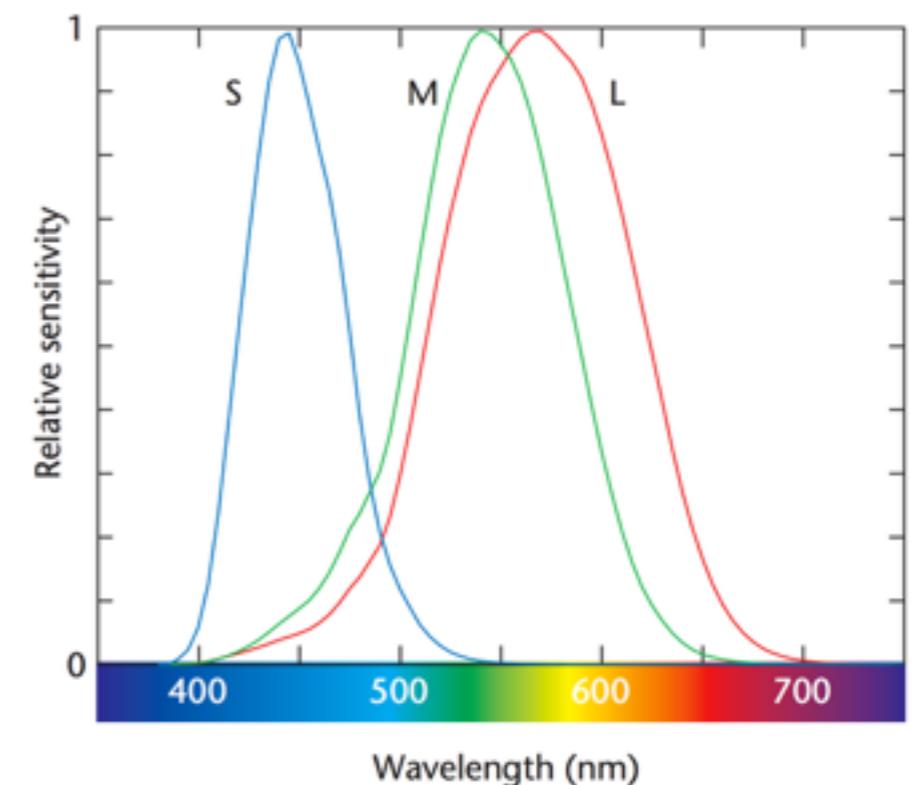
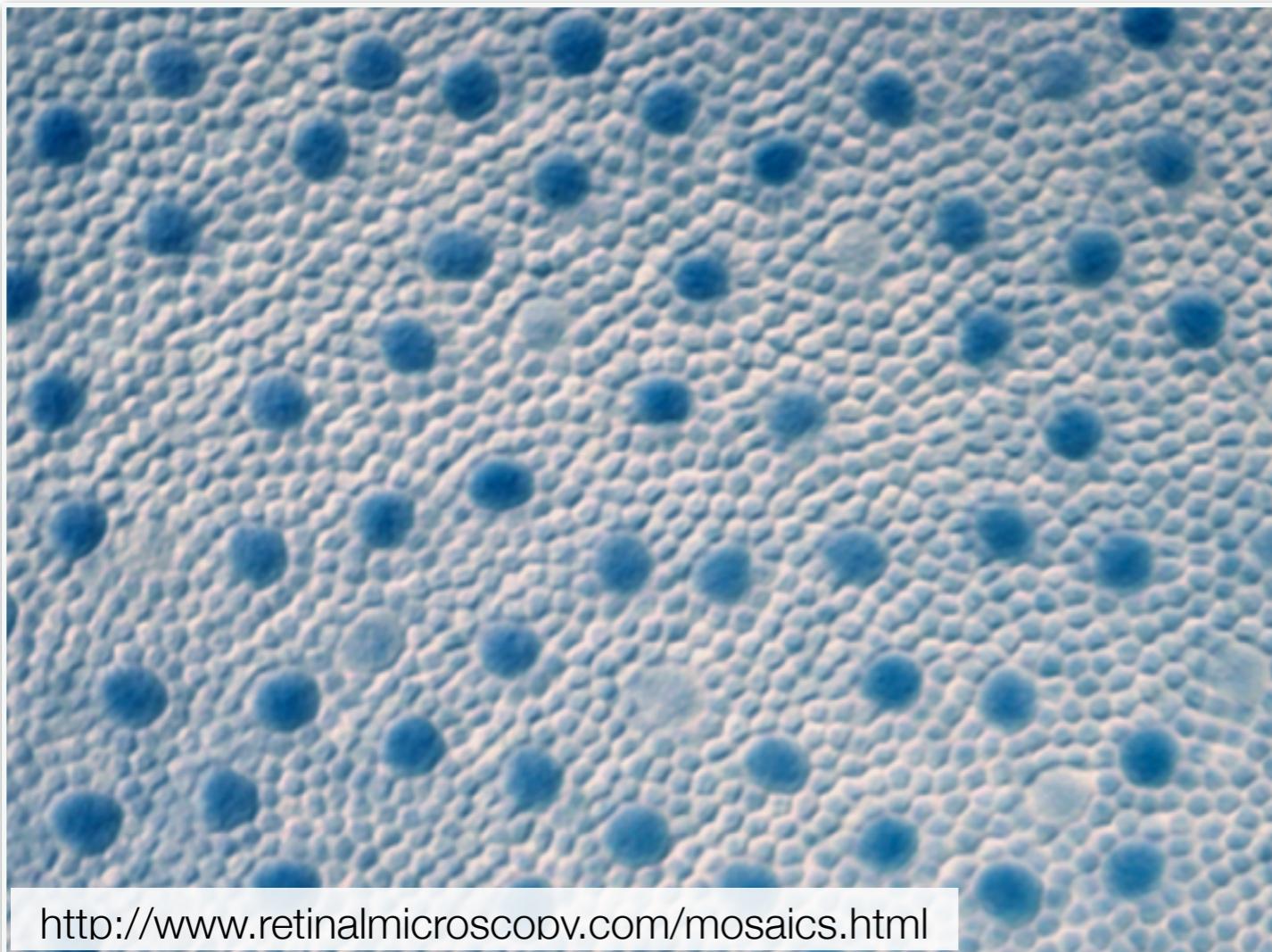
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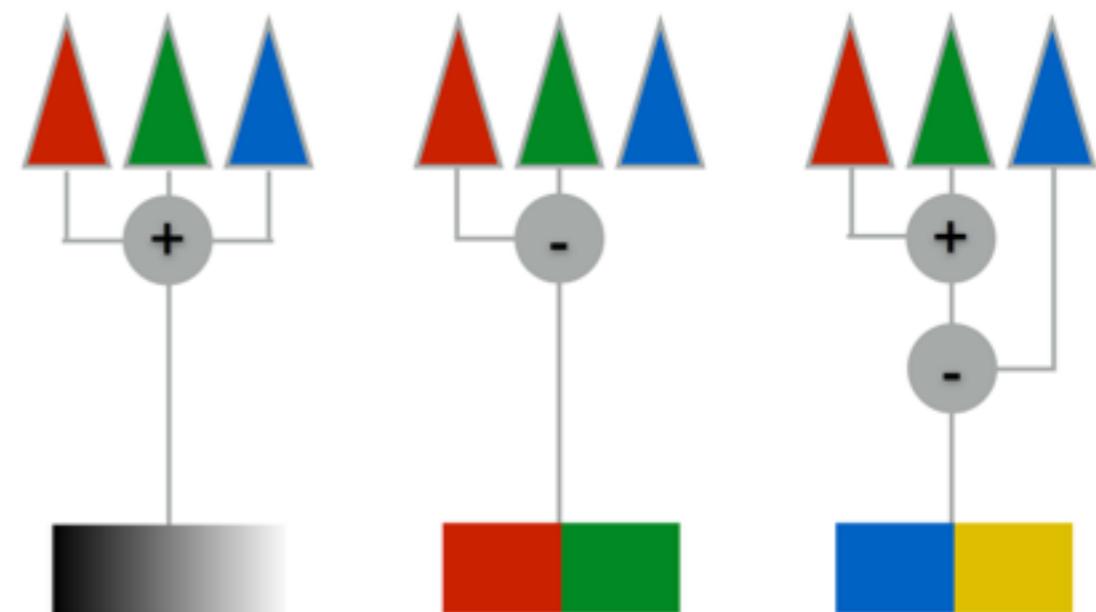
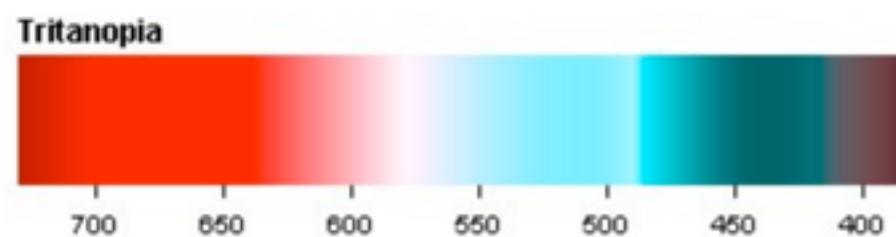
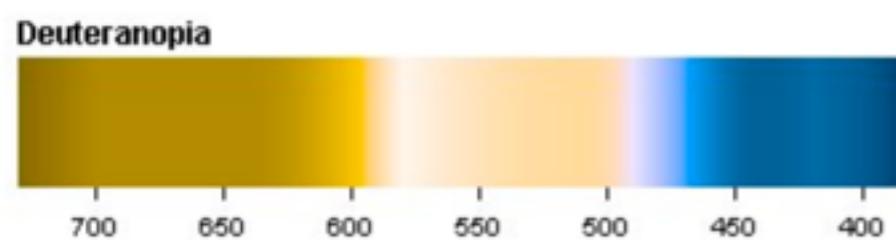
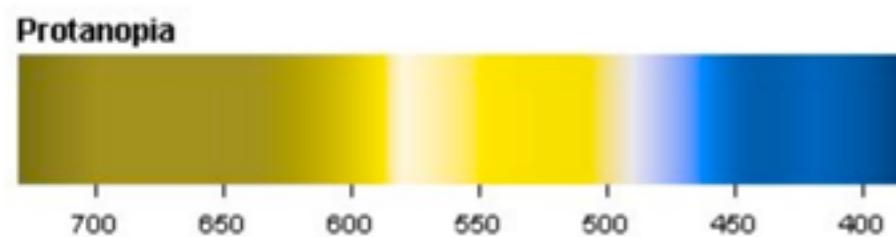
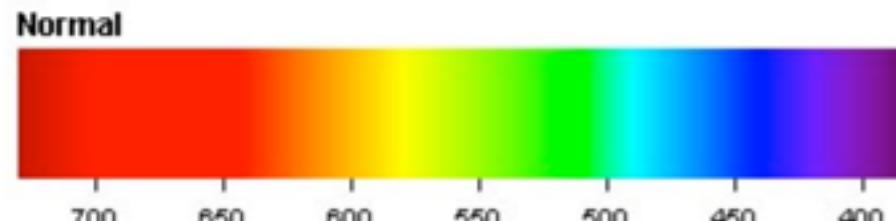
PRINCIPLES

