

Data Visualization

**DATA VISUALIZATION IS
COMMUNICATION**

Principles of Graphical Excellence

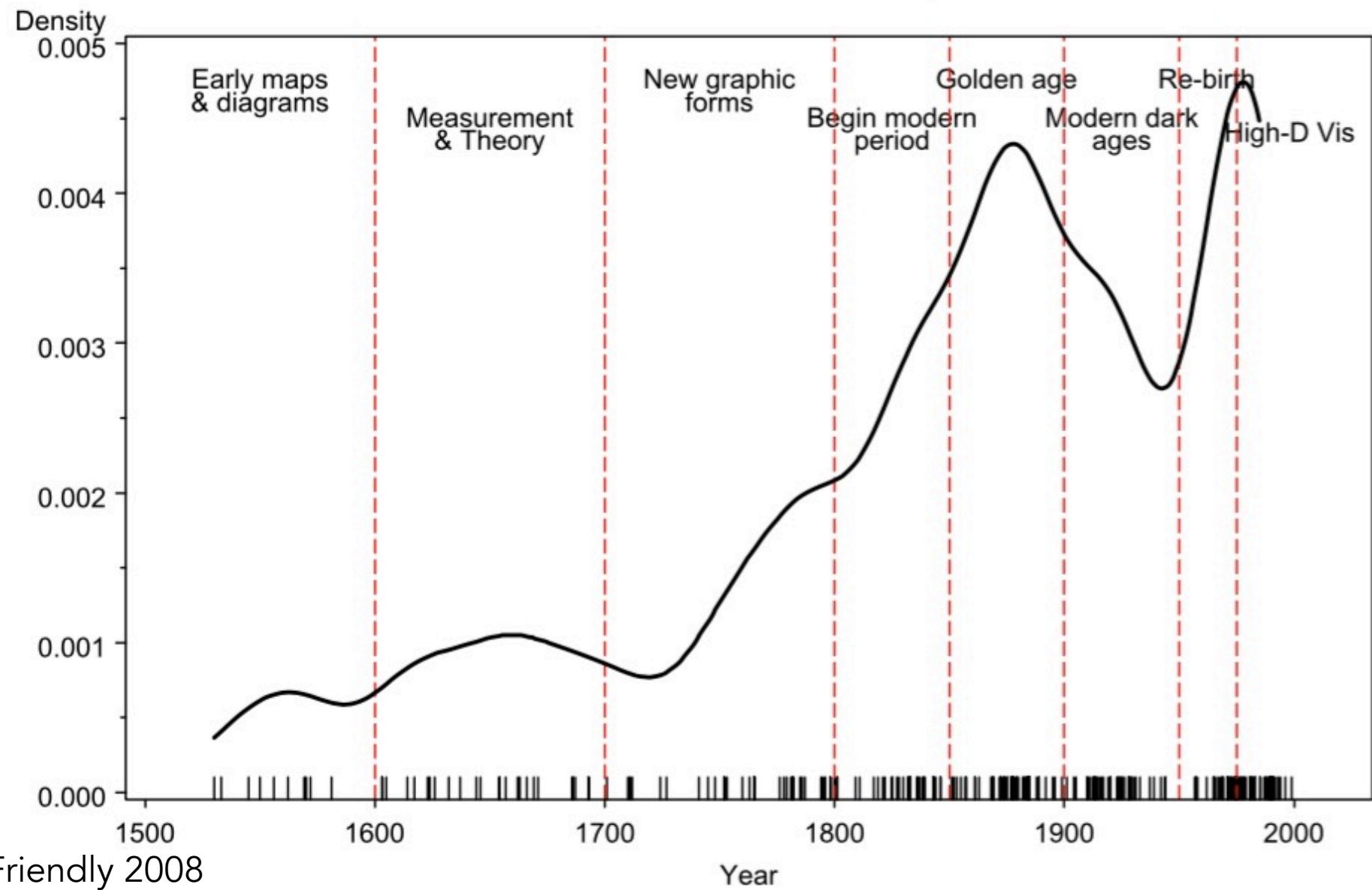
- Clarity
- Precision
- Efficiency
- Maximize ideas, minimize ink

(from Tufte)

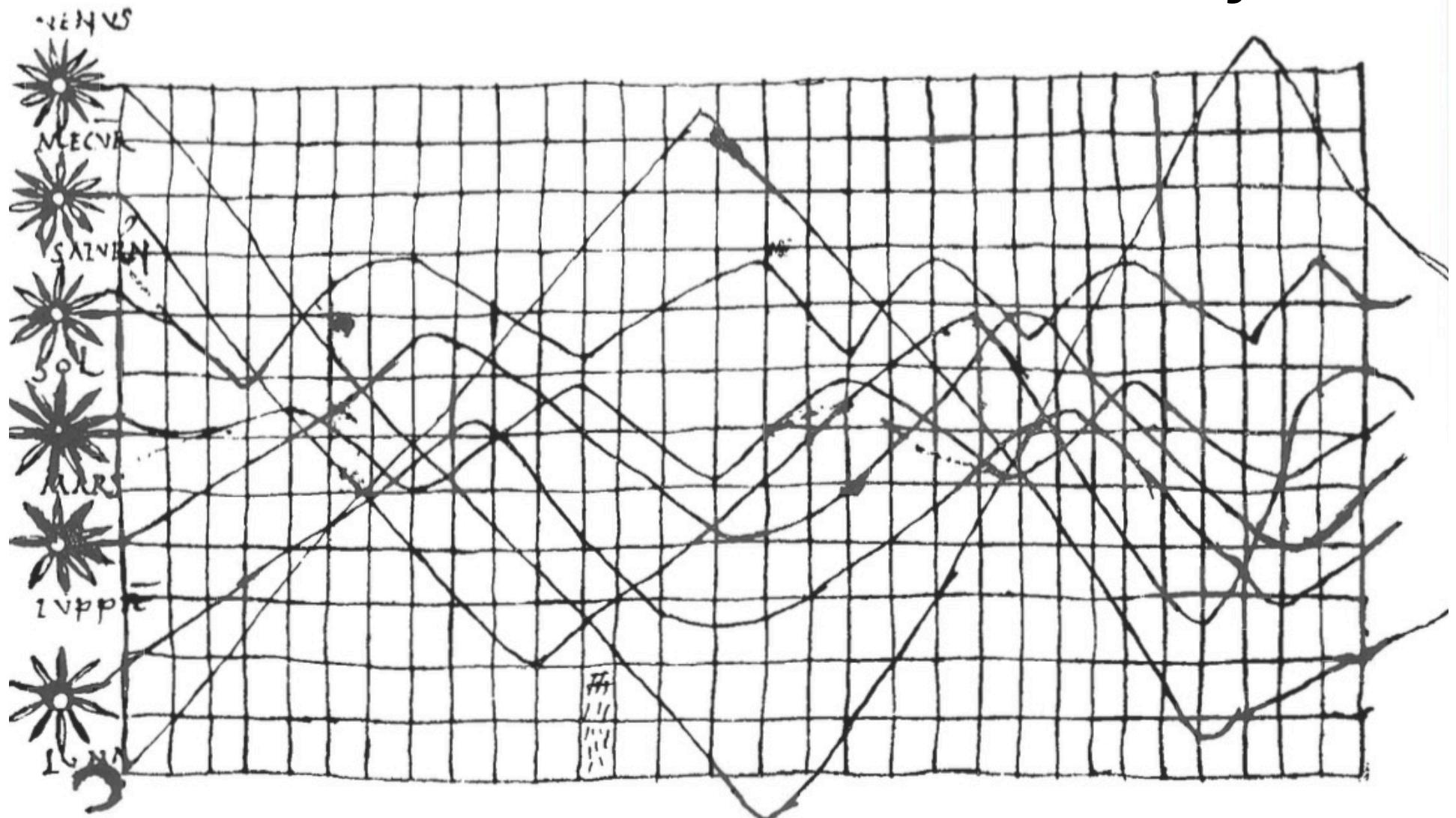
Data Viz in a Nutshell

1. History
2. Graphical Basics
3. Minimalist principles

Milestones: Time course of developments



Data Viz in the 10th Century



From Funkhouser 1936

Ecce formulam, vsum, atque

structuram Tabularum Ptolomxi, cum quibusdam locis, in
quibus studiosus Geographia se satis exercere potest.

SEPTENTRIO. pars superior.



OCCIDENS.
Sinistroramus.

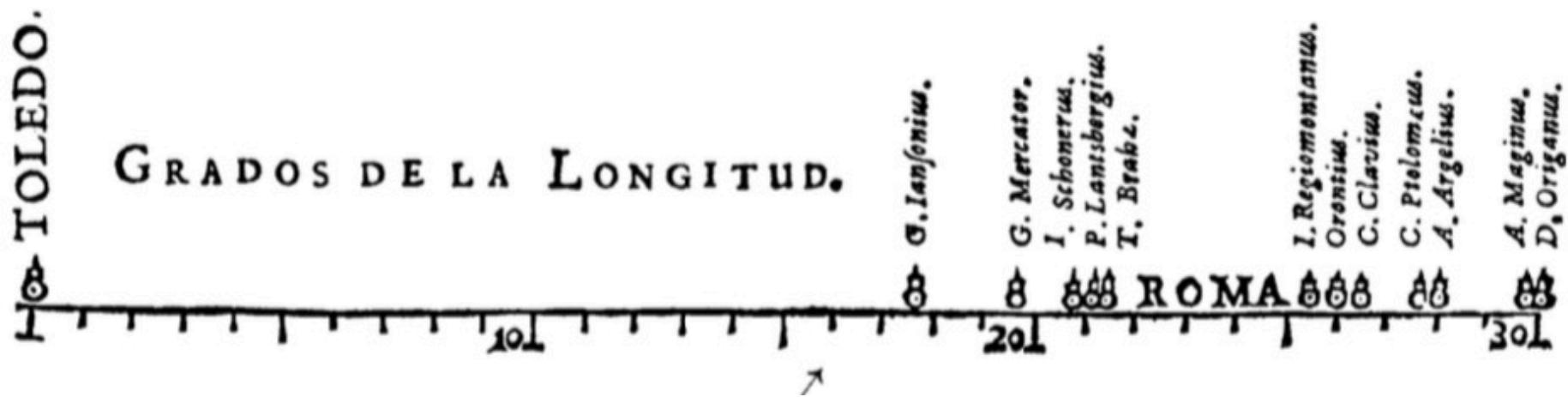
	28	29	30	31	32	33	34	35	36	37	
52										52	
51	Erfordē				Leyſtich					51	
50	Nurenberch					Praga				50	
49					Ingolſtade					49	
48	Monachū			Munichū			Vienne ch:			49	
47							Auſtriae			47	
46	Bauari									46	
	28	29	30	31	32	33	34	35	36	37	

CIRENS.
Dextroramus.

pars inferior.
MERIDIES.



Maps and Measurement Theory



Langren 1644

Maps as Rich Information Source

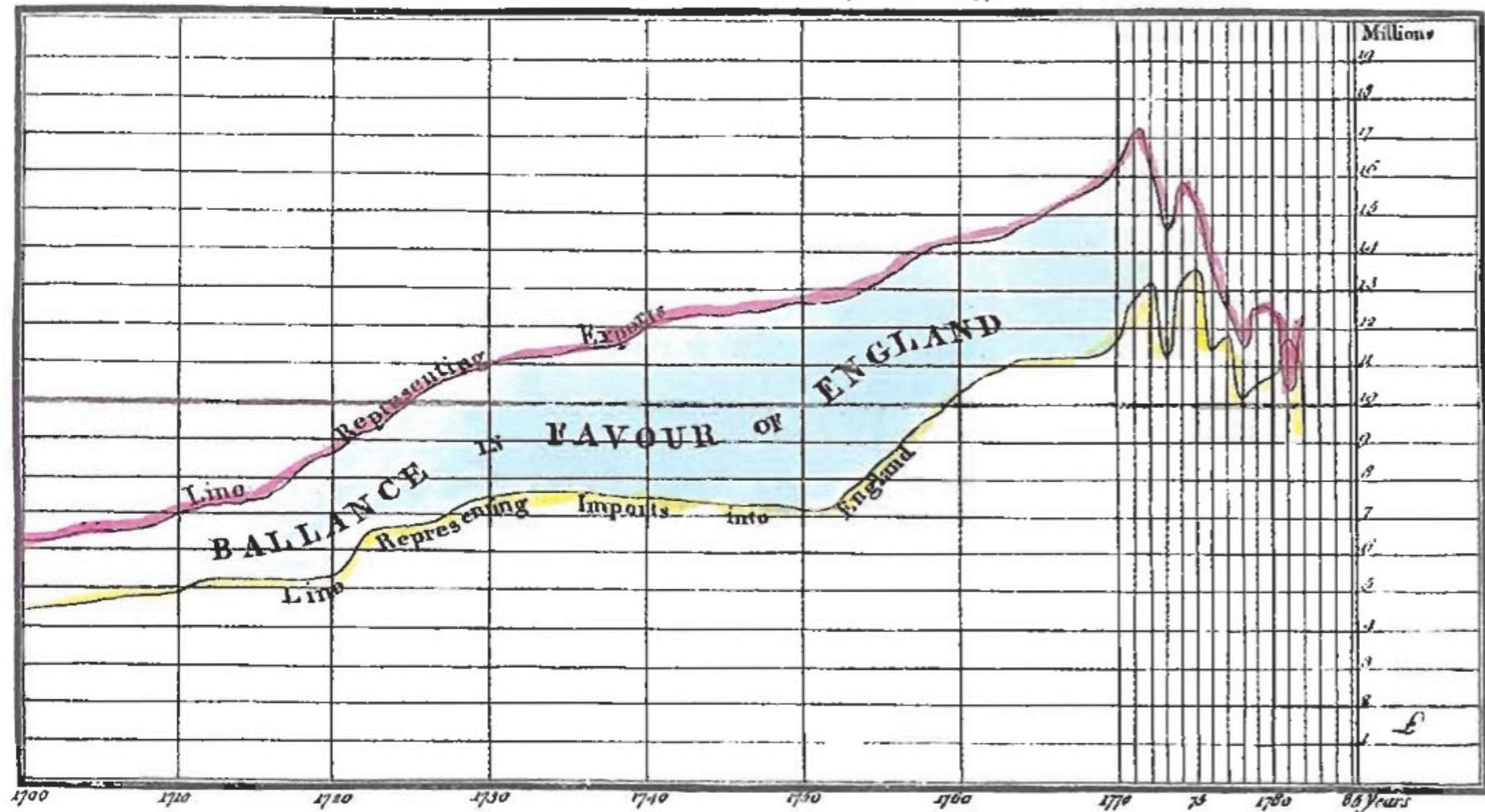


Cholera in London



John Snow 1855

*CHART of all the IMPORTS and EXPORTS to and from ENGLAND
From the Year 1700 to 1782 by W. Playfair*

