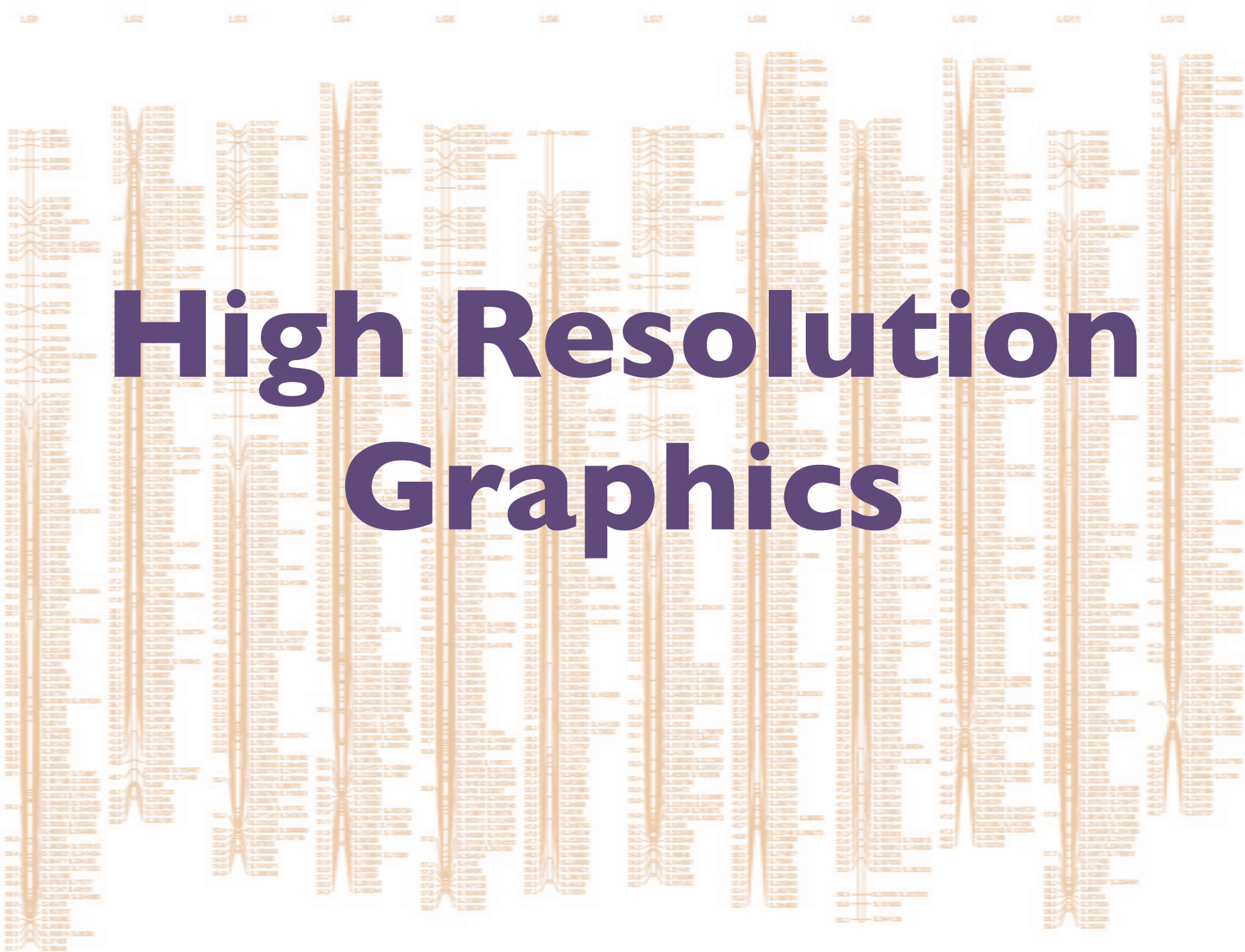
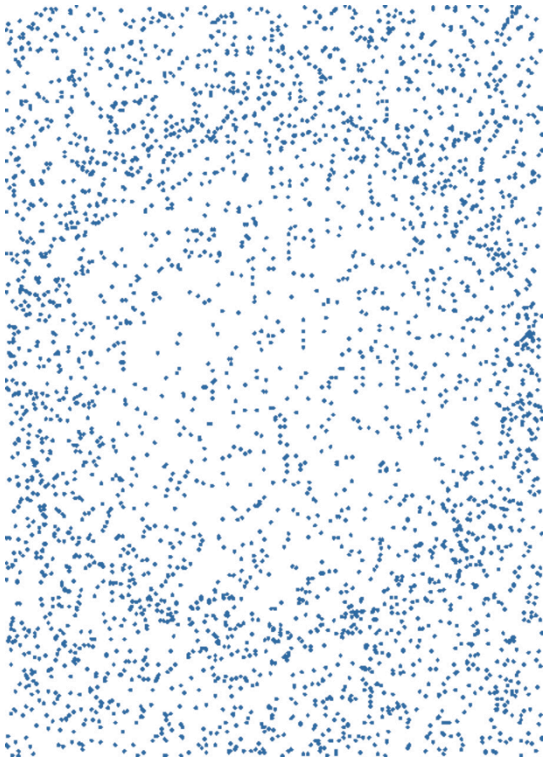

High Resolution
Graphics

Humans can see fine details.