Color Vision

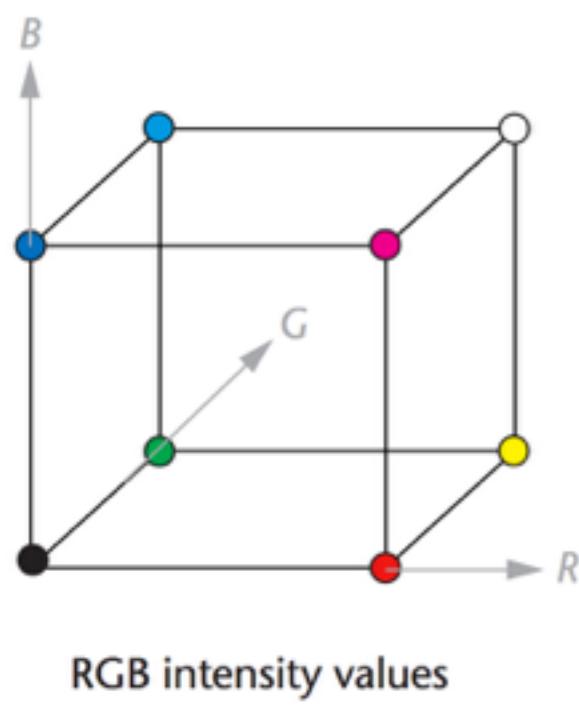
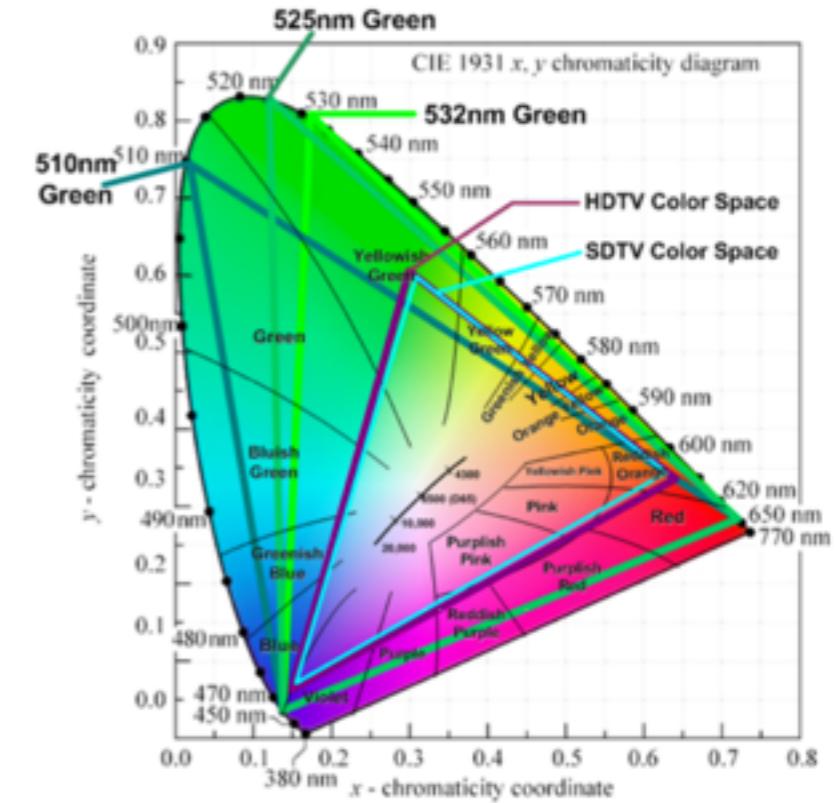
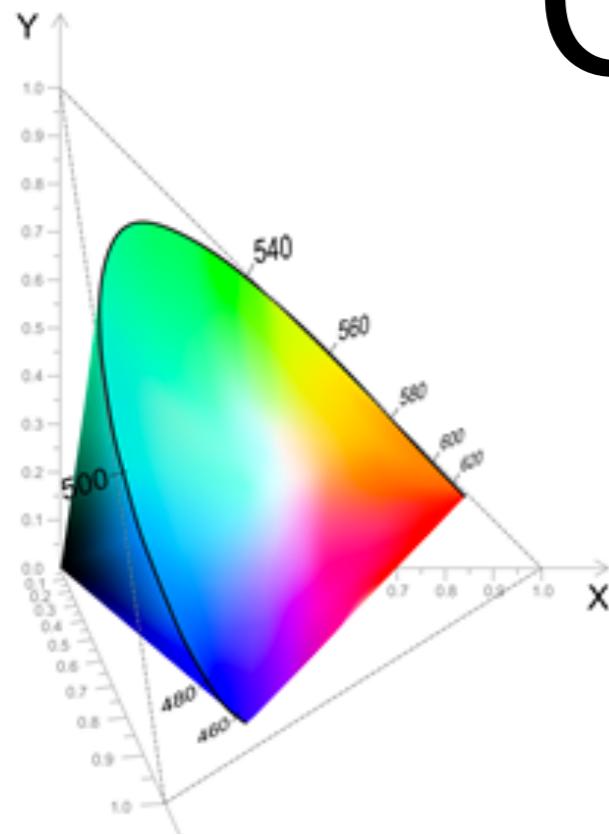