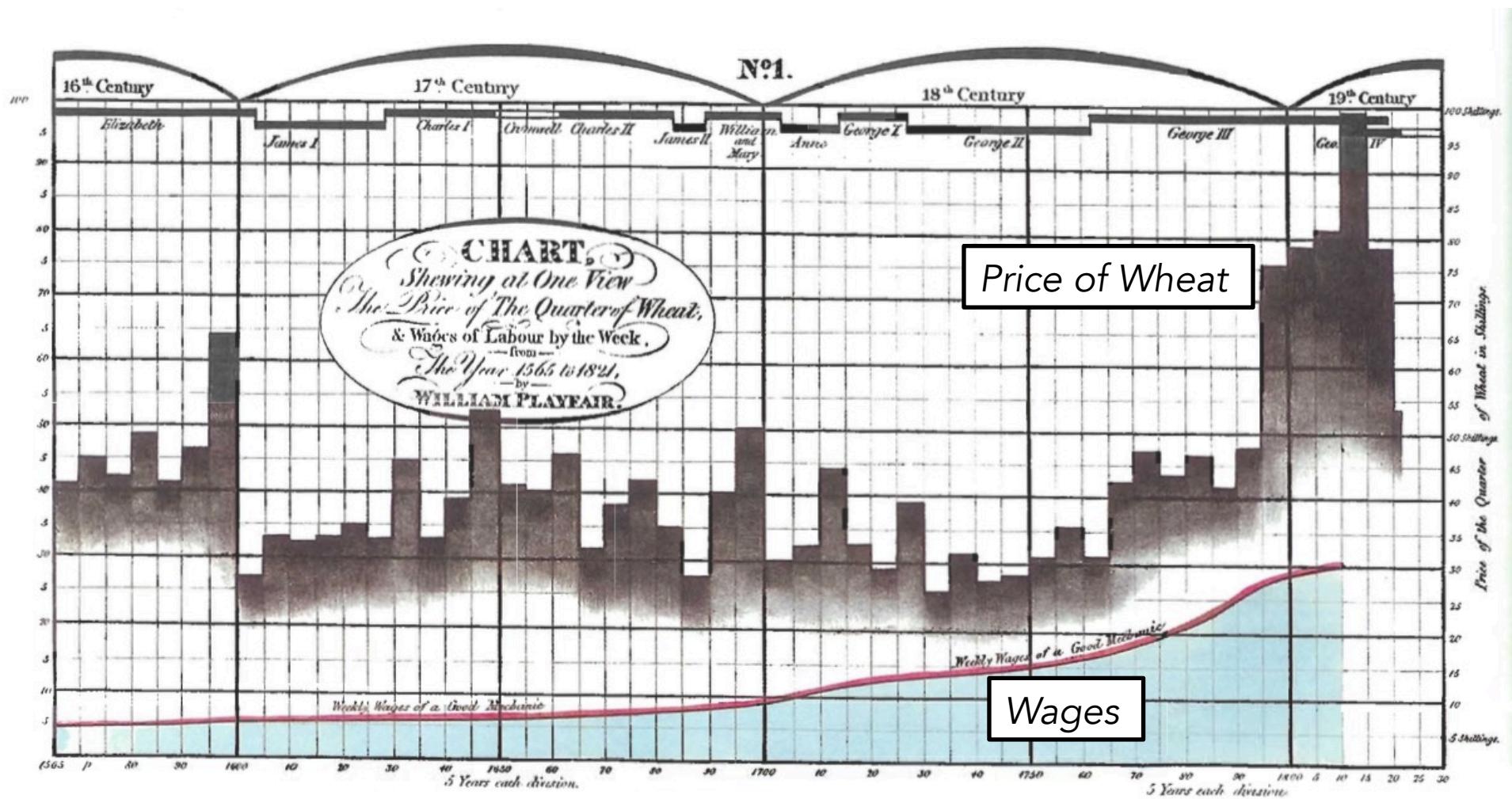


The Divisions at the Bottom, express'd YEARS, & those on the Right hand MILLIONS of POUNDS

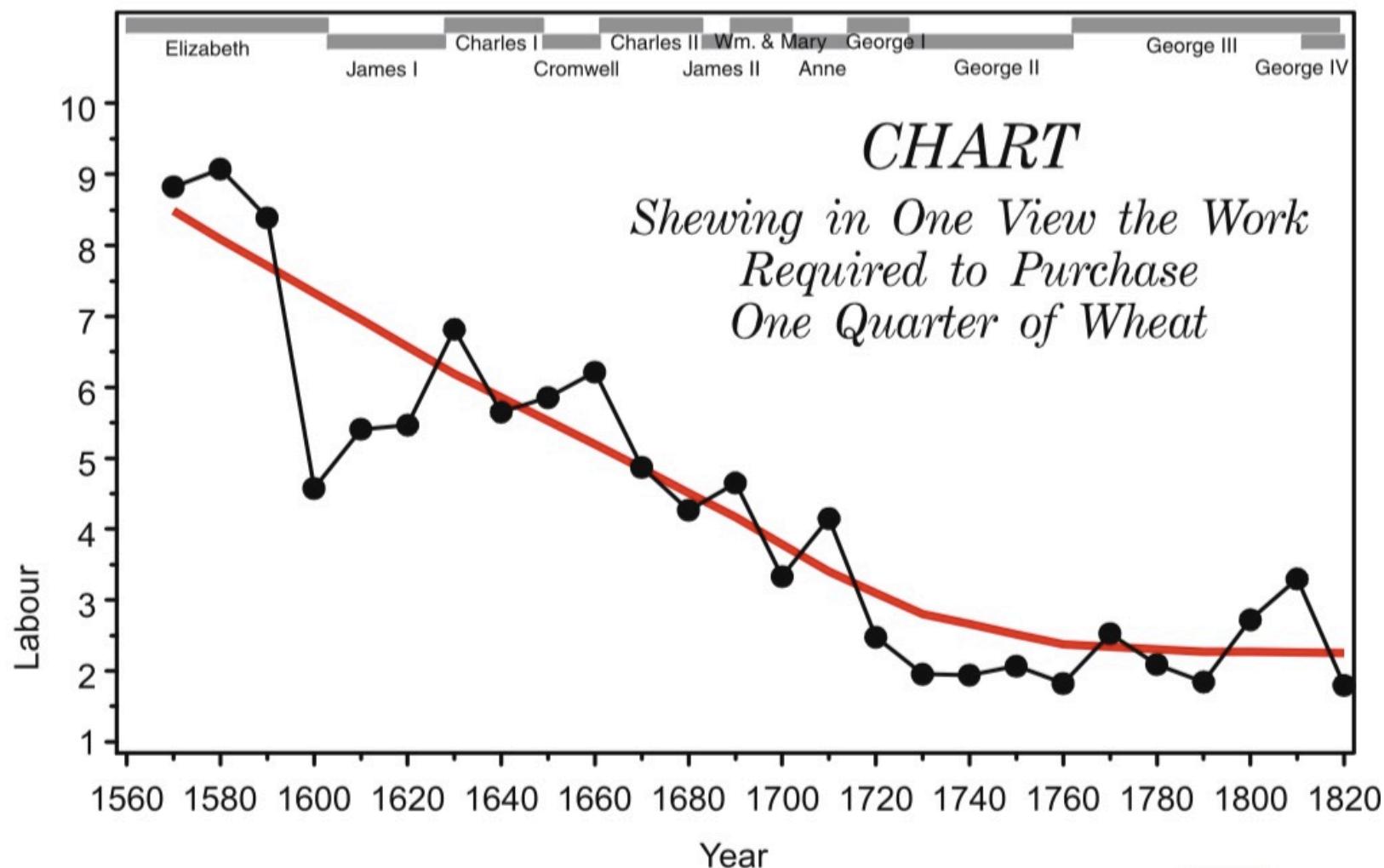
S. brasilis Staub.

Published as the Act directs. 20.th Aug. 1785.