- Most people can resolve ~600 points/in^2 (~100 points/cm^2), depending on the point size and shape, color, &c.



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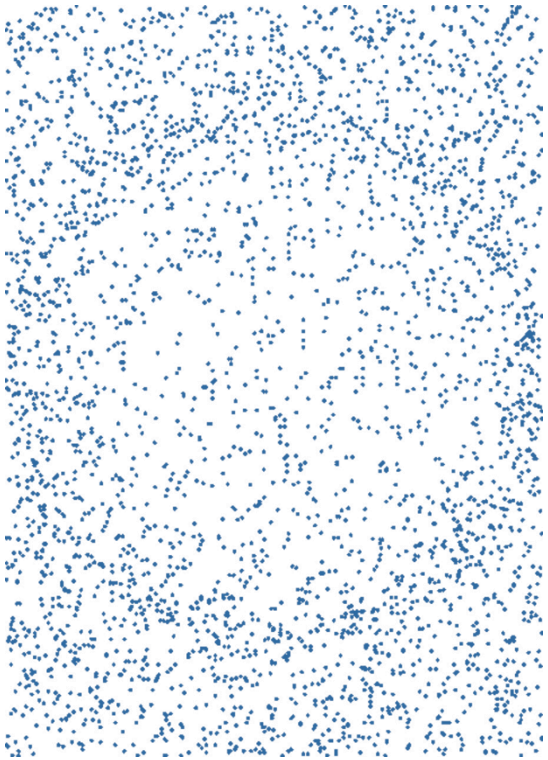

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- Use this capability!

  "Maximize data density and the size of the data matrix, within reason."
- Applies to both text and graphical elements

$$\text{Data Density} = \frac{\text{Number of data entries}}{\text{Area of graphic}}$$

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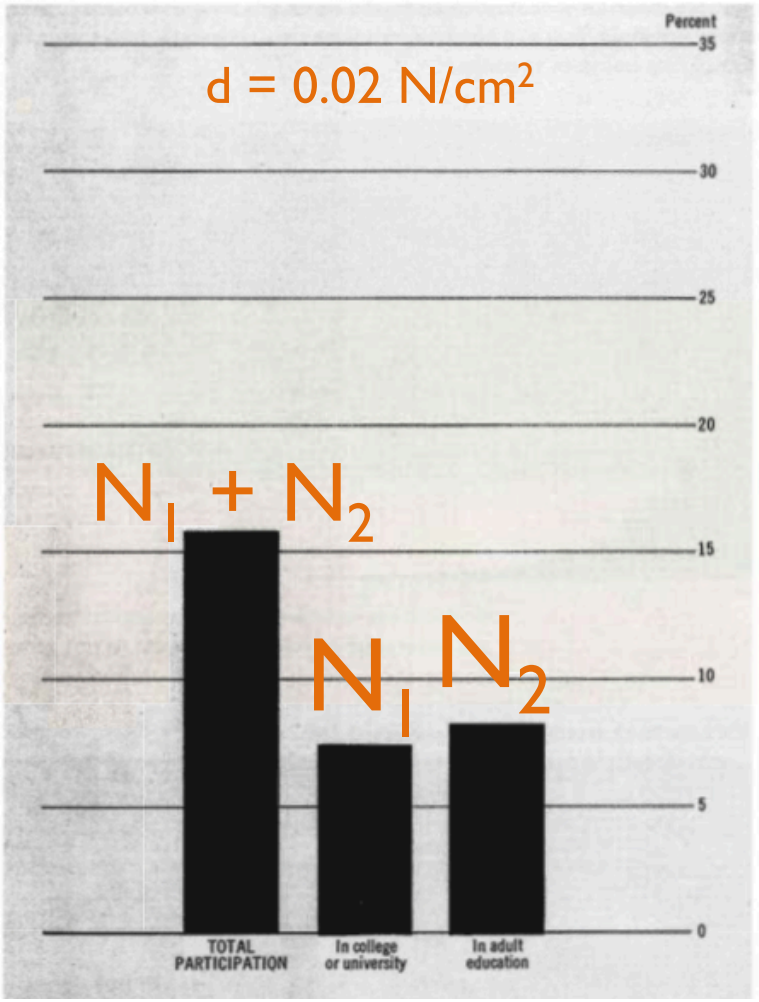
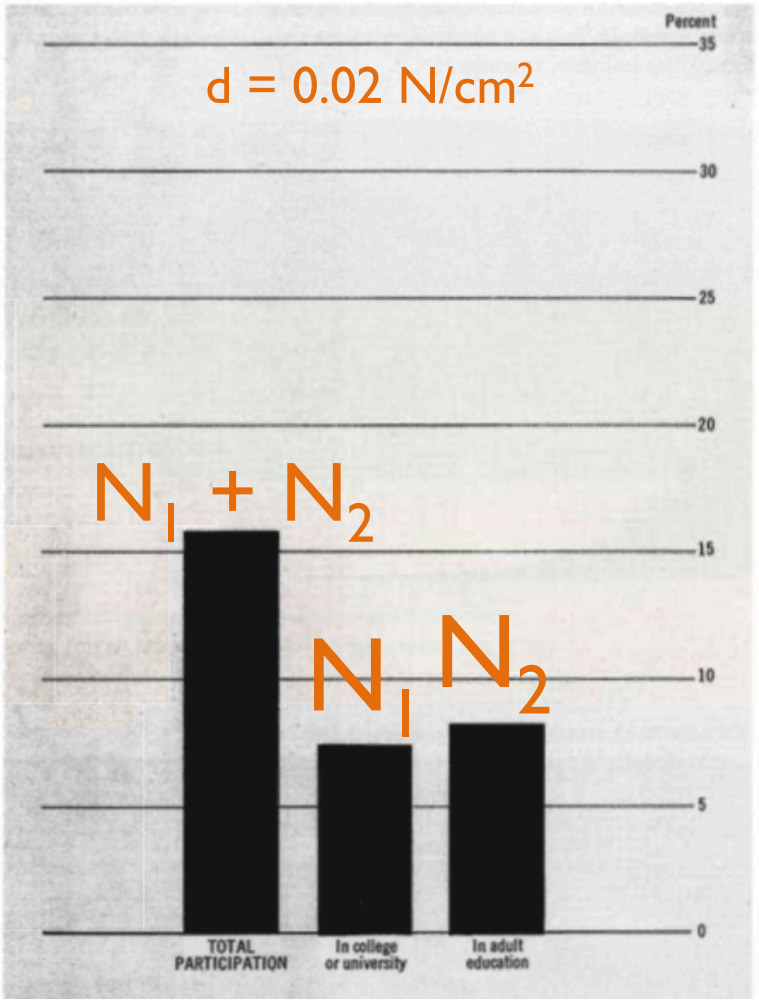
Low