Color Vision Deficiencies

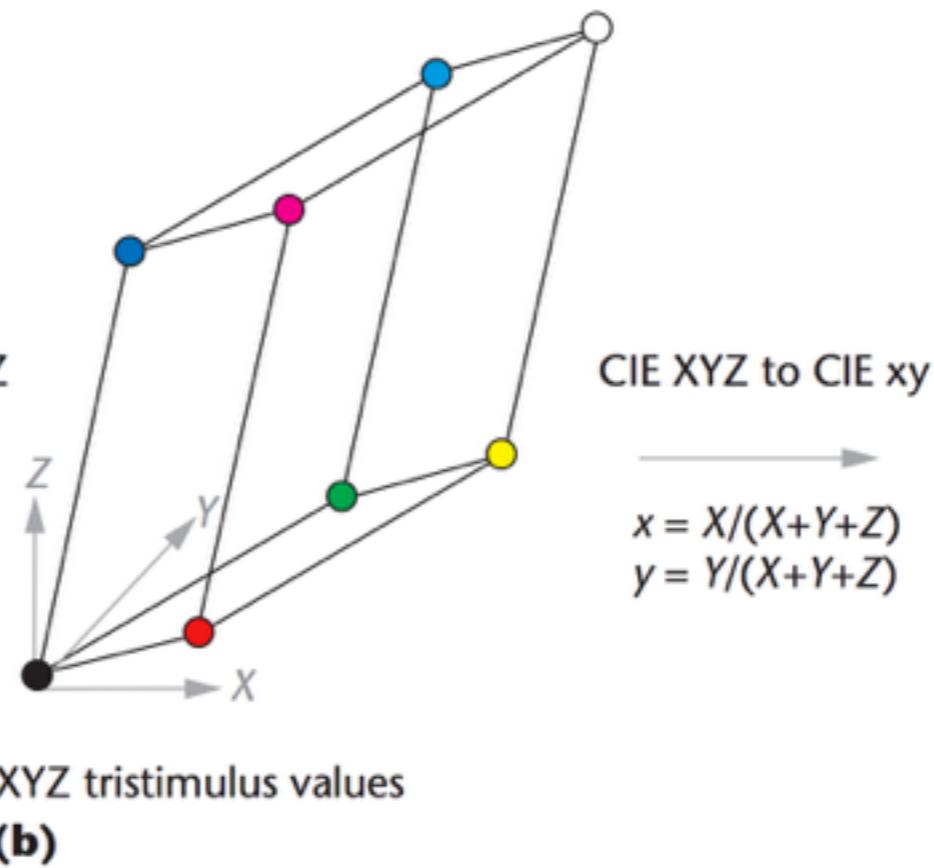
Never use red-green as primary color discriminator!