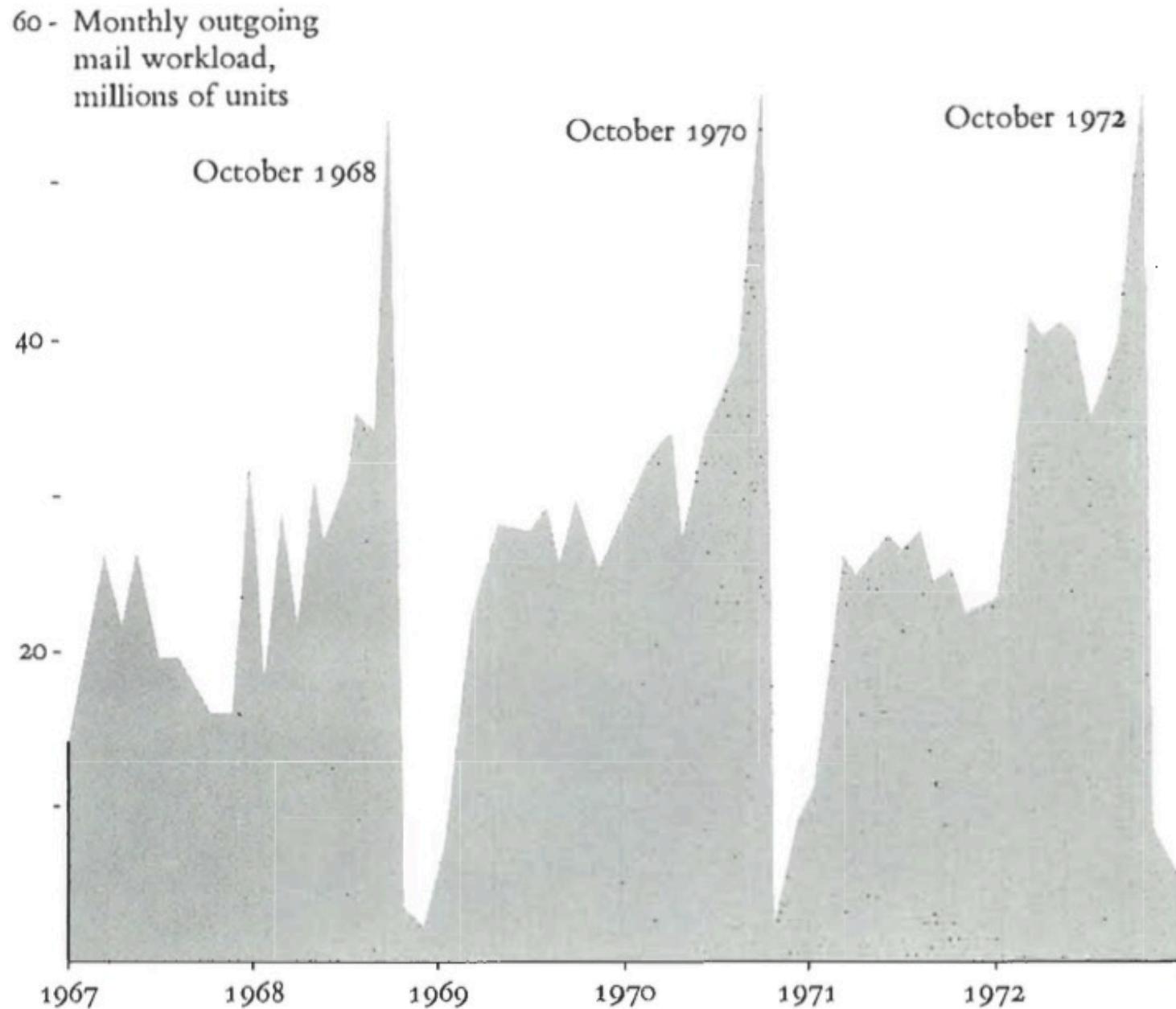
Multiple Data Sources to Make a Point



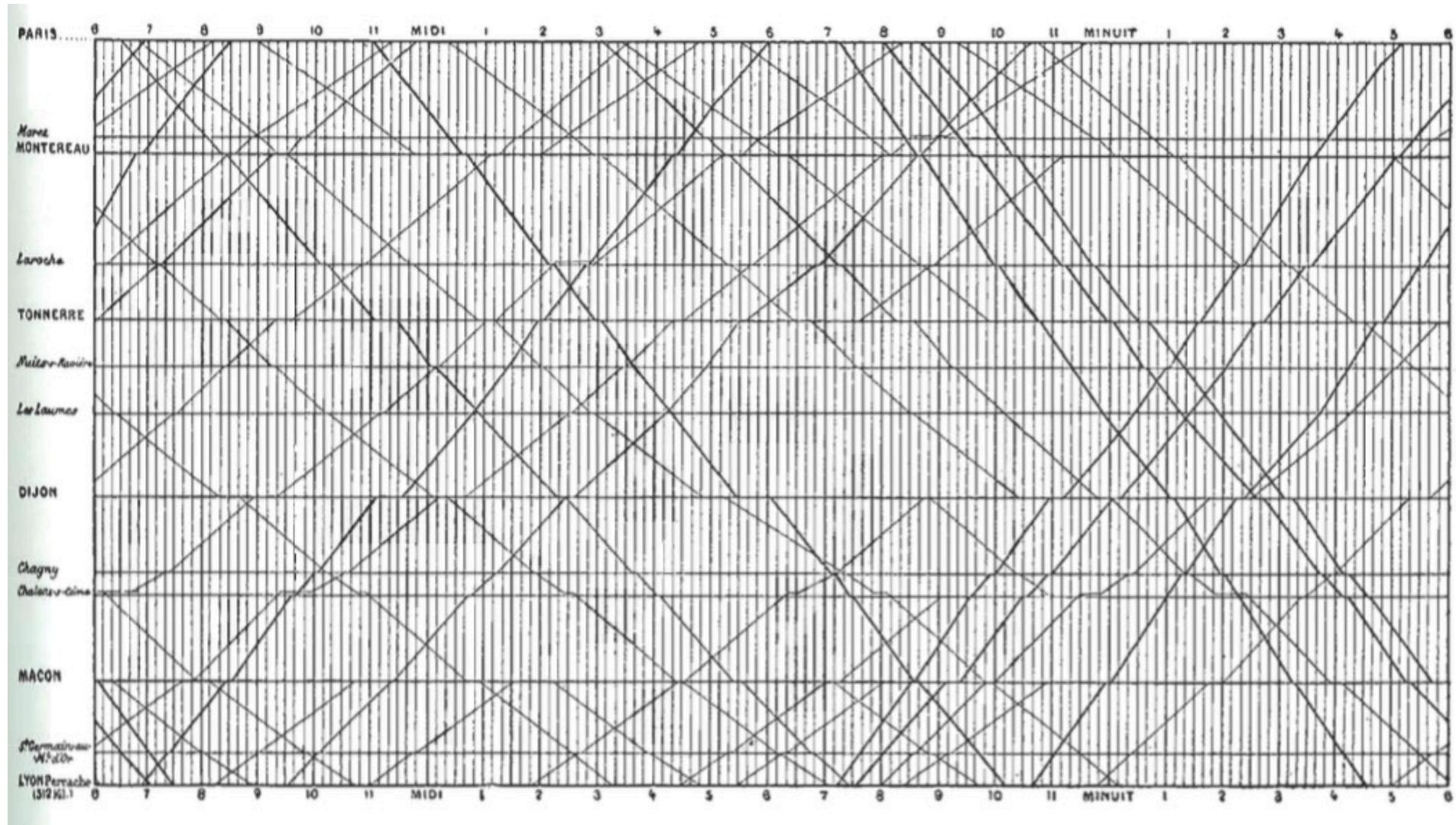
Showing Relationships Helps Comprehension