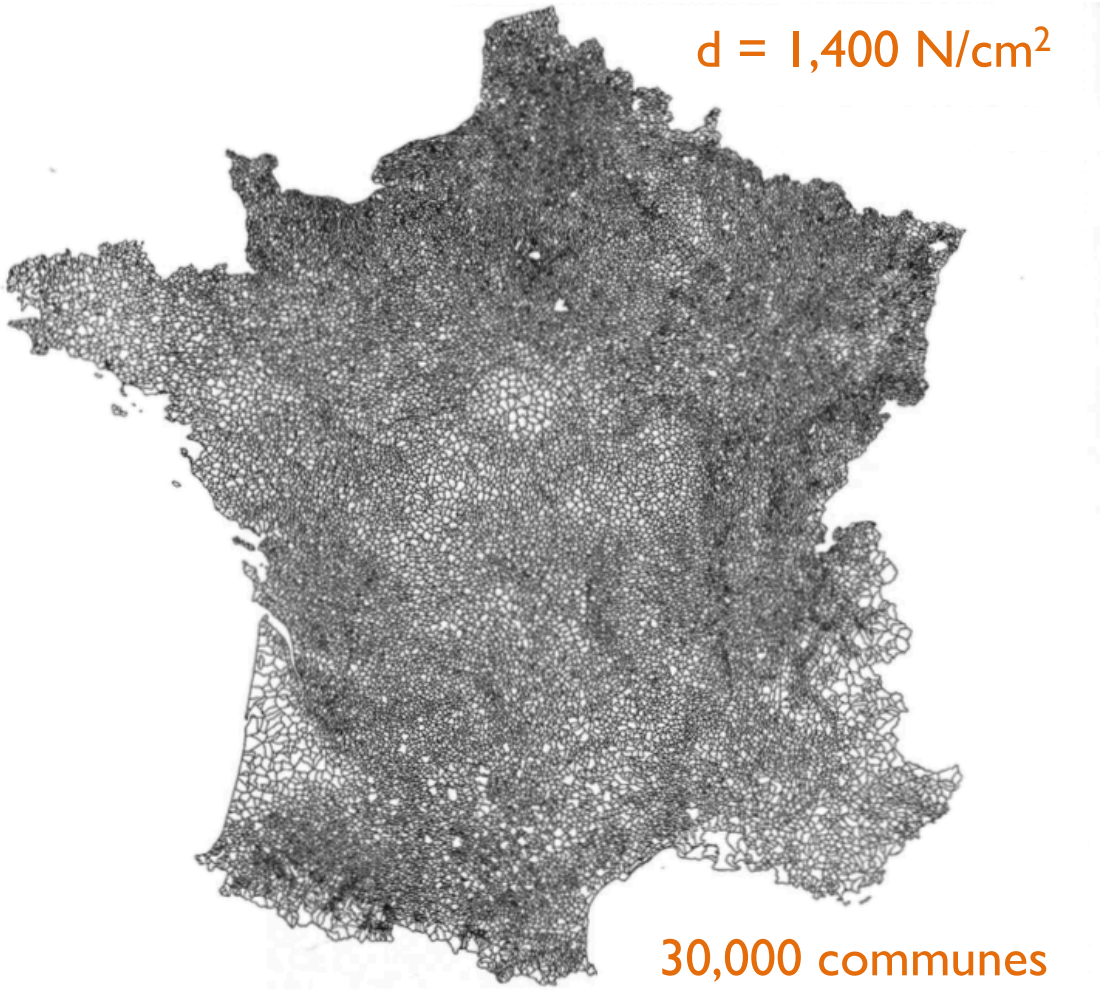


$$\text{Data Density} = \frac{\text{Number of data entries}}{\text{Area of graphic}}$$