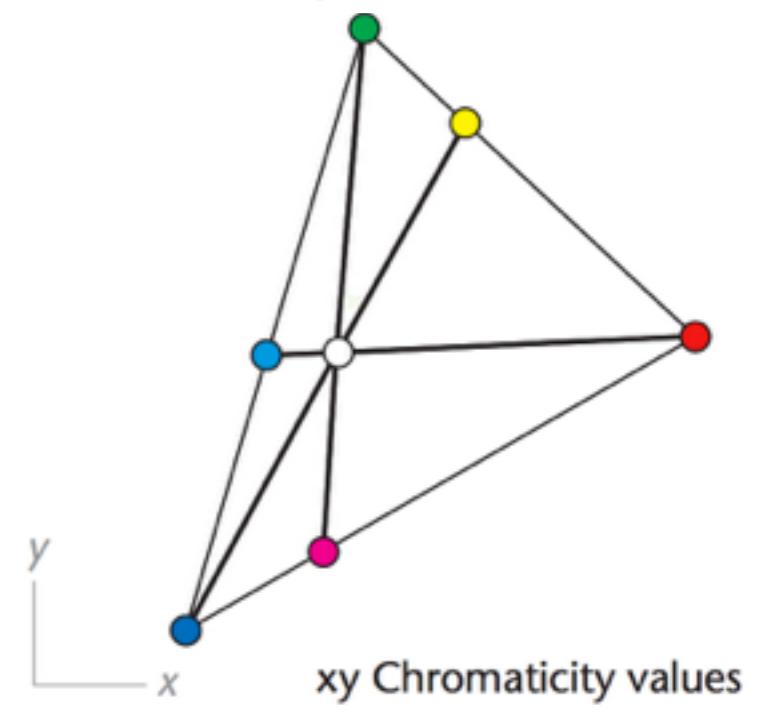
Color Gamuts



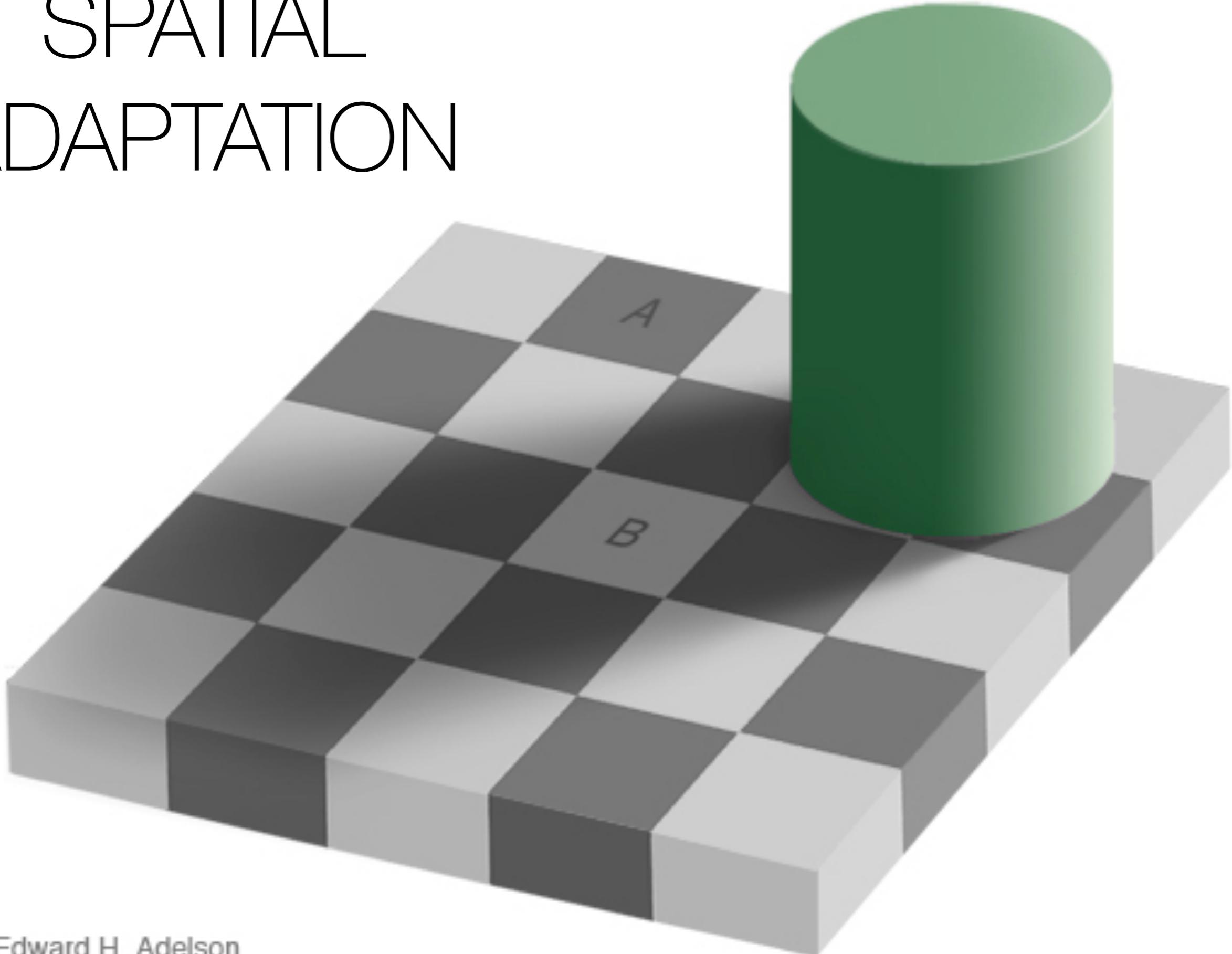
RGB to CIE XYZ
3 x 3 matrix



CIE XYZ to CIE xy
 $x = X/(X+Y+Z)$
 $y = Y/(X+Y+Z)$



SPATIAL ADAPTATION



Edward H. Adelson

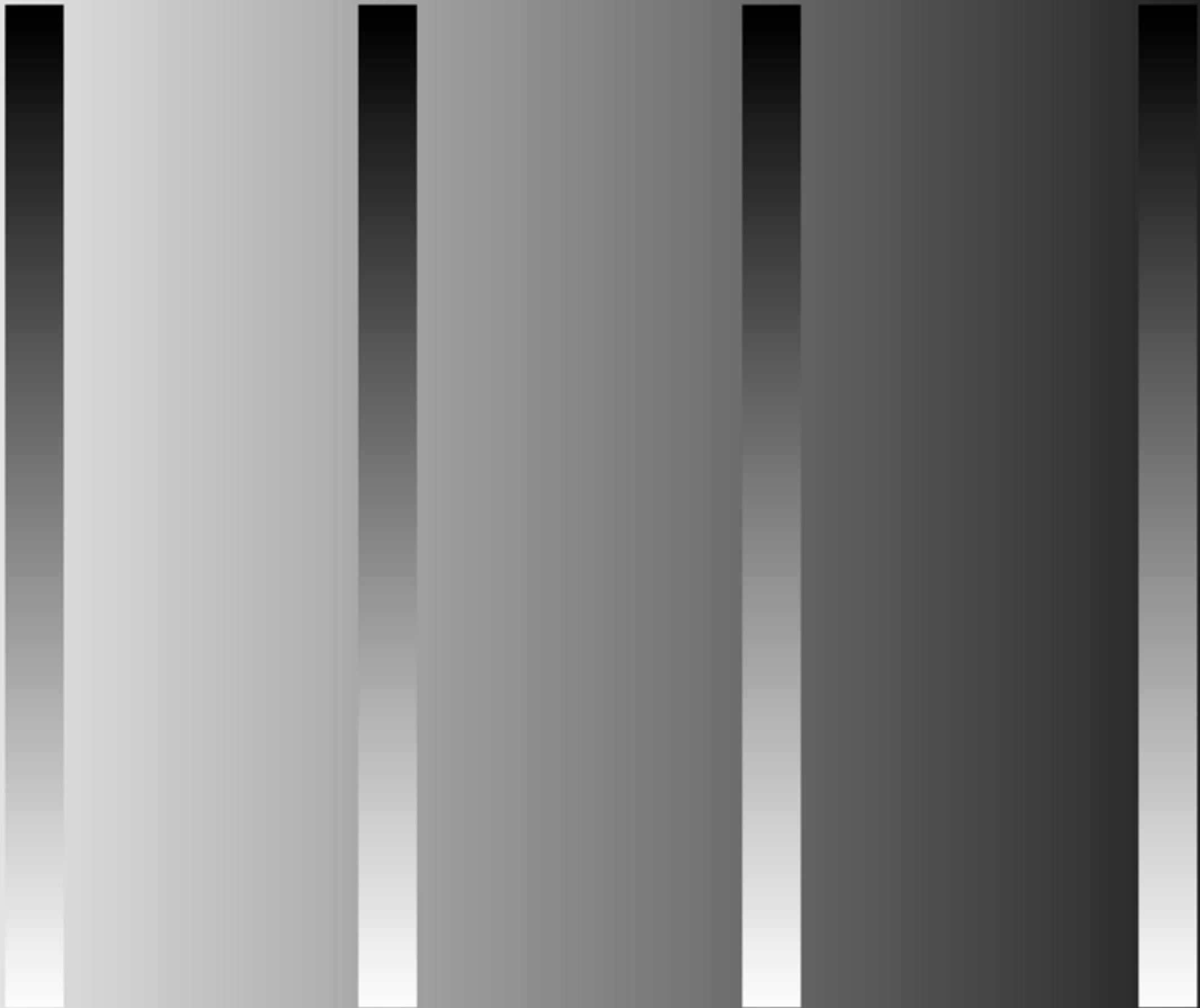
SPATIAL ADAPTATION

A

B







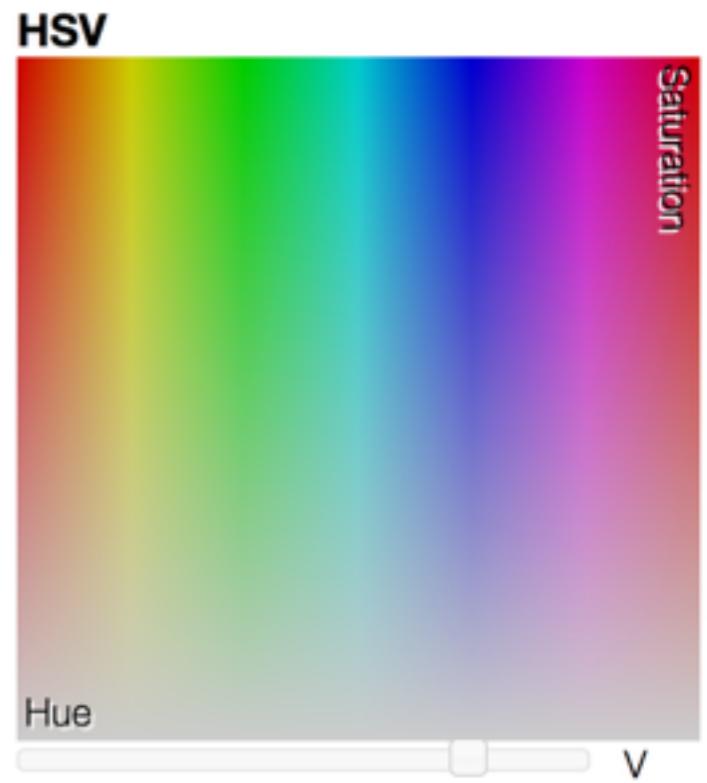


TEMPORAL ADAPTATION

<http://www.moillusions.com/black-and-white-in-colour-again.html/13191556xteeocm7>

Color Spaces

- RGB, CMYK, HSL: Device dependent, bad
- Luv, Polar Luv (“HCL”): Perceptually-driven, better
 - distances in coordinates are meaningful

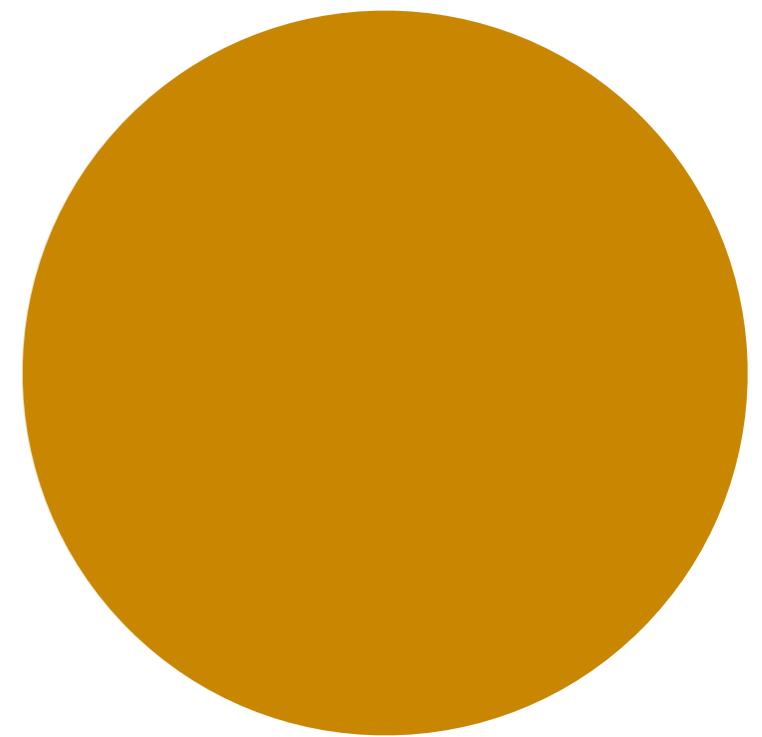
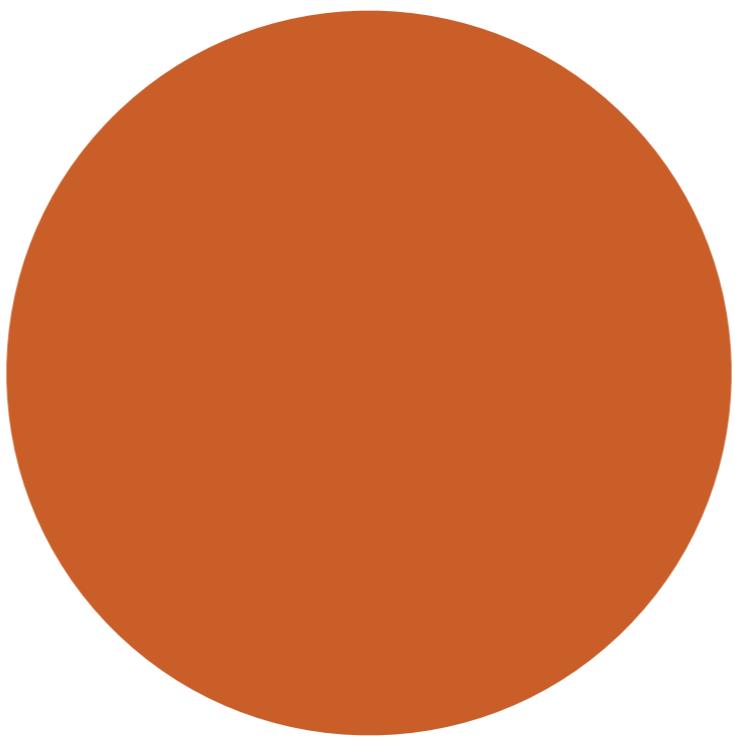
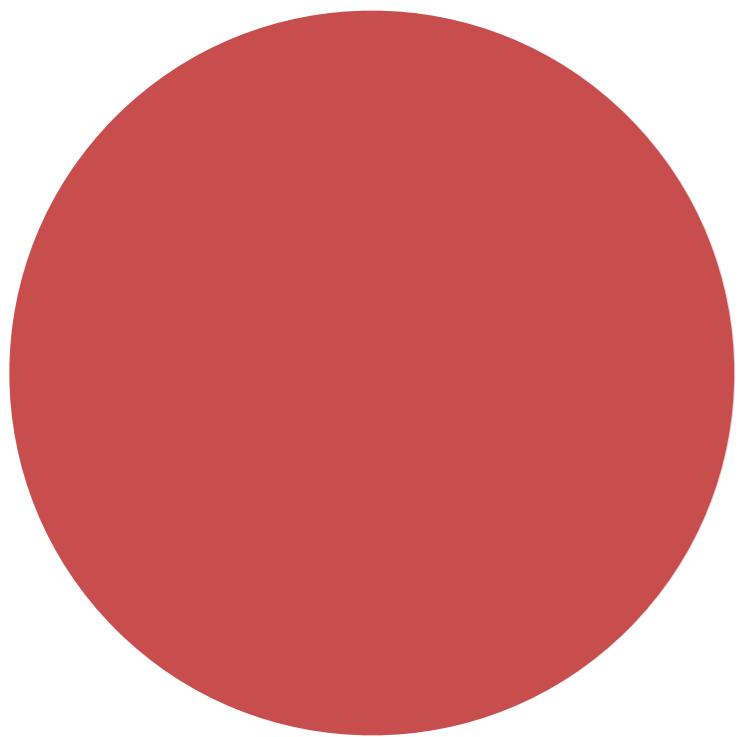