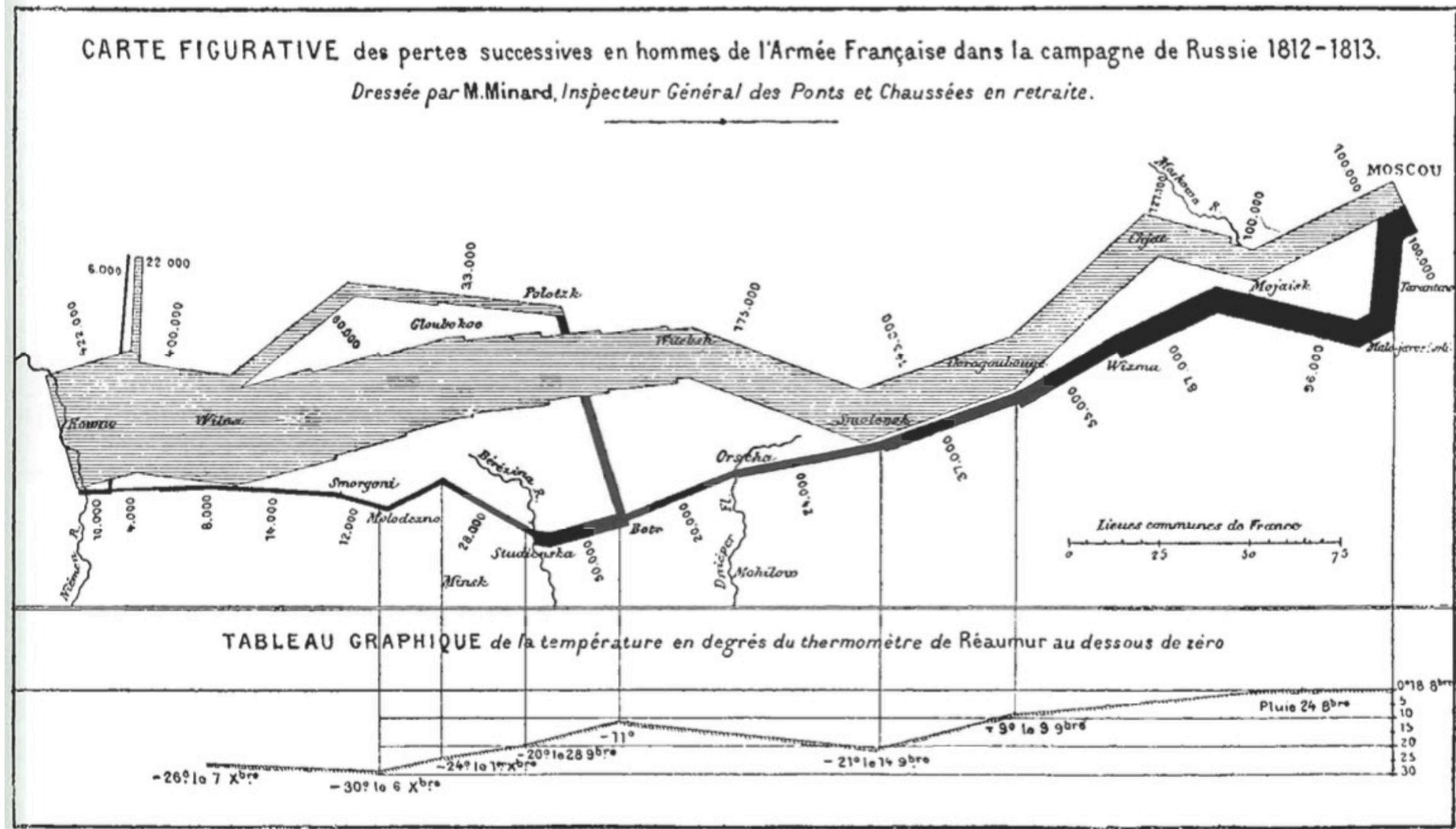
Sometimes One Variable is Enough



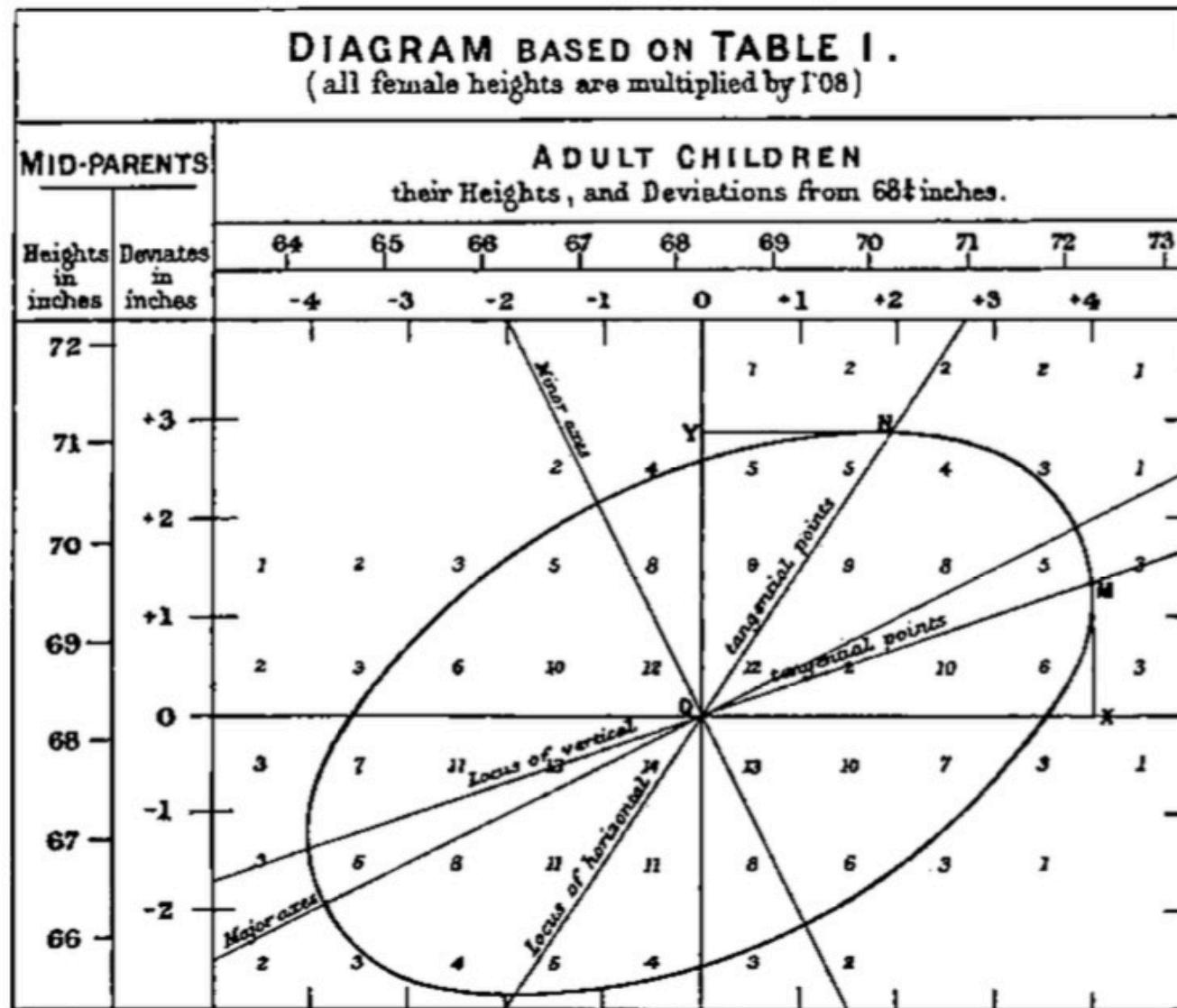
Adding Space to Time



Unifying Maps and Timeseries

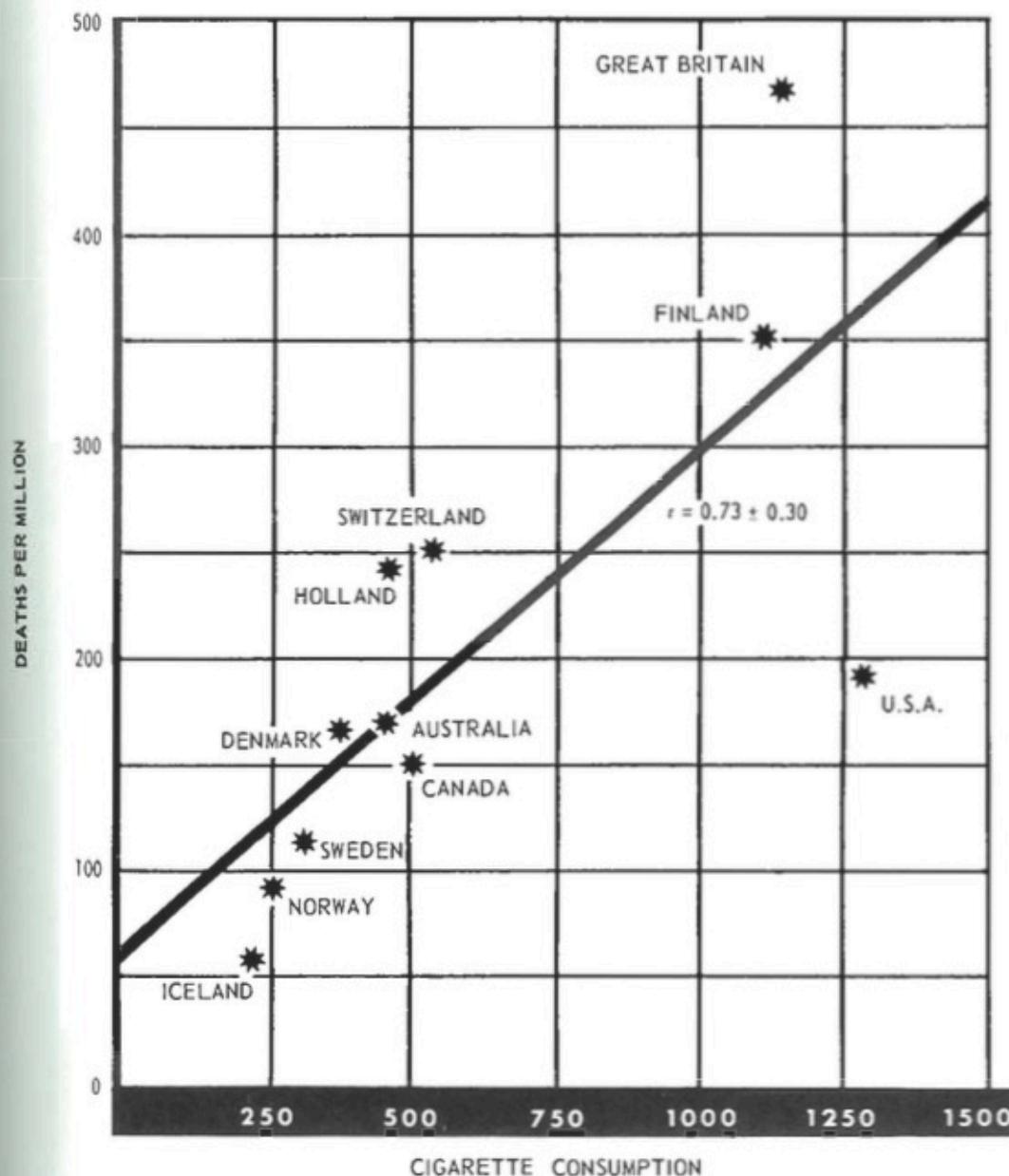


Understanding Relationships

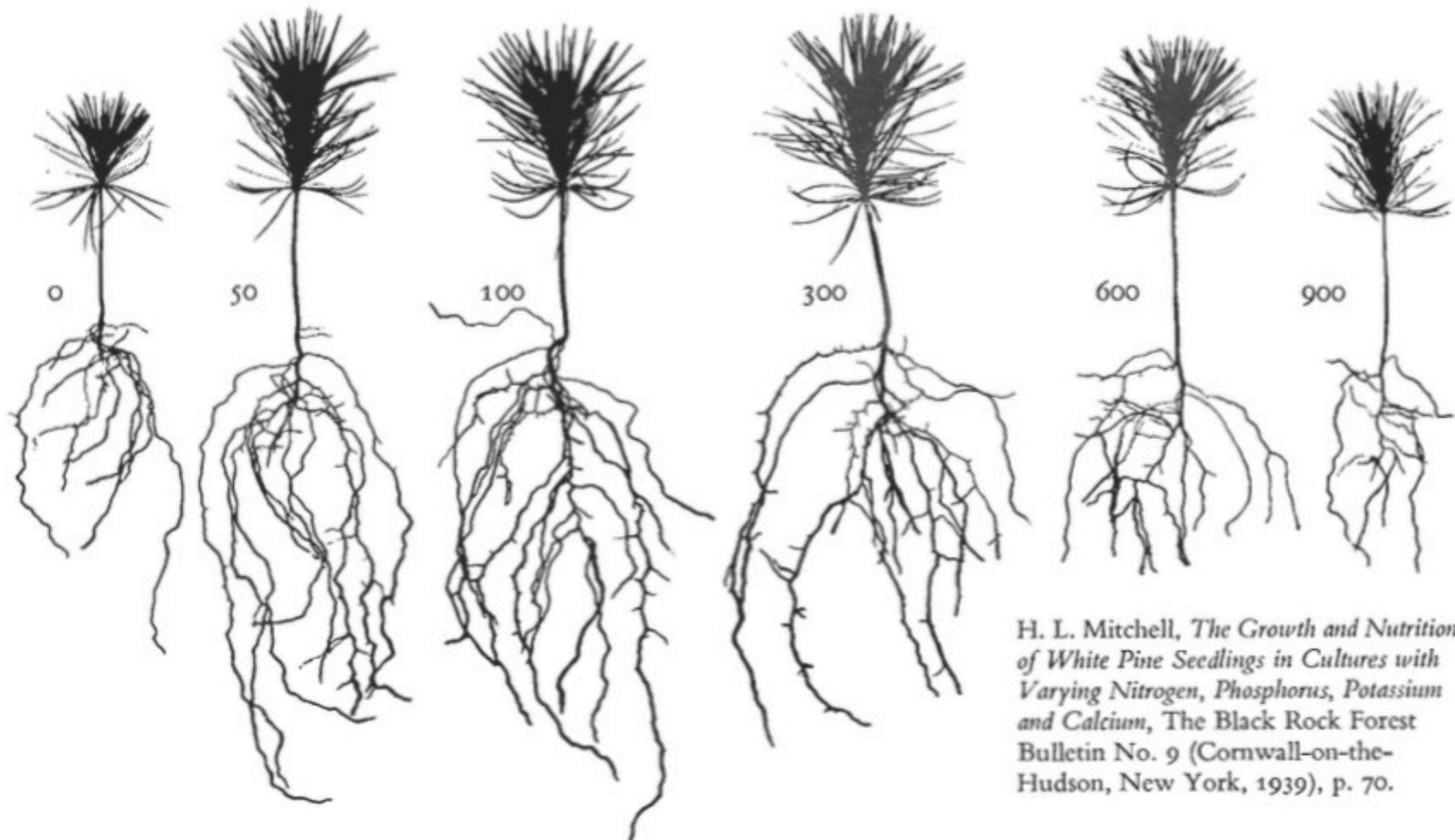


Galton 1886

CRUDE MALE DEATH RATE FOR LUNG CANCER
IN 1950 AND PER CAPITA CONSUMPTION OF
CIGARETTES IN 1930 IN VARIOUS COUNTRIES.



Abstraction Can Tell Wonderful Stories



H. L. Mitchell, *The Growth and Nutrition of White Pine Seedlings in Cultures with Varying Nitrogen, Phosphorus, Potassium and Calcium*, The Black Rock Forest Bulletin No. 9 (Cornwall-on-the-Hudson, New York, 1939), p. 70.

Data Viz in a Nutshell

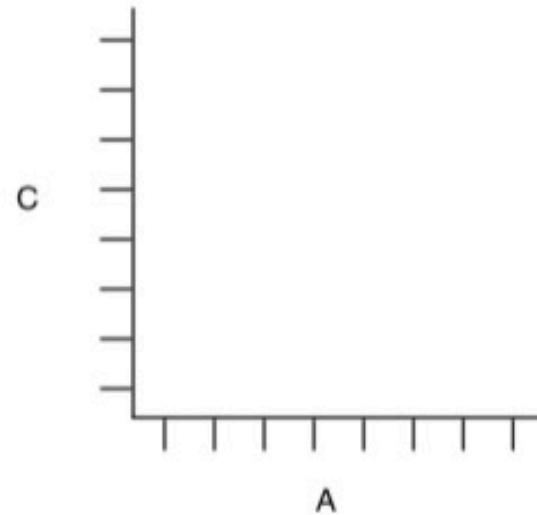
1. History
2. Graphical Basics
3. Minimalist principles