Low

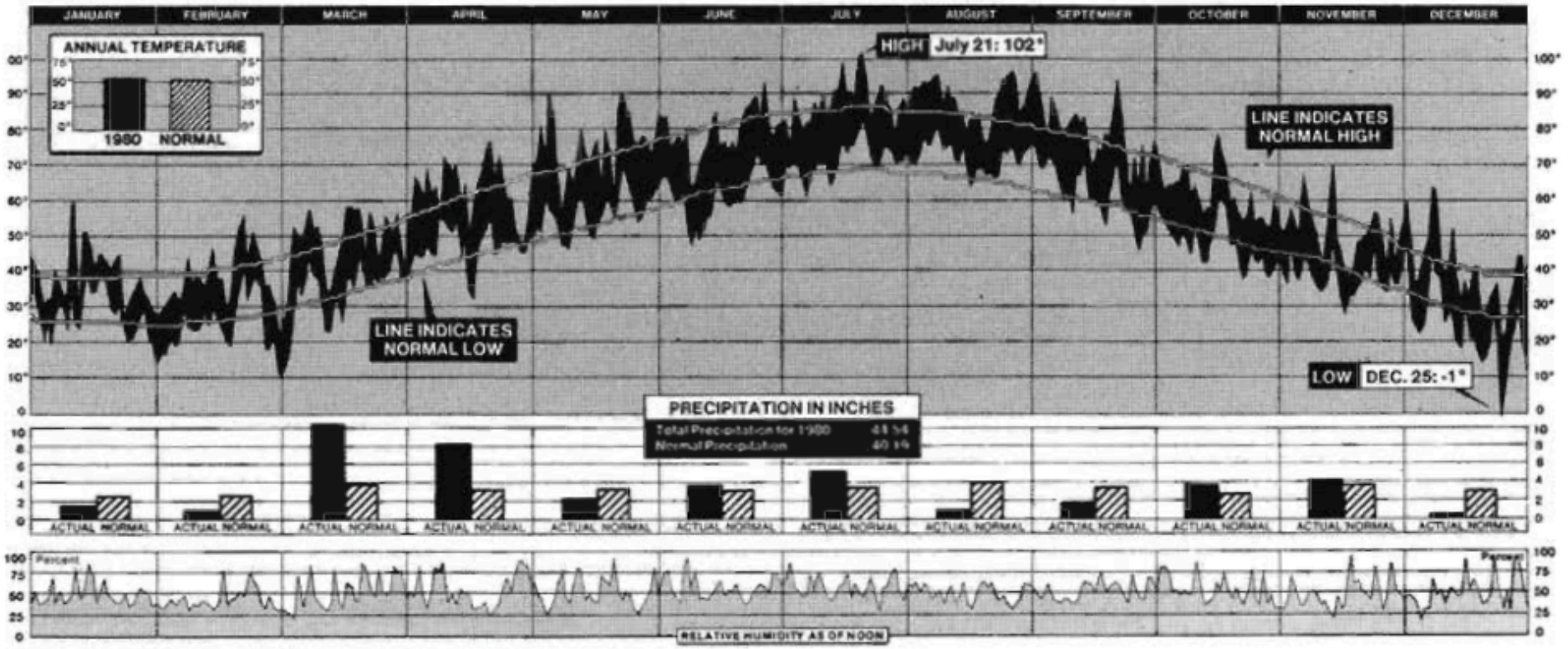


High



Some more examples