Do not rely only on hue boundaries to
depict shape

Area affects saturation perception

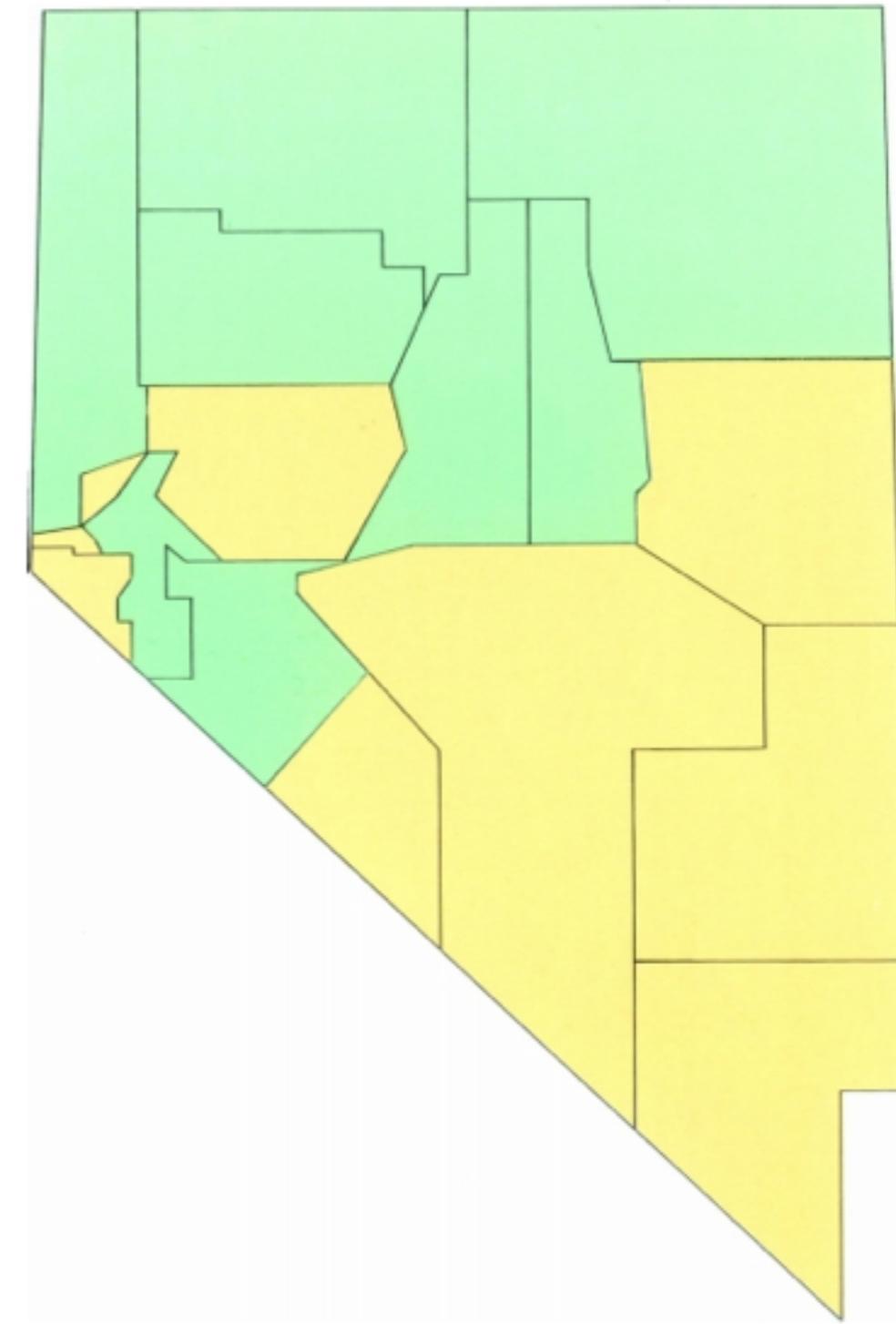
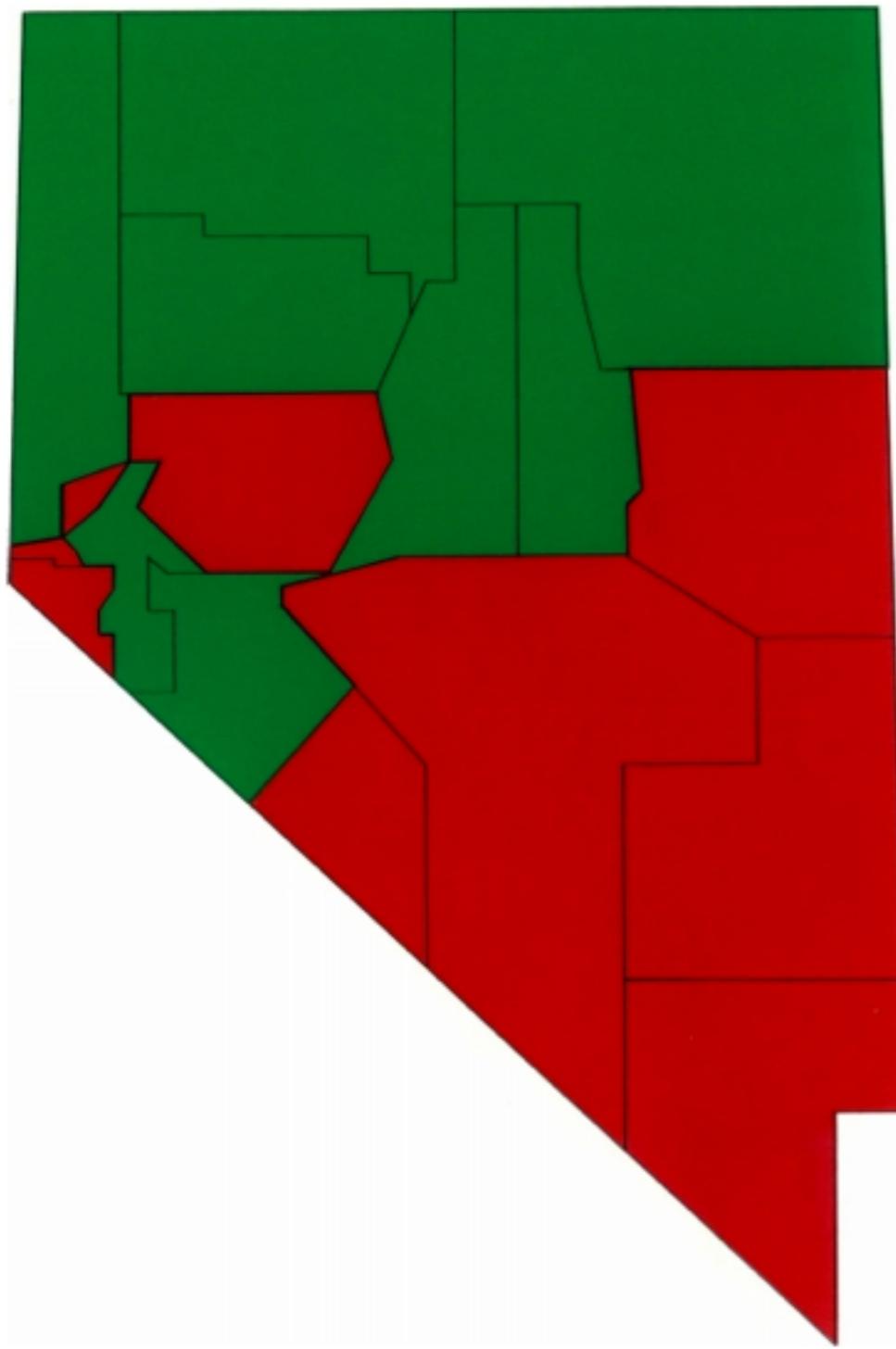