Elements of a Plot

Geometric Objects



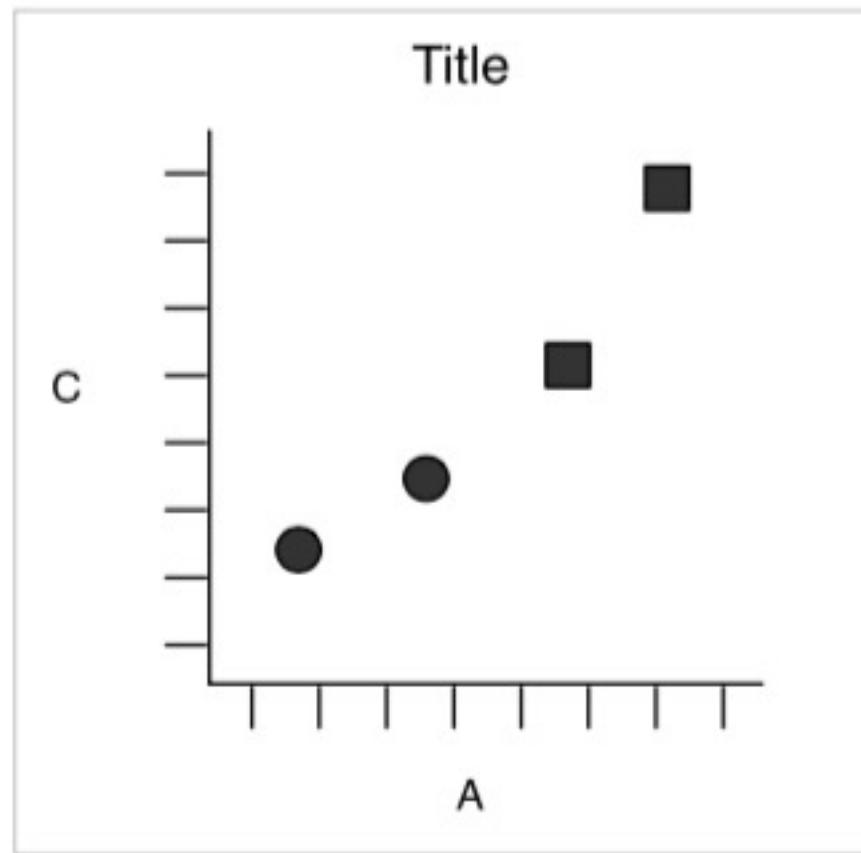
Scales & Coordinates



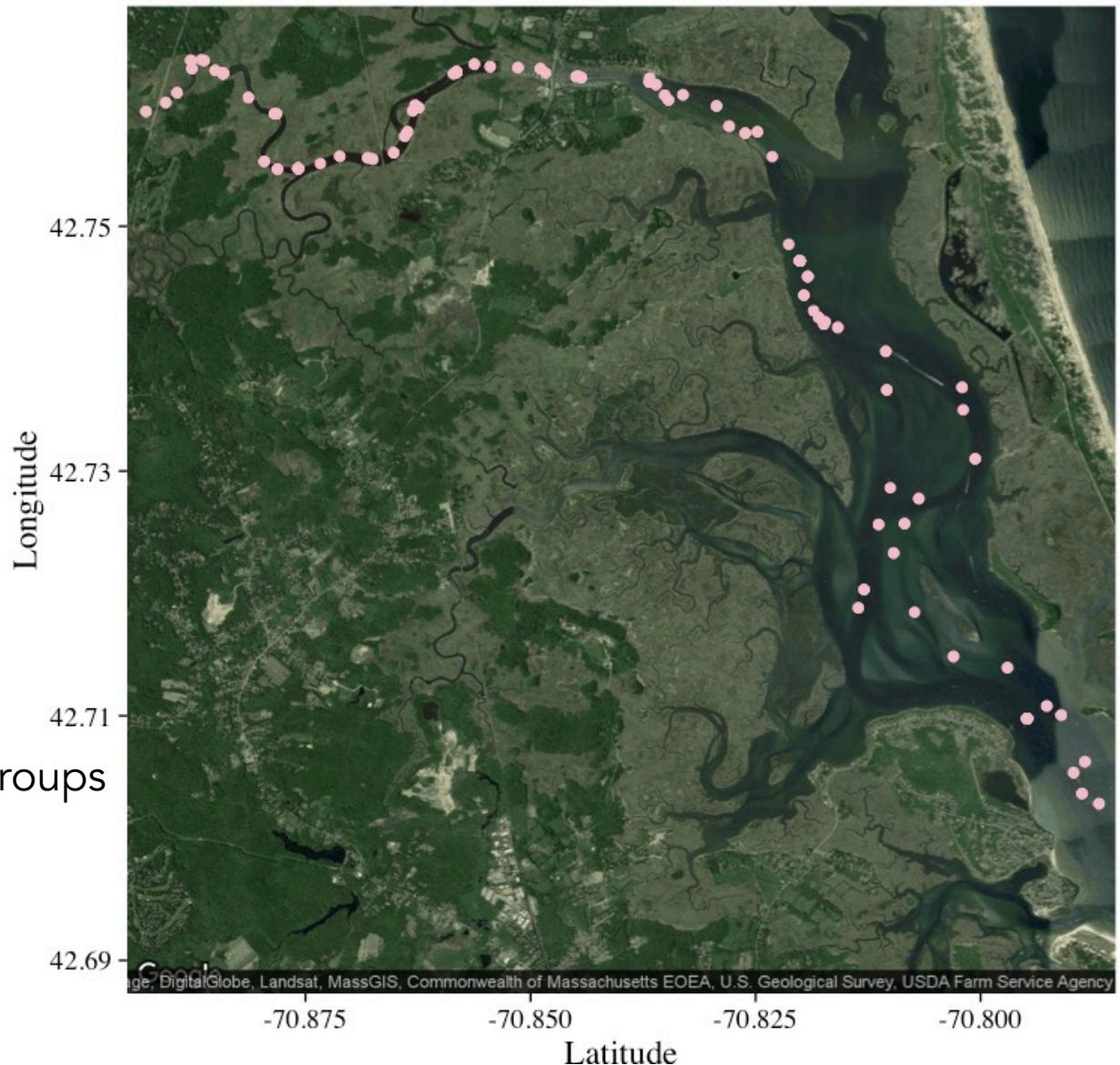
Annotations



Elements of a Plot

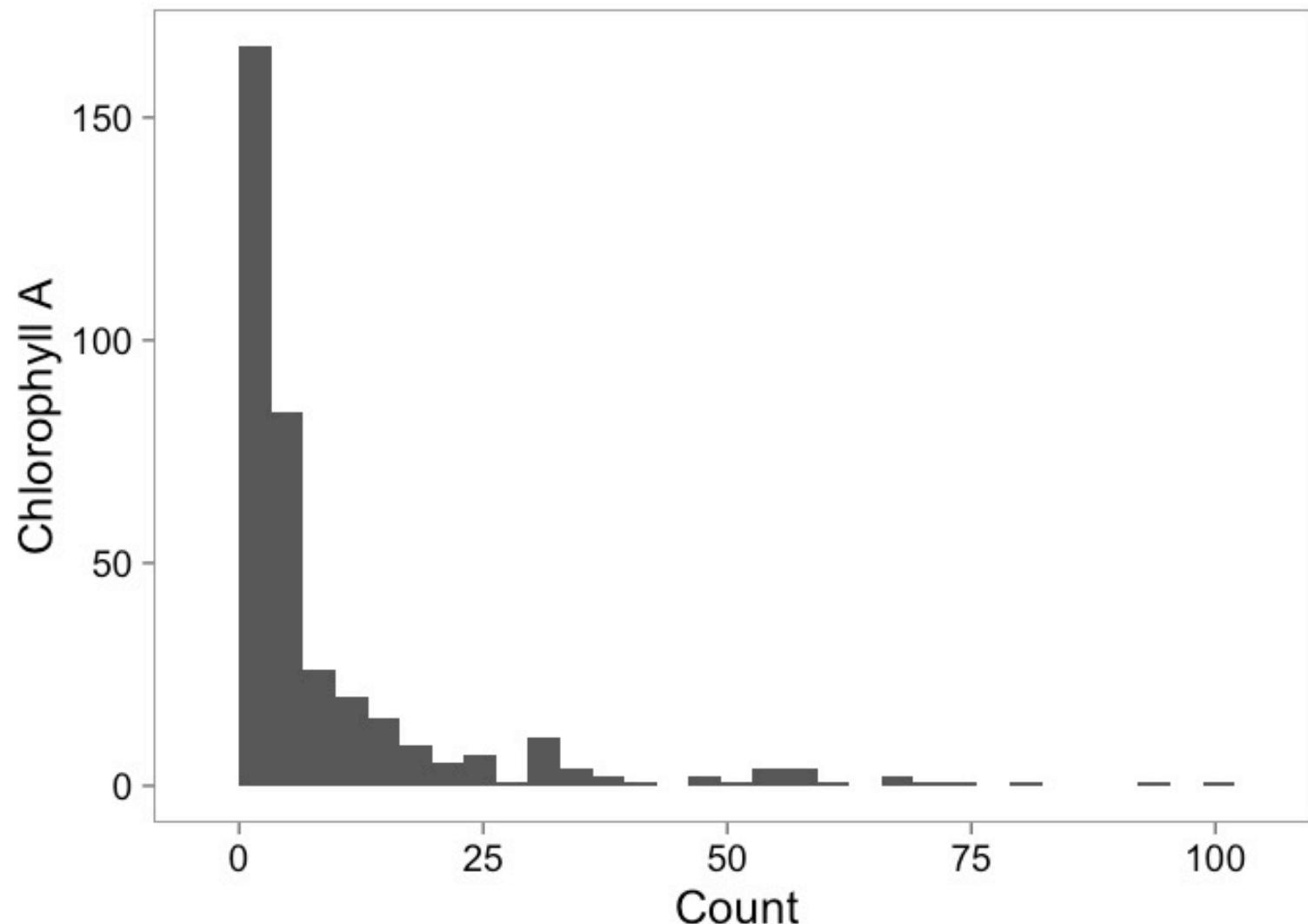


Plankton Data from Plum Island

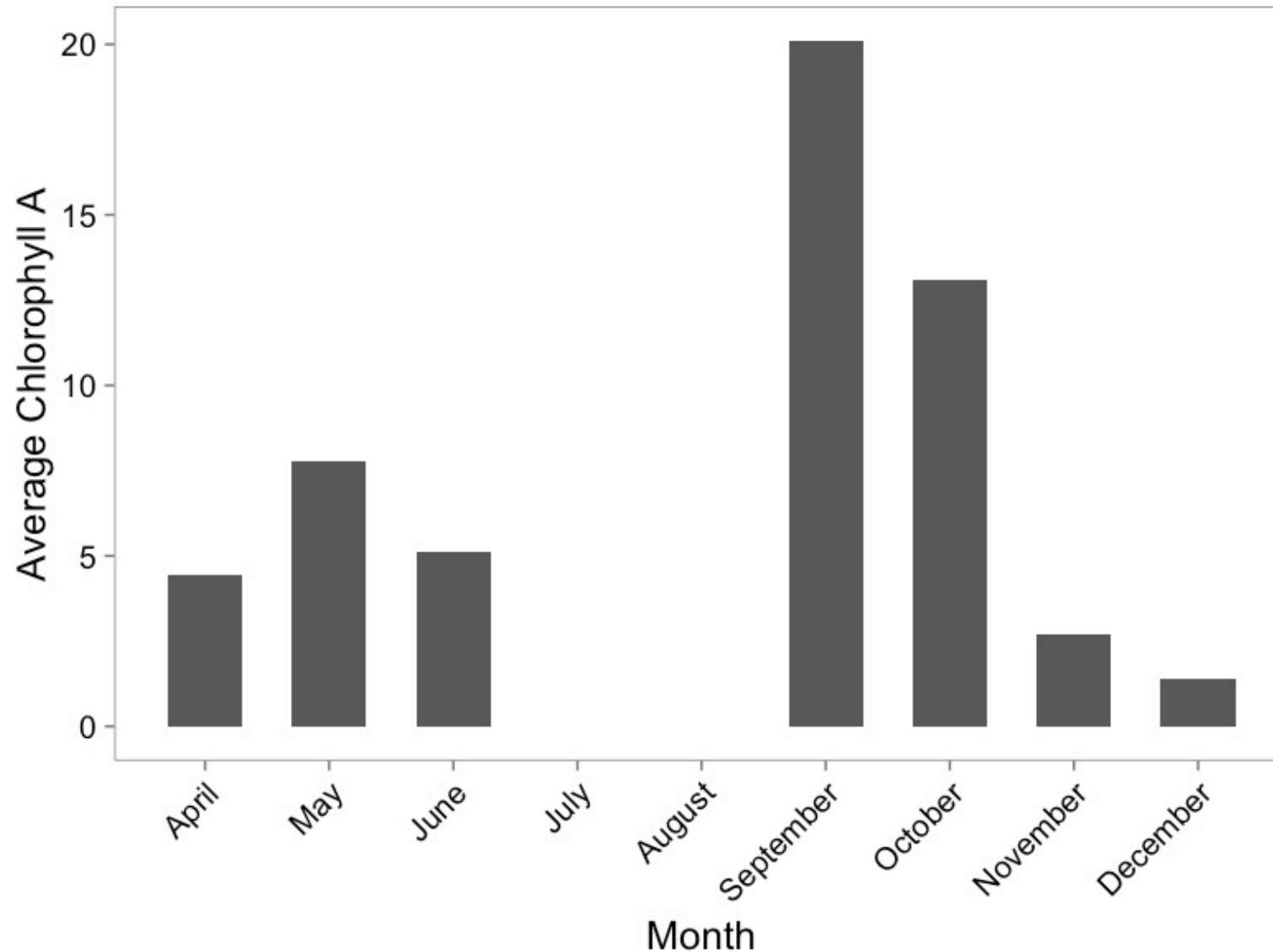


- Chlorophyll a
- Abundance of taxonomic groups
- Temperature
- Salinity

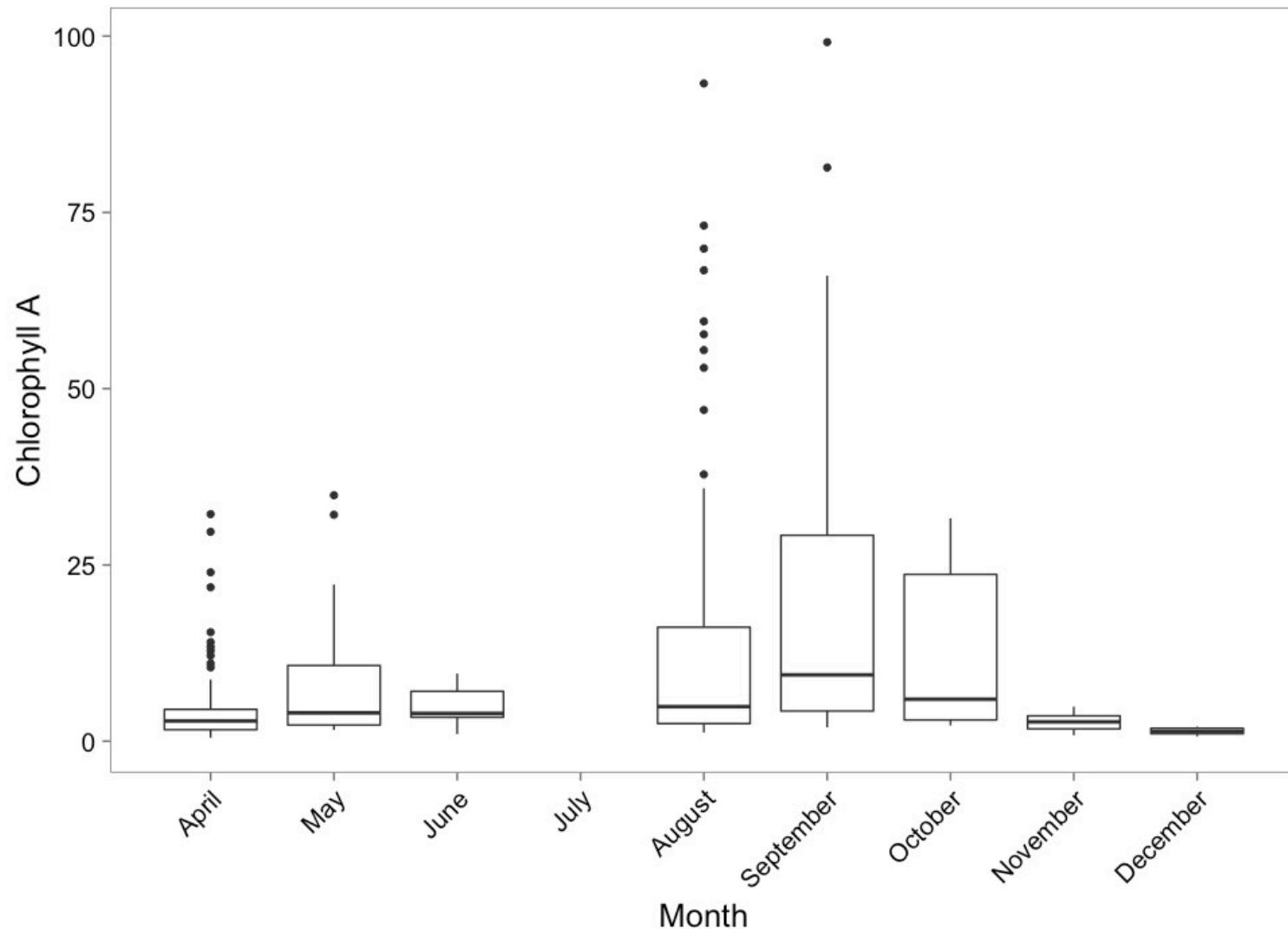
Histograms Show Frequency