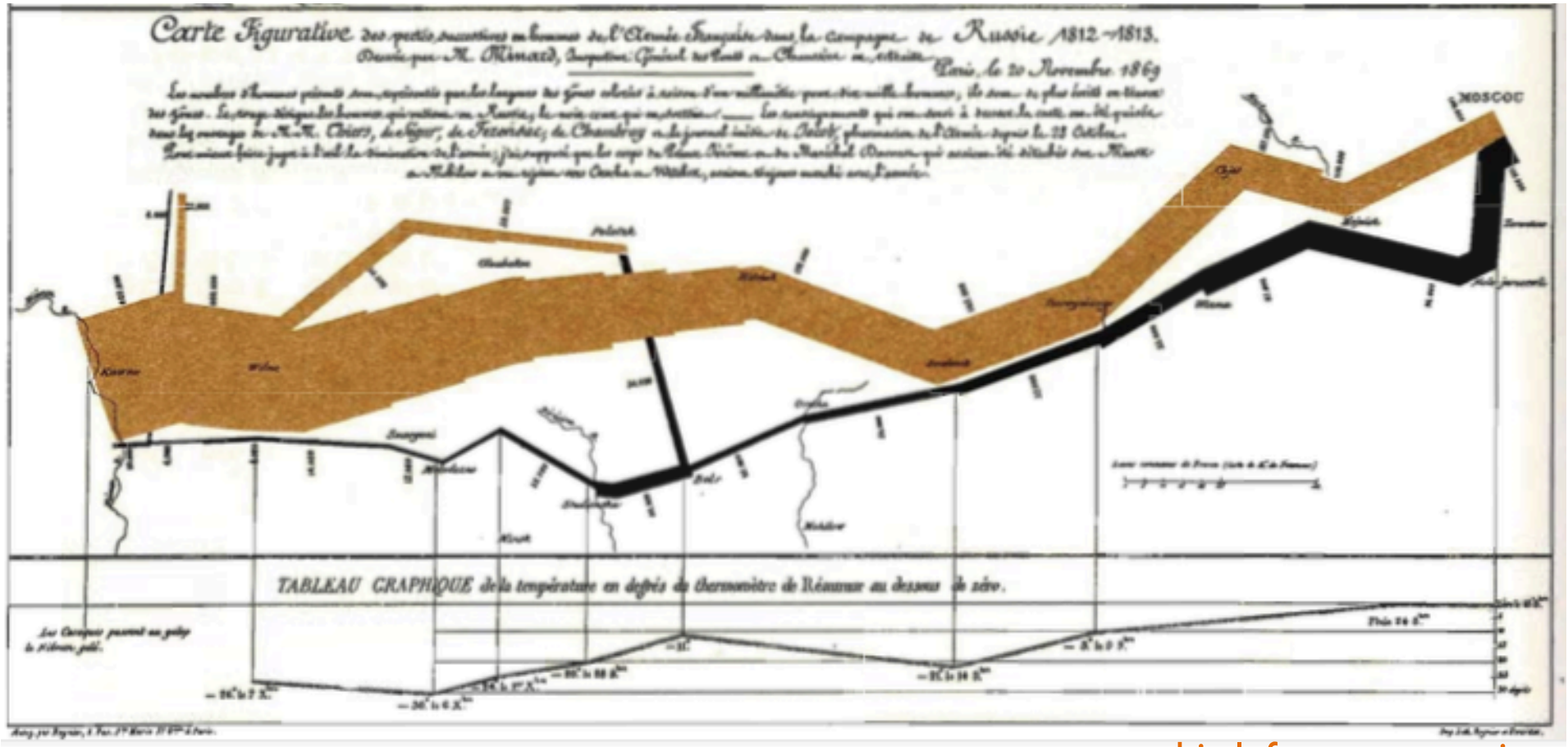
NYC's weather in 1980: temperature, precip, & humdity