Area affects saturation perception



Saturation affects area perception

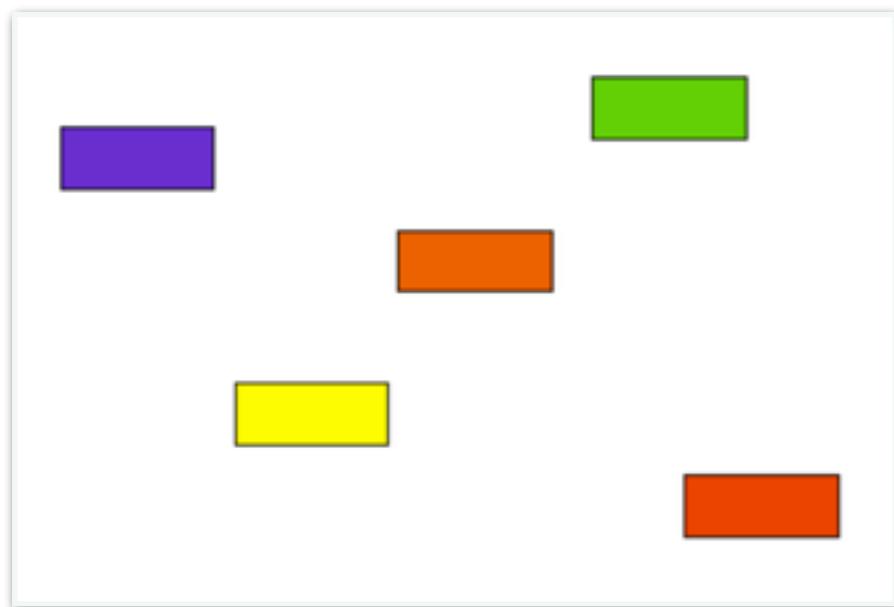
102 © *The American Statistician*, May 1983, Vol. 37, No. 2



Area affects saturation perception

Saturation affects area perception

Consider implied ordering in color channels



Hue



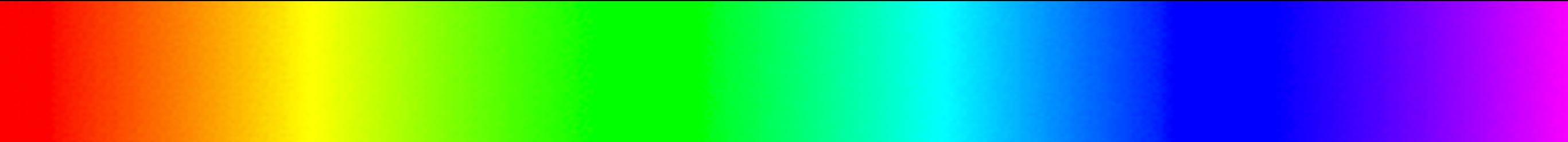
Luminance



Saturation

If you're going to use the rainbow colormap, use an **isoluminant** version, **quantize** it, or **both**

Bad



Better



Be aware of implied and perceptually forced color relationships

For categorical data, use color only when you have few categories (less than 10)