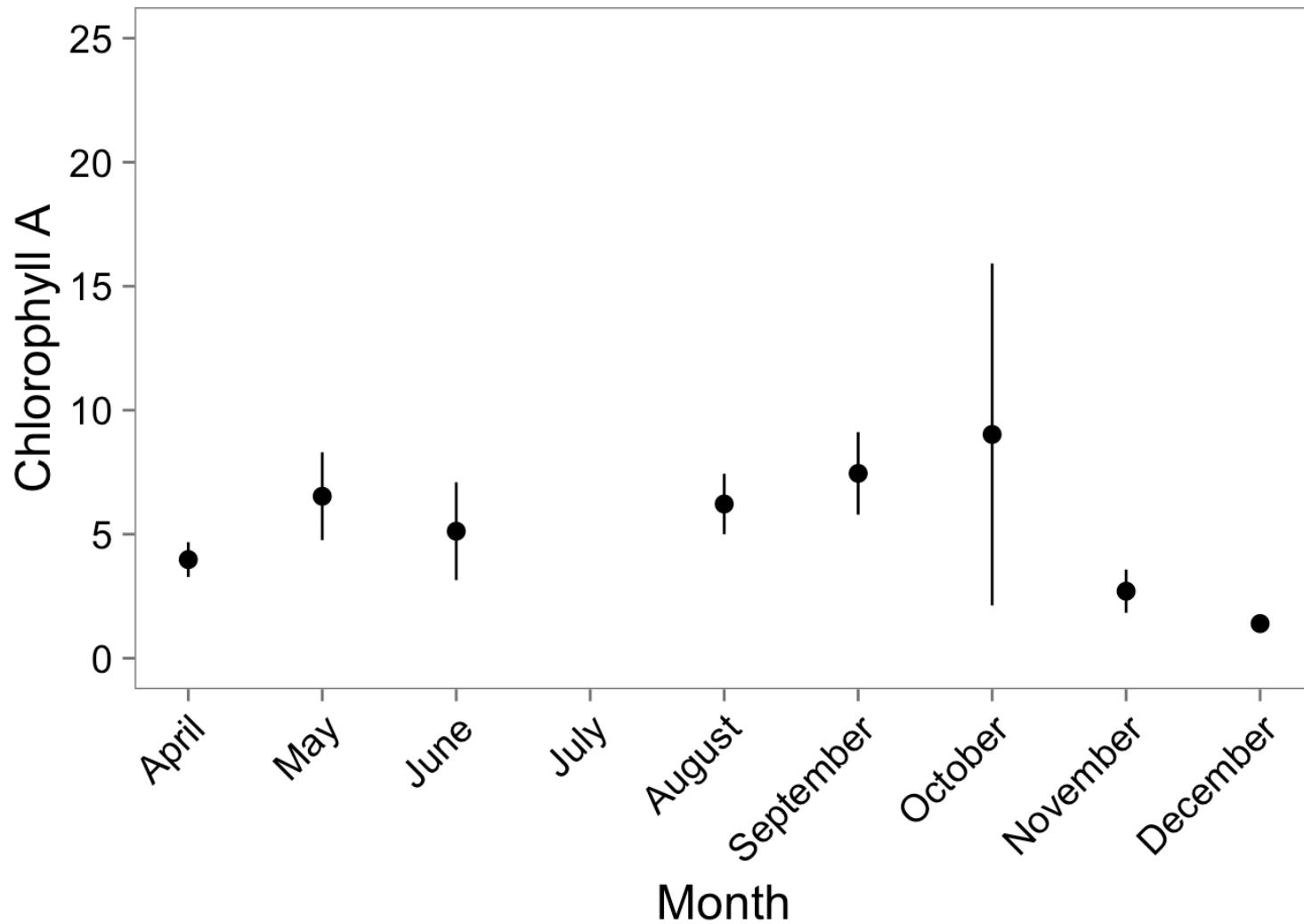
Barplots for Summarized Data



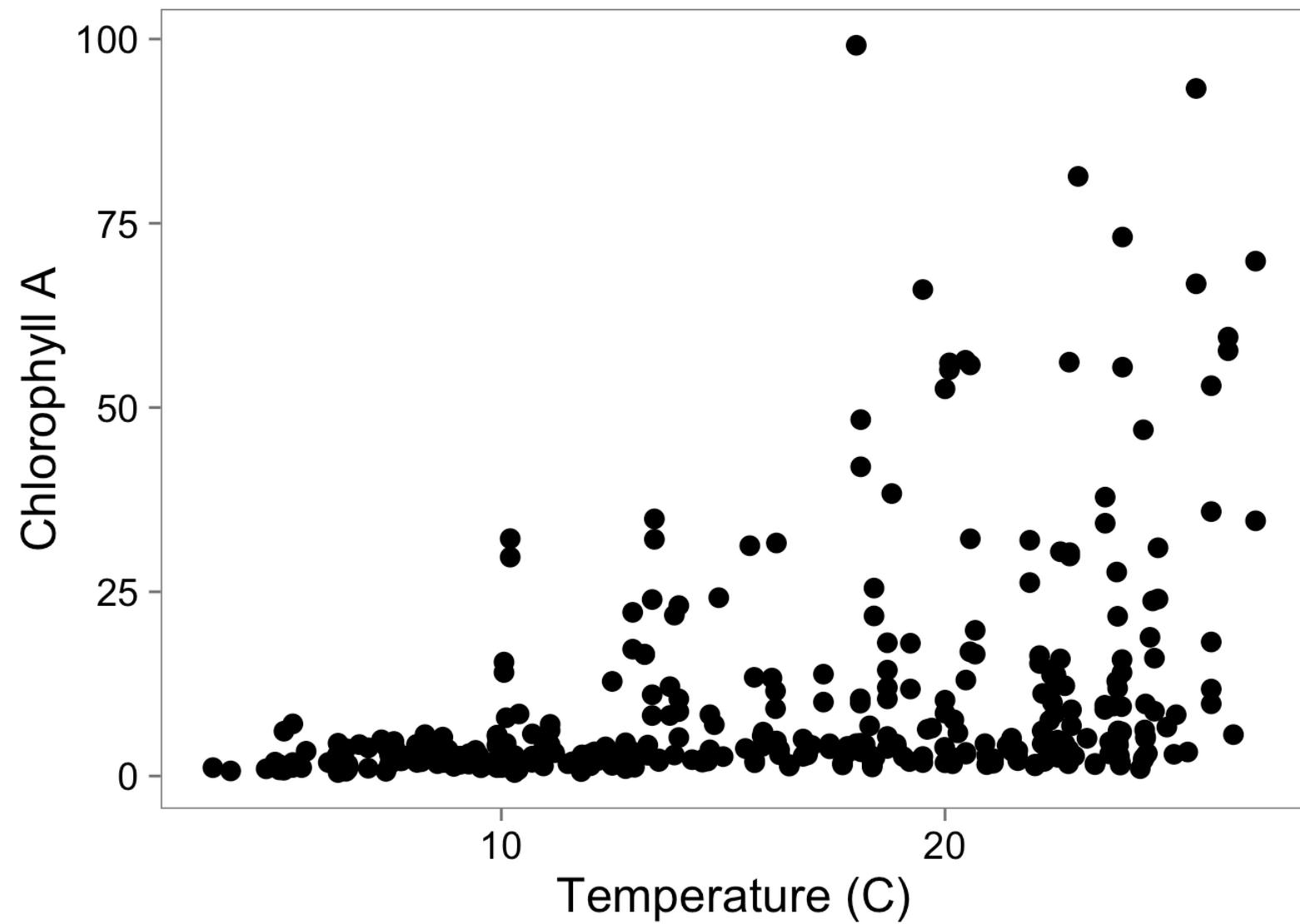
Boxplots to Show Variation



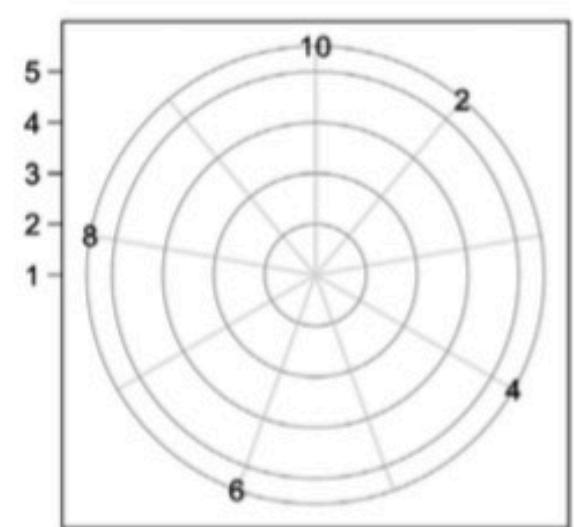
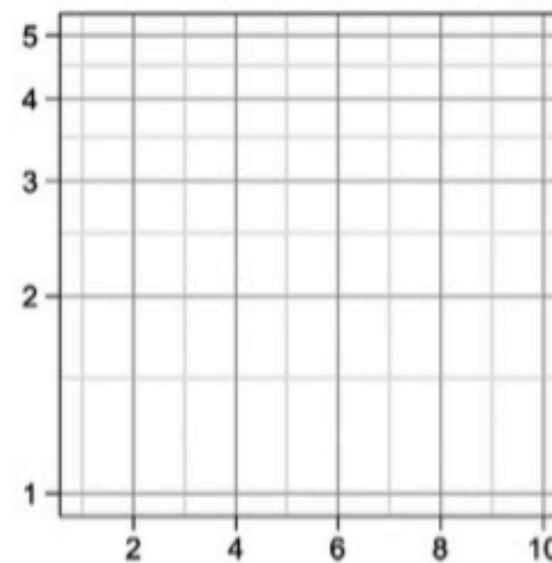
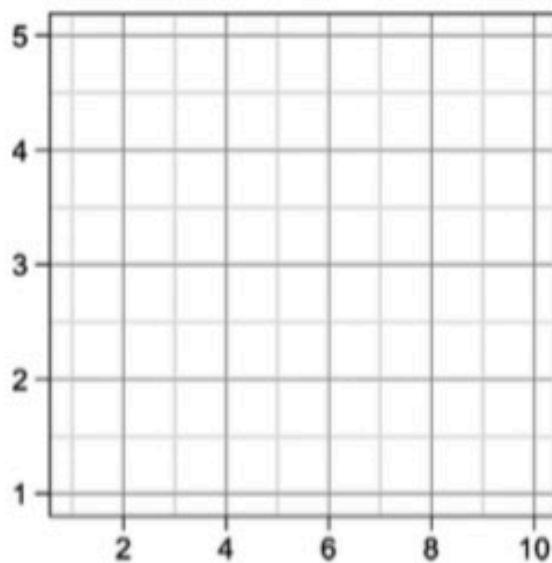
...Or Point-Ranges



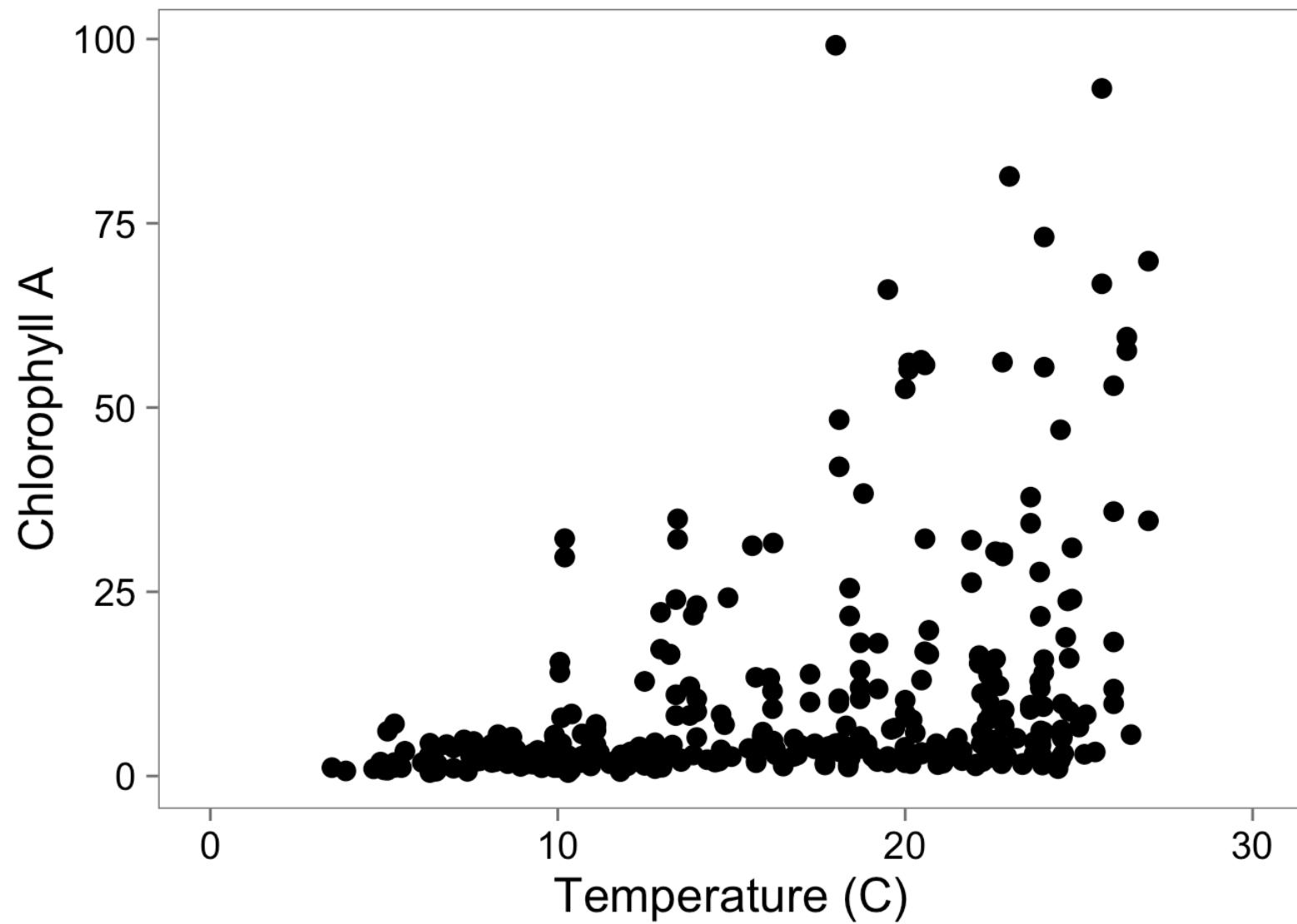
Scatterplots Show Relationships



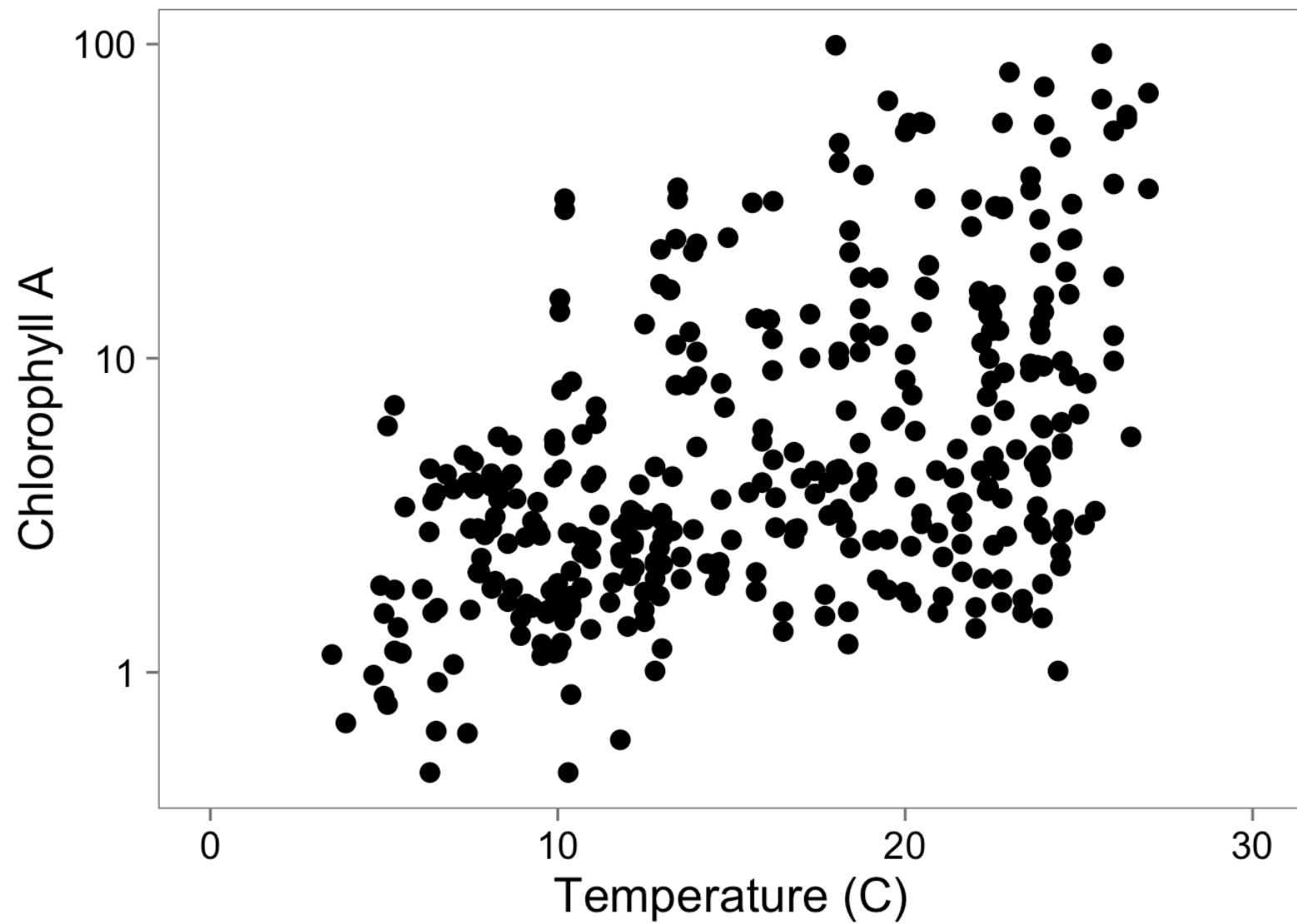
Coordinate Systems Transform Relationships