d = 28 N/cm^2

Some more examples

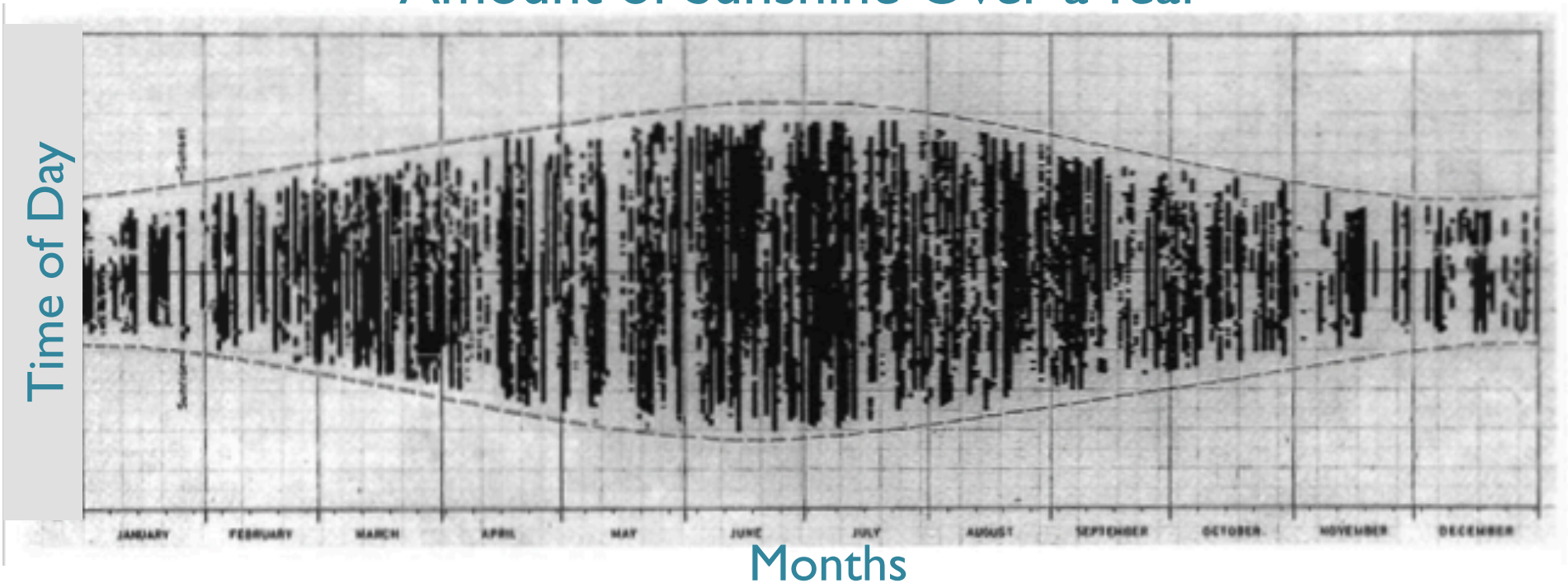
Napoleon's 1812-1813 march to/from Moscow



d is left as an exercise for the reader

Some more examples

Amount of Sunshine Over a Year



$d = 160\ N/cm^2$

Small Multiples

Graphics that repeat combinations of variables,
each time changing a third variable

- Easy to compare
- Almost entirely data-ink
- Small and high-density
- Show a narrative
- Decrease fraction of

time spent understanding

the variables

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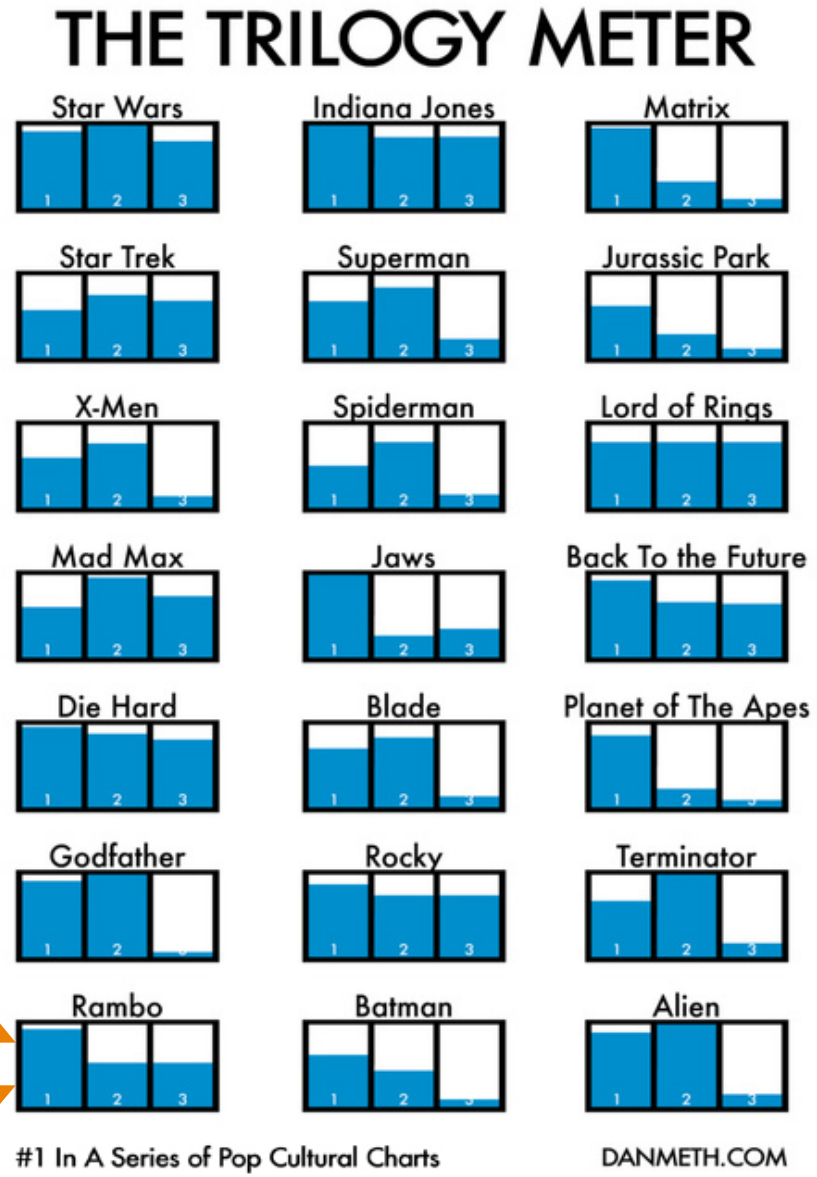