THE STANDARD VISUAL CHANNELS

④ Position

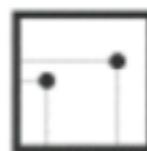
→ Horizontal



→ Vertical



→ Both



④ Color



④ Shape



④ Tilt



④ Size

→ Length



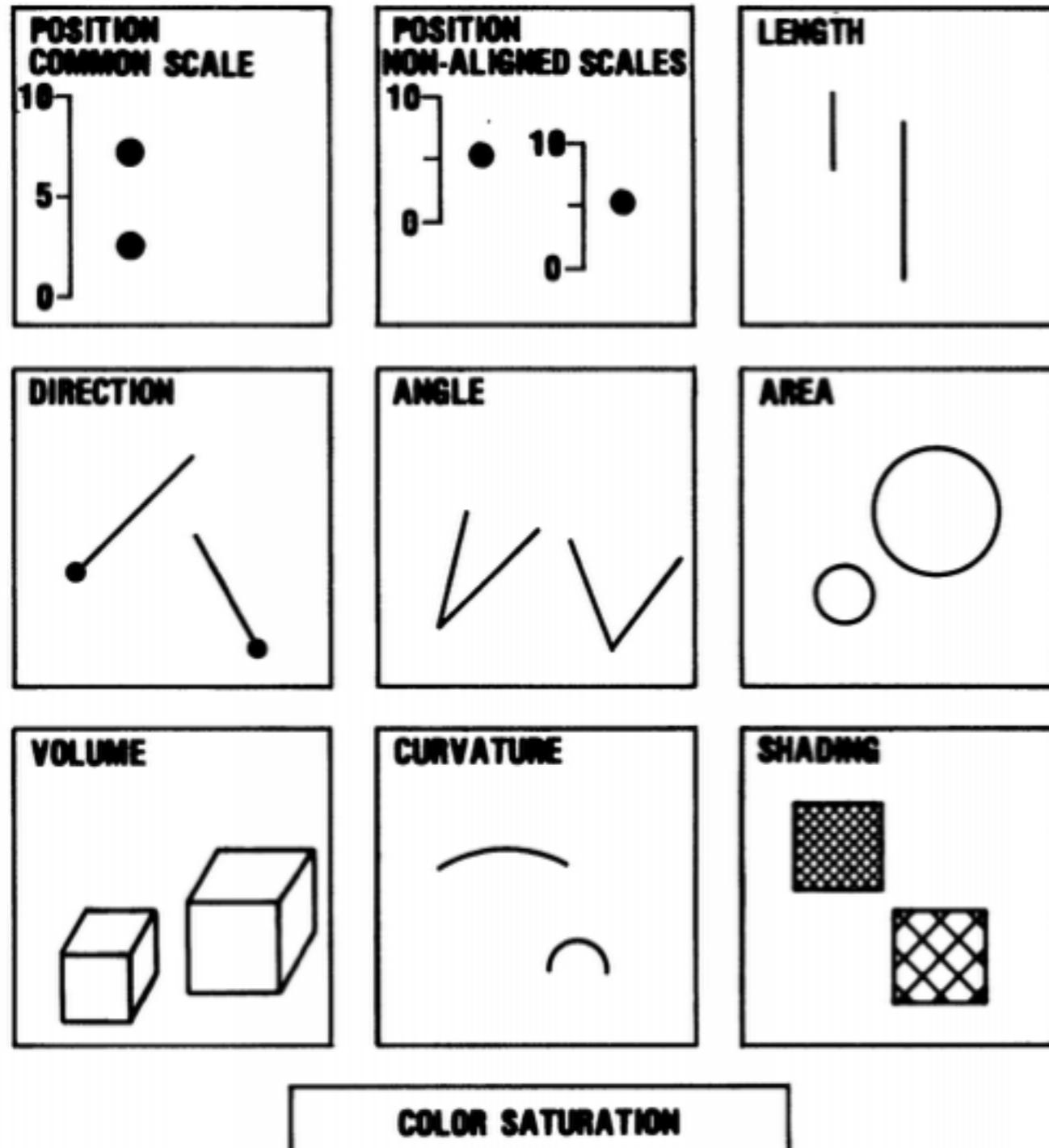
→ Area



→ Volume



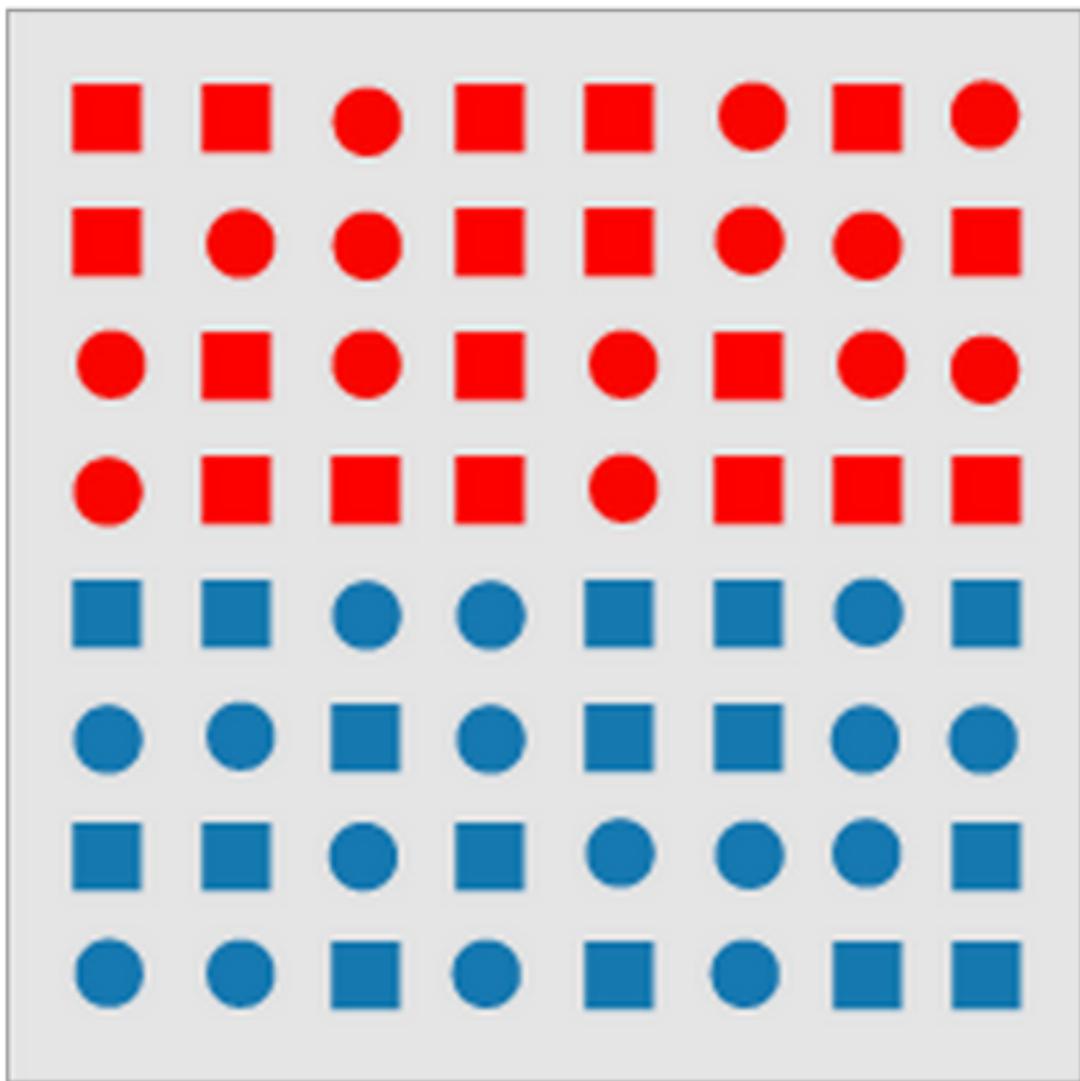
Cleveland/McGill perception papers



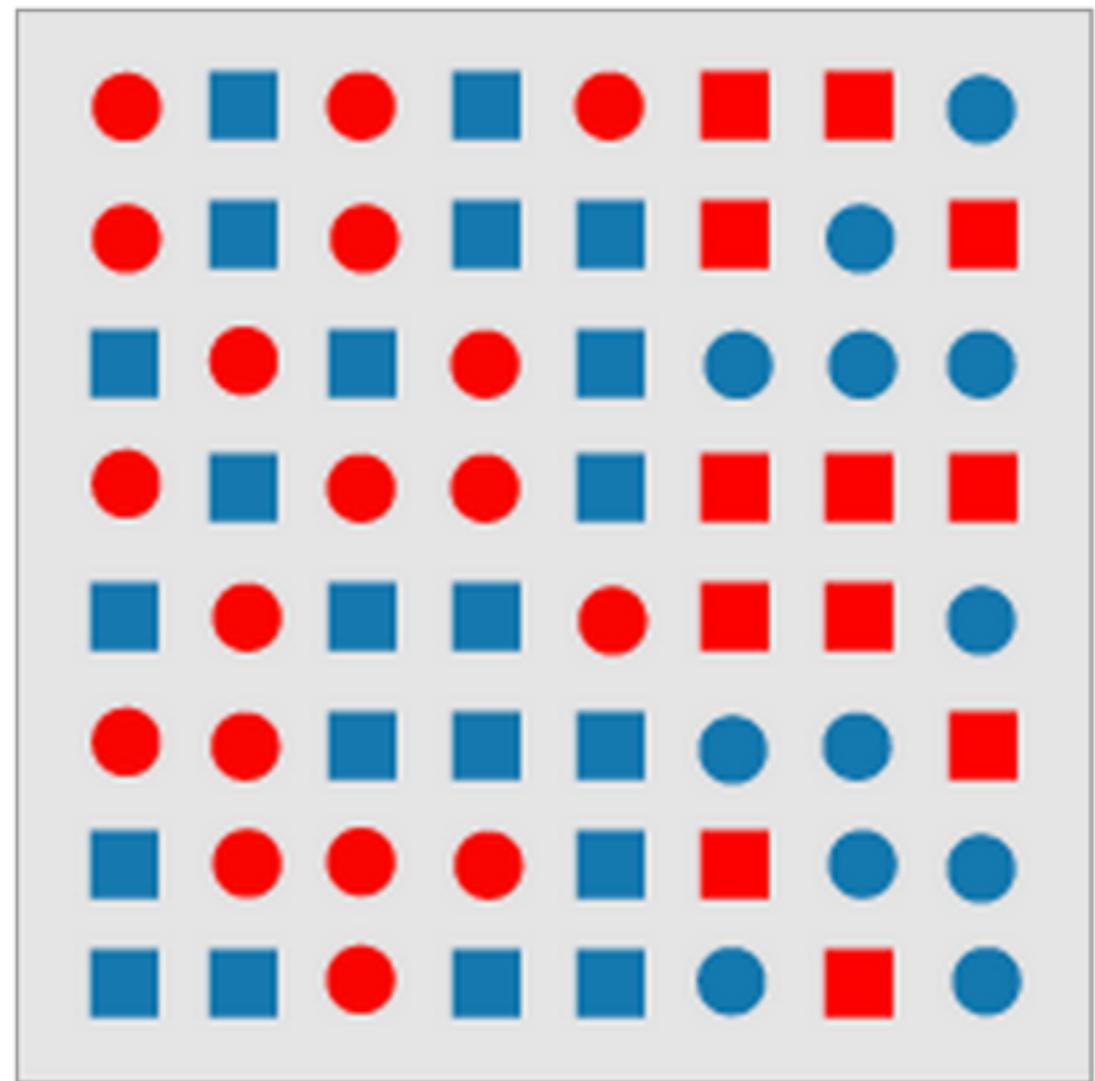
1. Position along a common scale
2. Positions along nonaligned scales
3. Length, direction, angle
4. Area
5. Volume, curvature
6. Shading, color saturation

Figure 1. Elementary perceptual tasks.