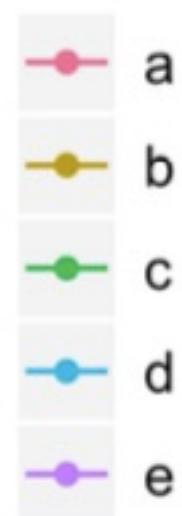
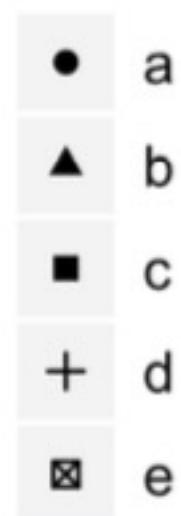
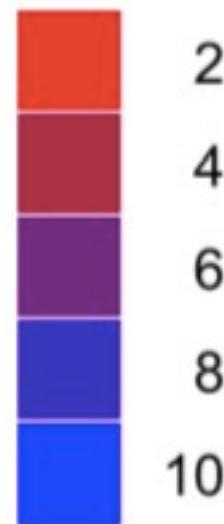
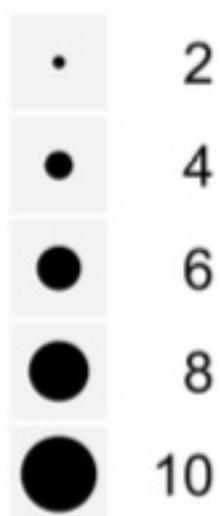
Adding Full Scale to 0



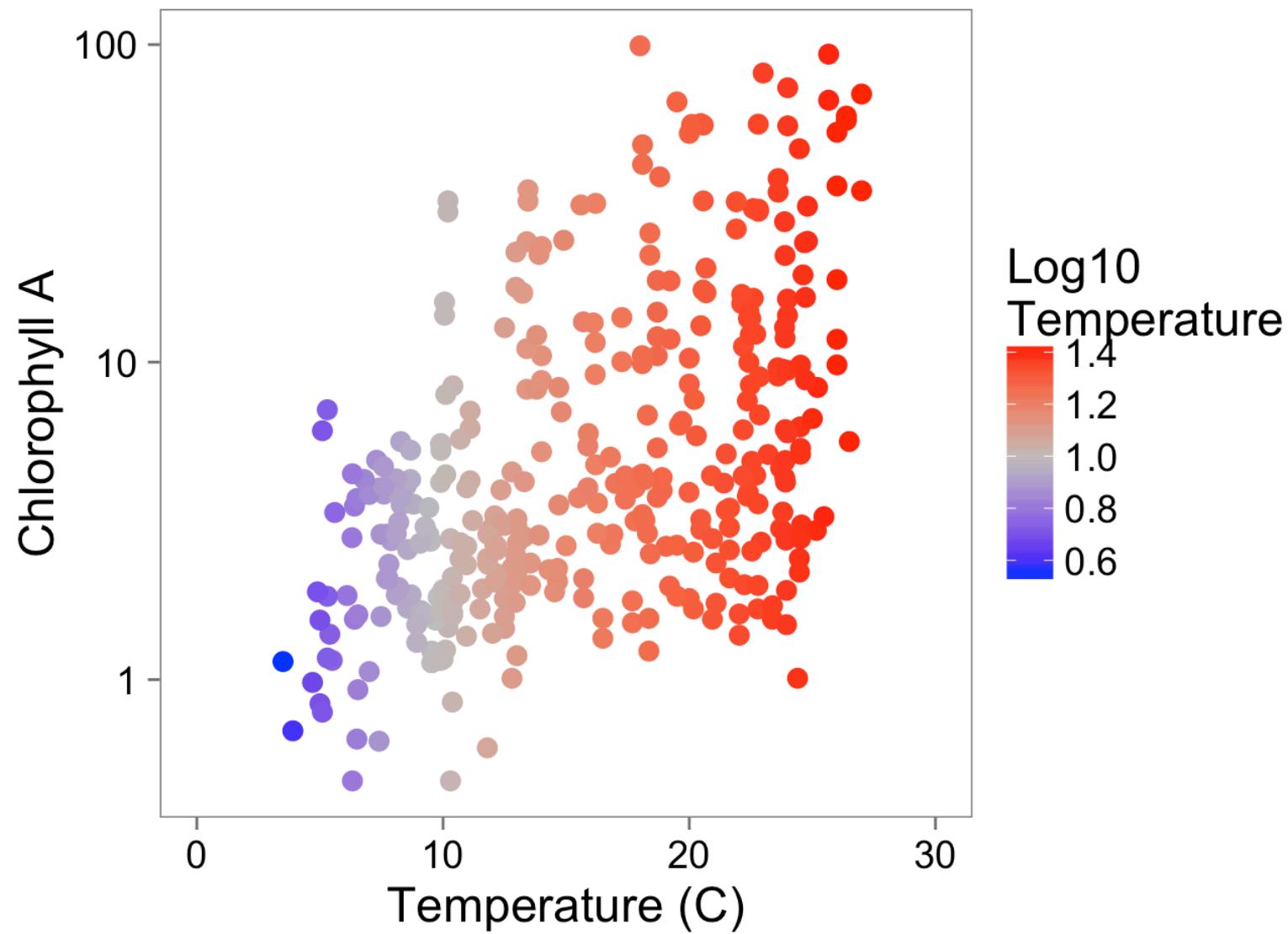
Log-Transformation To See Relationship



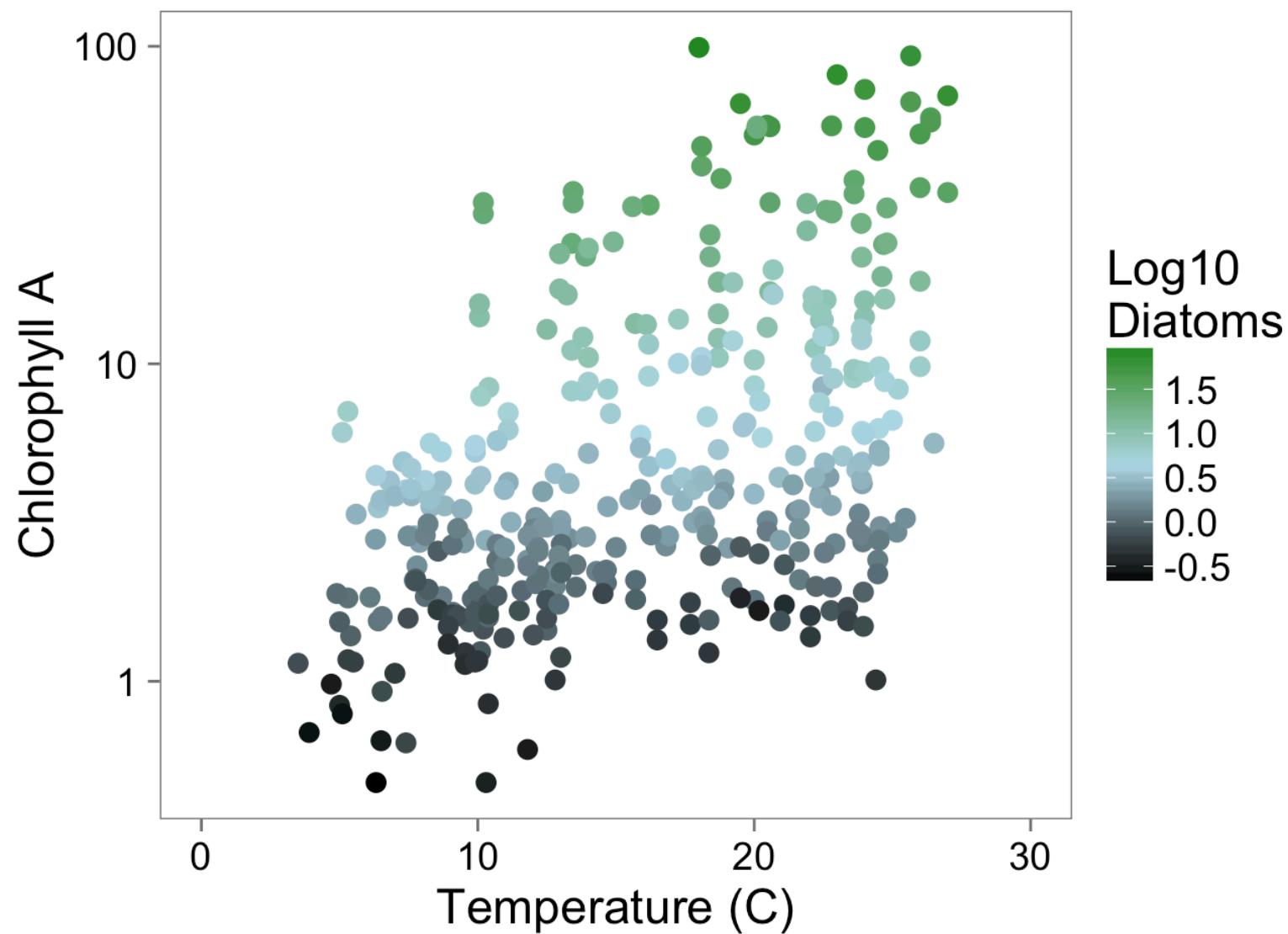
Scales to Add Dimensions of Data



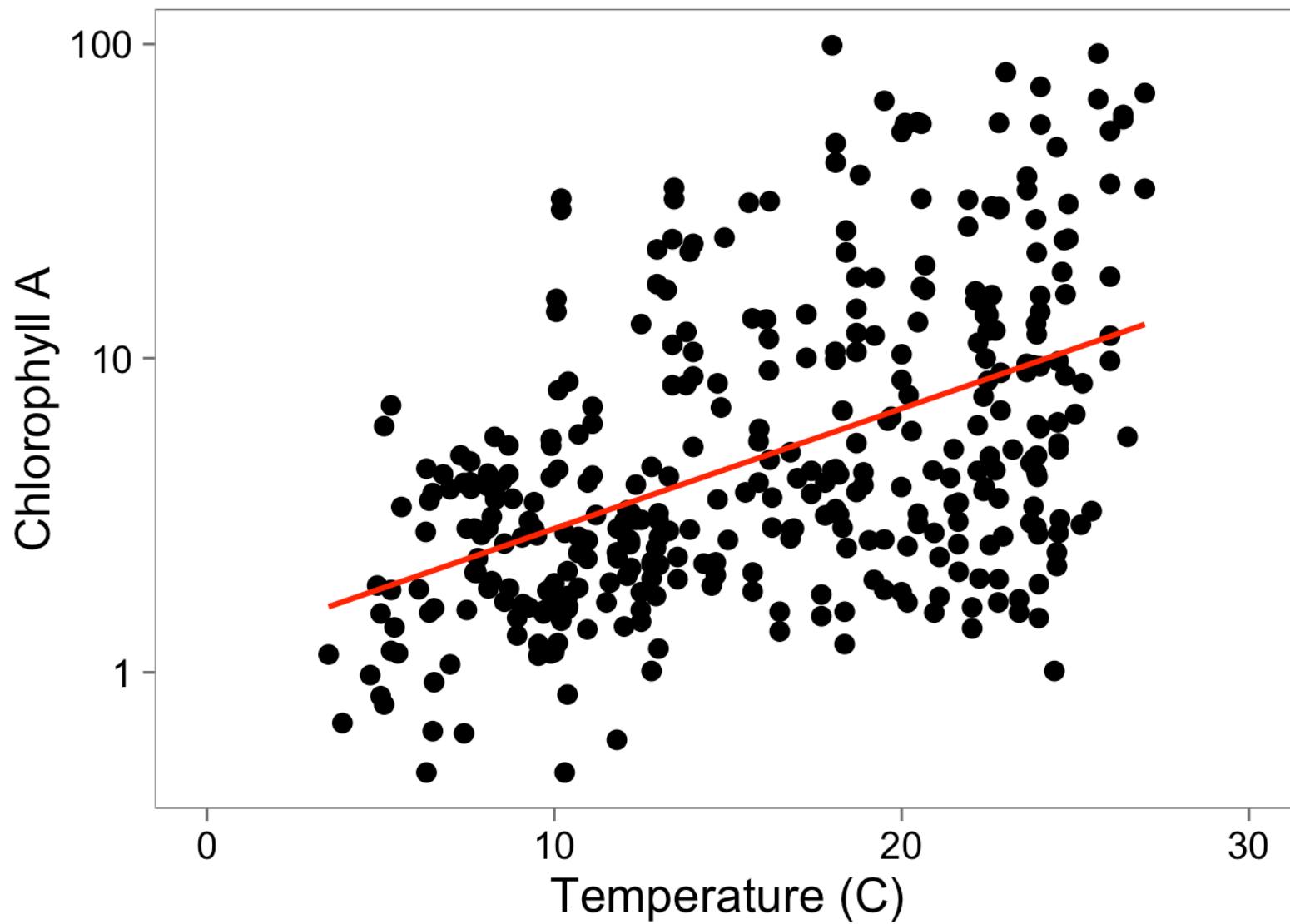
A Touch of Color!