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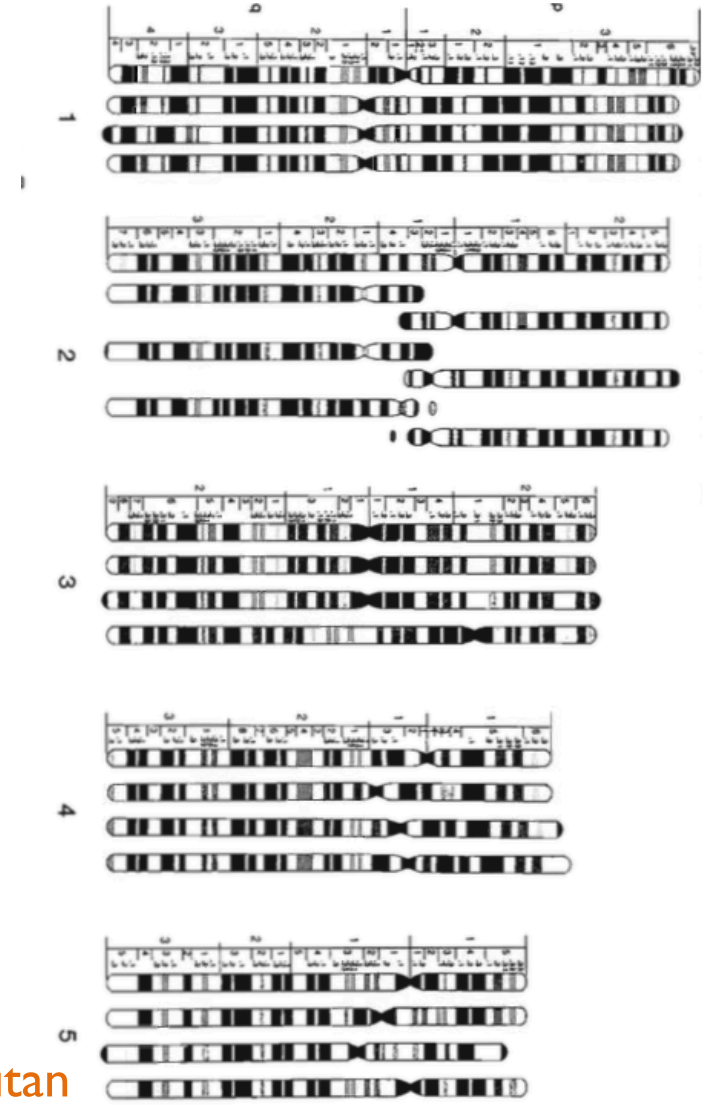