PREATTENTIVENESS,
OR “VISUAL POP-OUT”



(a)



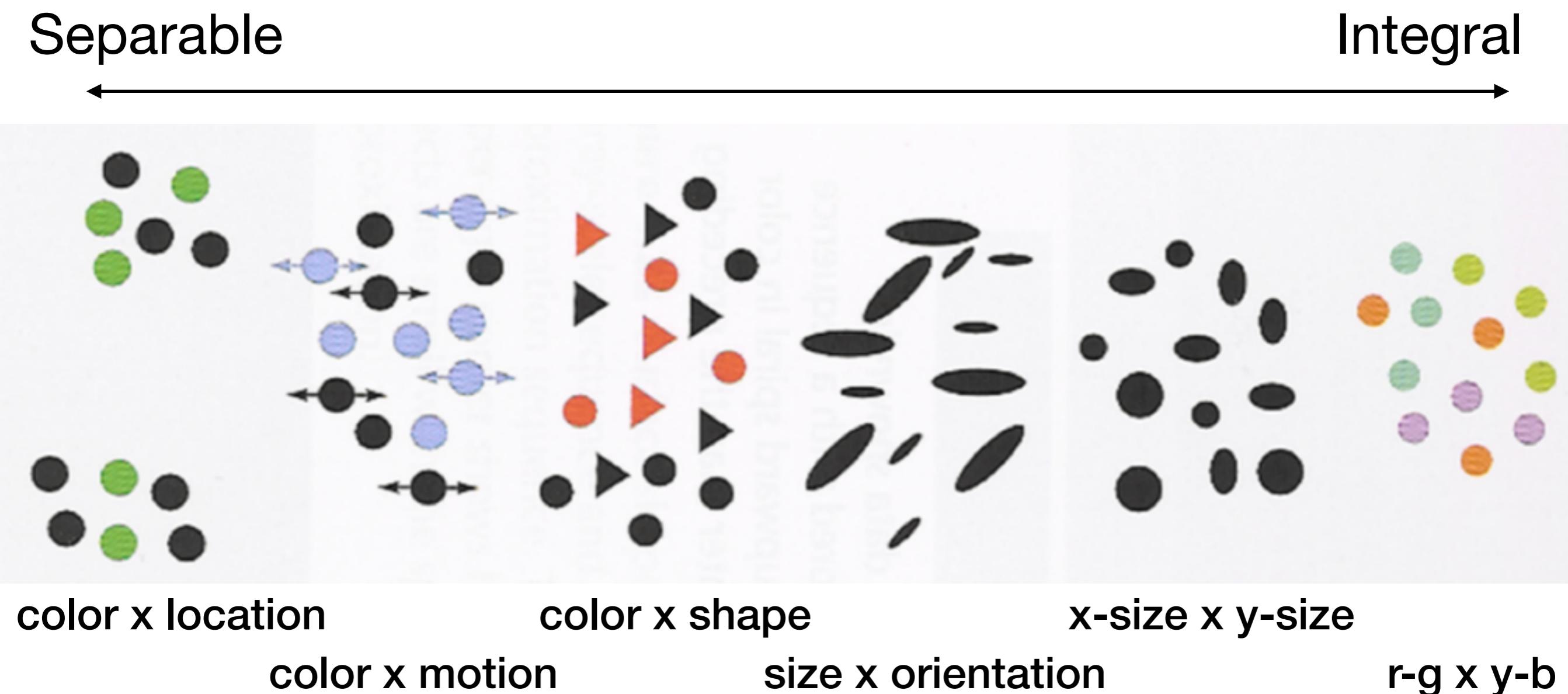
(b)

Preattentiveness
(mostly) works one-
channel-at-a-time.

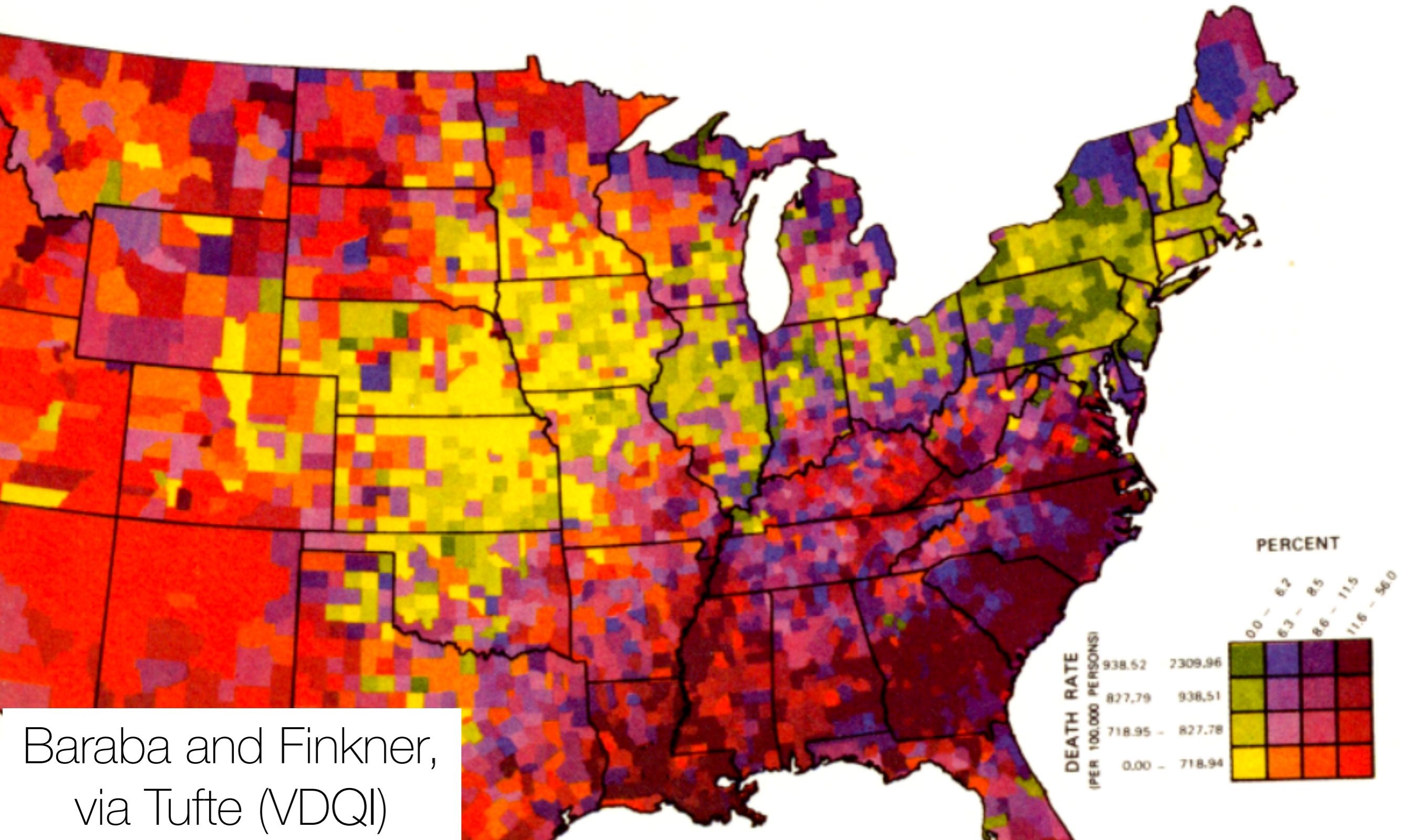
Integral vs. Separable Channels

- Do humans perceive values “as a whole”, or “as things that can be split”?

Integral vs. Separable Channels



Bivariate Color Map (Bad)



Baraba and Finkner,
via Tufte (VDQI)

INTERACTION, FILTERING,
AGGREGATION

What if there's too much data?

- Sometimes you can't present all the data in a single plot (Your final projects are like this!)
- **Interaction:** let the user drive what aspect of the data is being displayed
- **Filtering:** Selectively hide some of the data points
- **Aggregation:** Show visual representations of subsets of the data

Shneiderman's “Visual information seeking mantra”

**Overview first,
zoom and filter,
then details-on-demand**

Overview first:

Before all else, show a “high-level” view, possibly through appropriate aggregation

Zoom and Filter:

Use interaction to create
user-specified views

Details on Demand:

Individual points or attributes
should be available, but only
as requested