Chromosomes of
Human
Chimp
Gorilla
Orangutan

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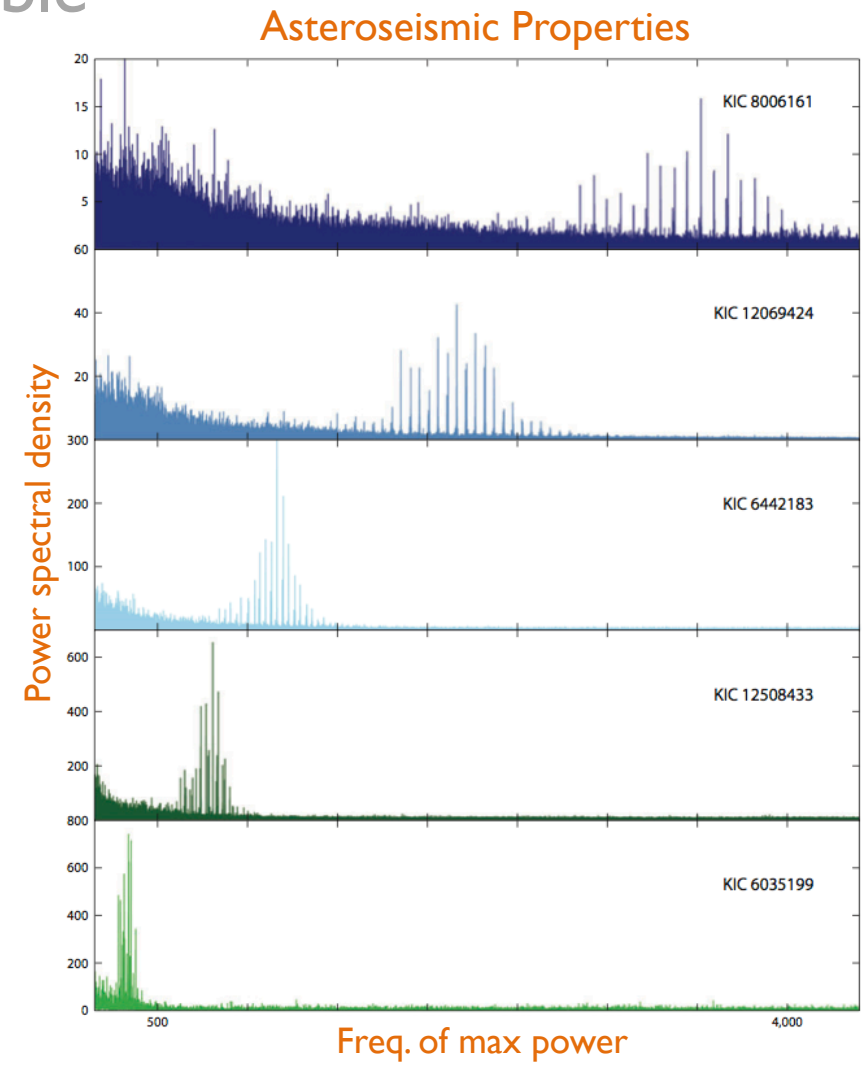
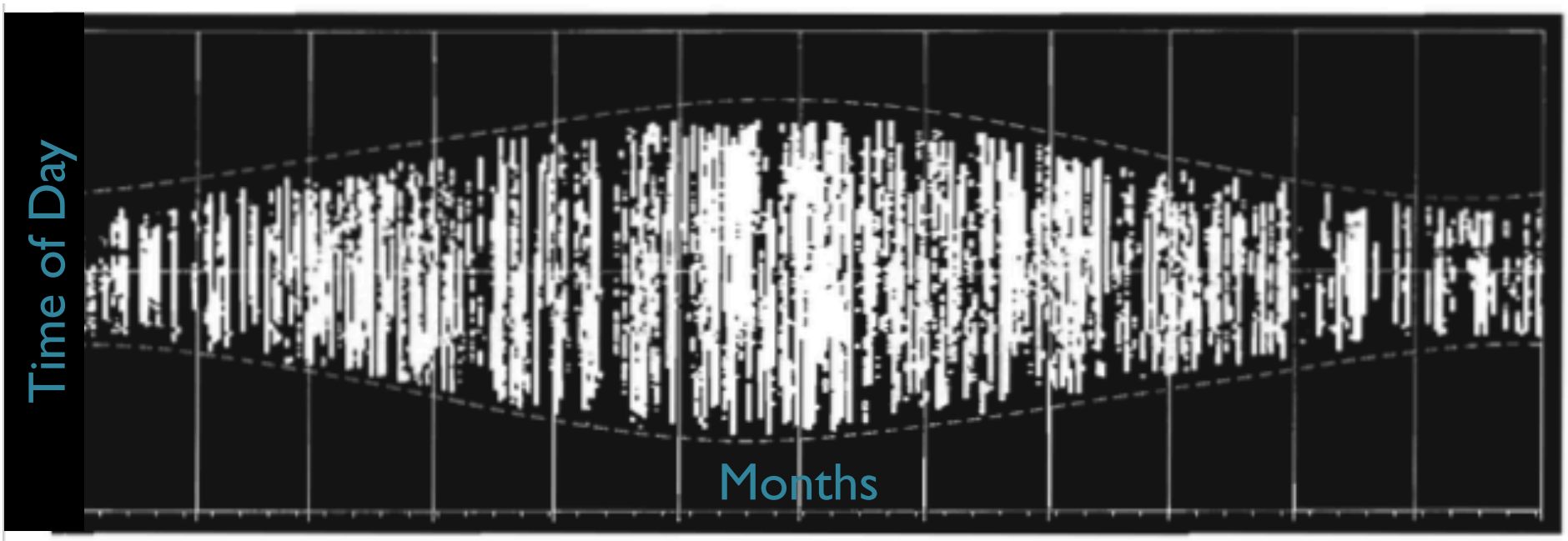


What do these have in common?
(What makes a "good" high-resolution graphic?)

- Based on large datasets
  - Show "large" data's big-picture behavior
  - "Small" data should go in tables
- Physically small enough to absorb with minimal eye movement
- Use data element reduction techniques to eliminate superfluous crowding (thin lines, small dots, &c.)
- Avoid chartjunk like the plague

Efficient, Not Overwhelming

- A good data-rich graphic should allow the viewer to answer 3 levels of questions:
  - Elementary: *What is the value of Y at X?*
  - Intermediate: *What is the mean trend of Y with X?*
  - Big Picture: *What does this trend say about X and Y?*



Eeek!

- As the discussion was wrapping up, we realized that Gail's copy of Tufte didn't have the "sparklines" section that later versions do. So we talked about those too. Fun!