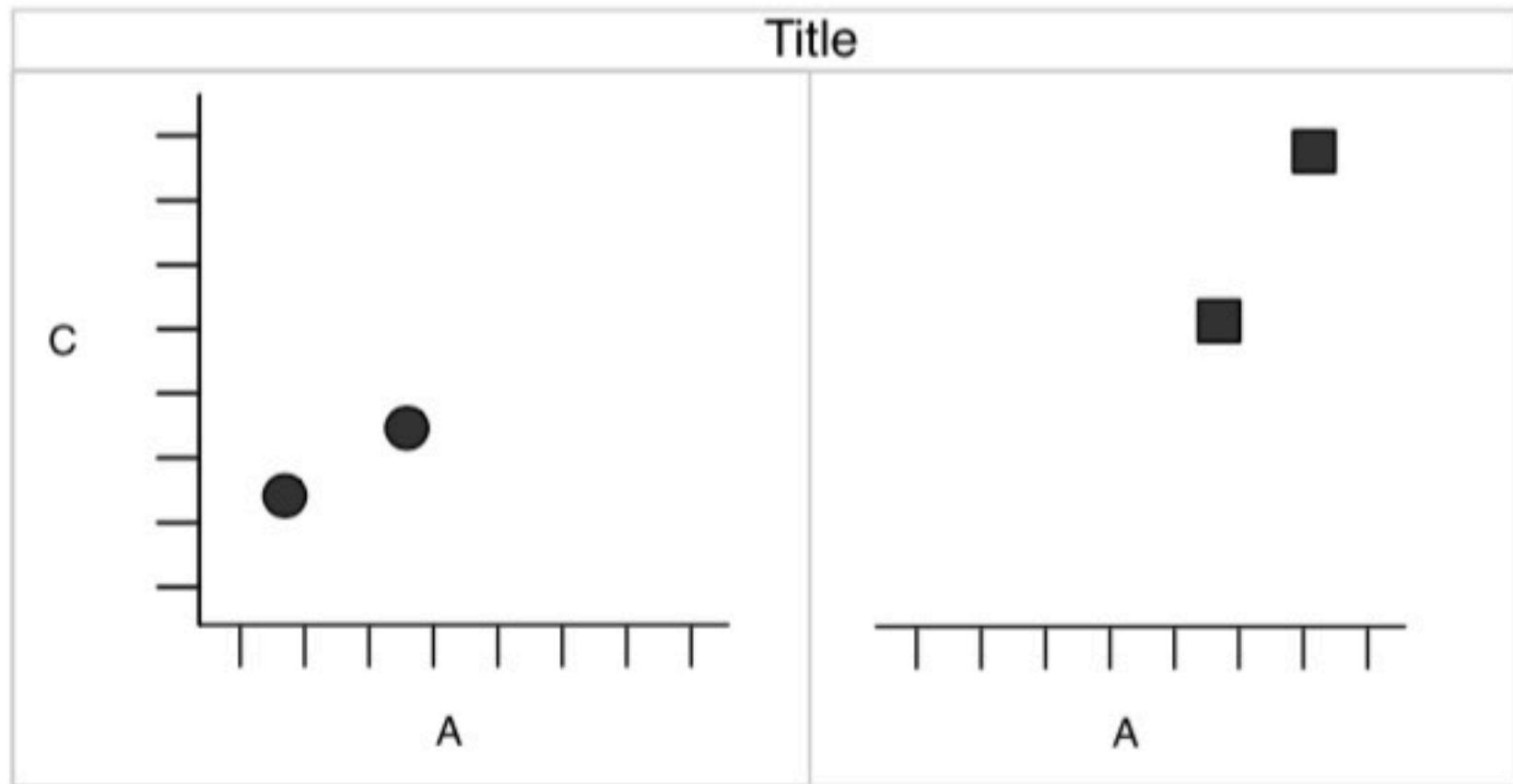
Color Can Bring in Another Dimension



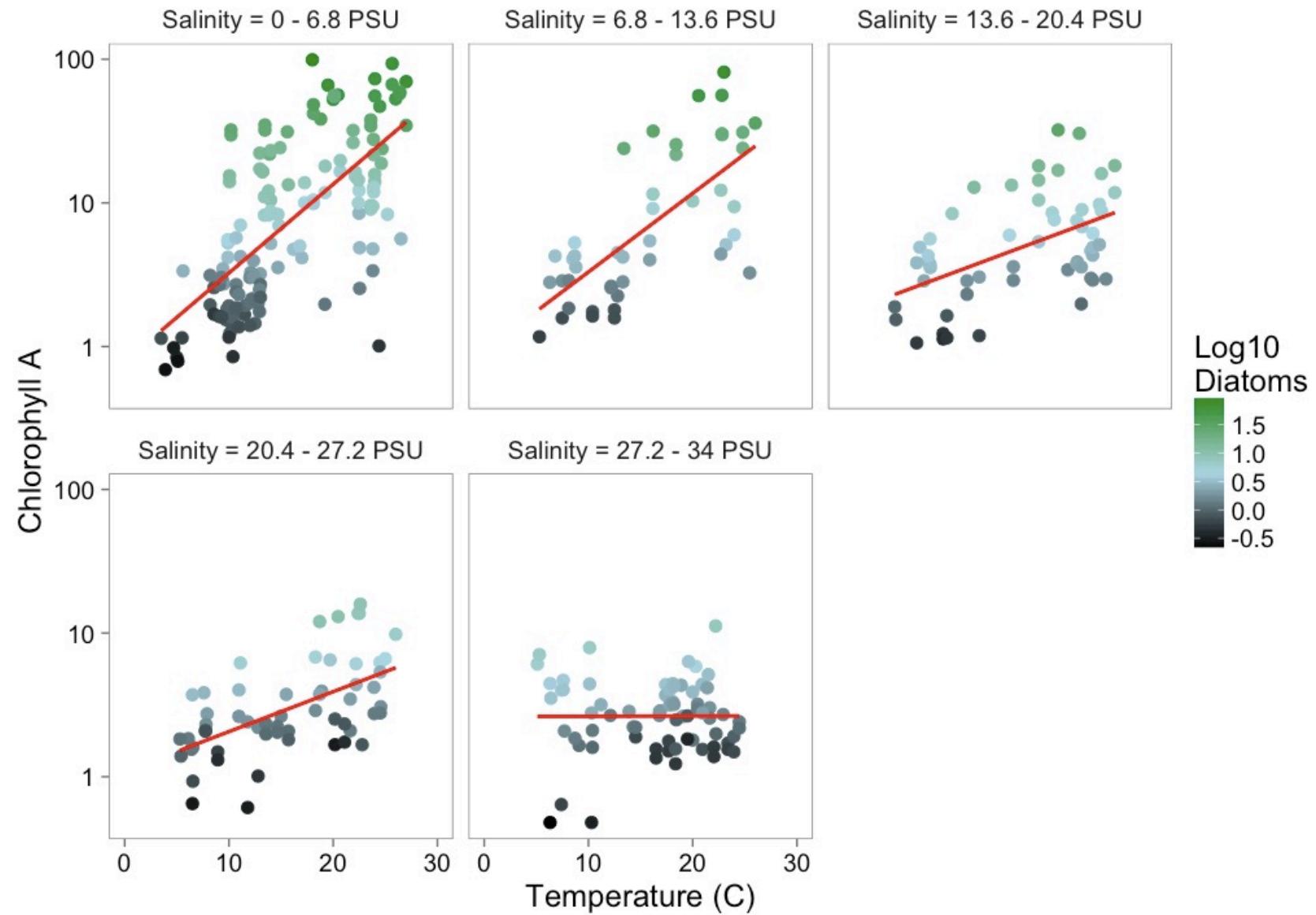
Statistical Fit to Aid Understanding



Facets to Add Fine-Grained Information or New Dimensions



Facets Add Information

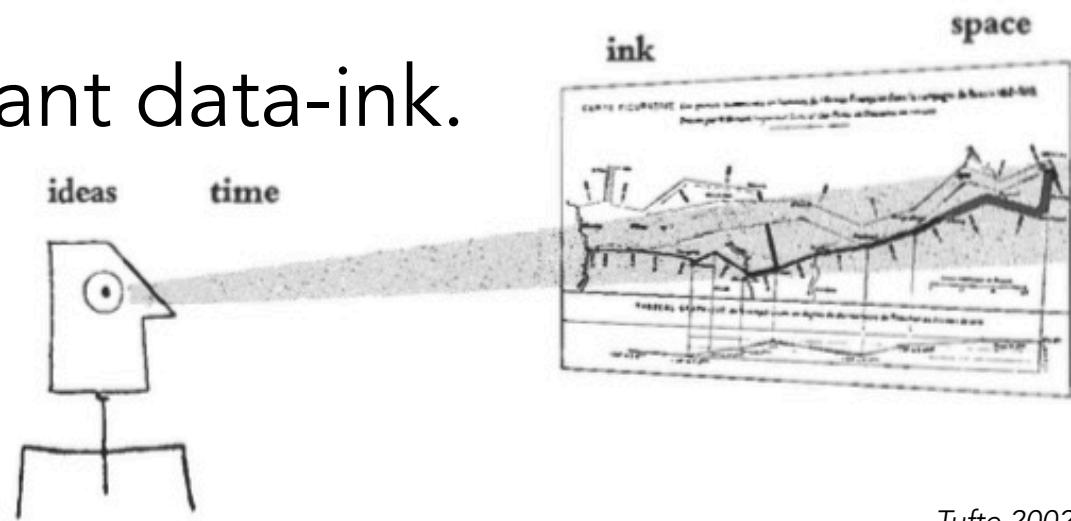


Data Viz in a Nutshell

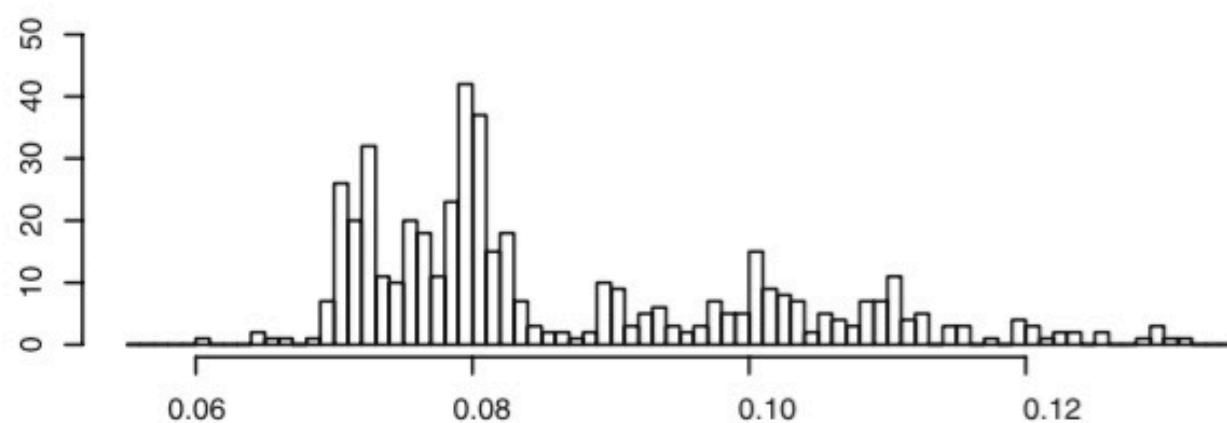
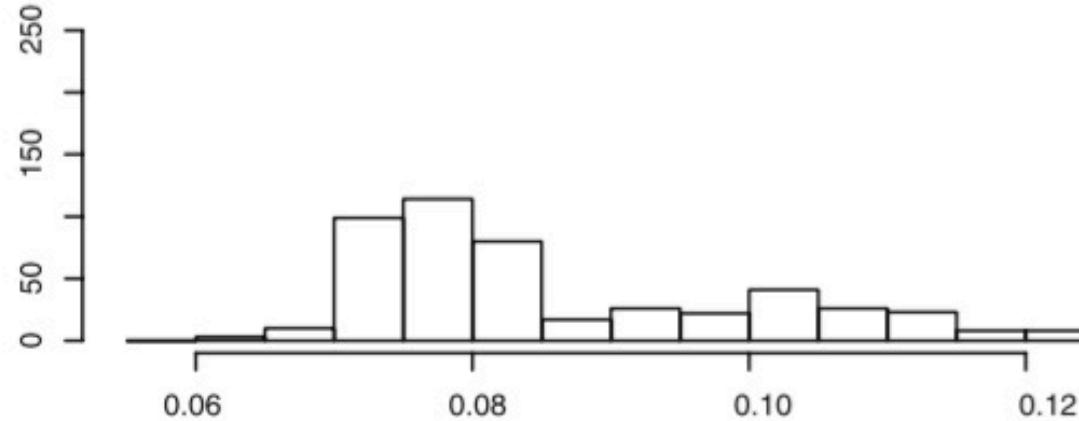
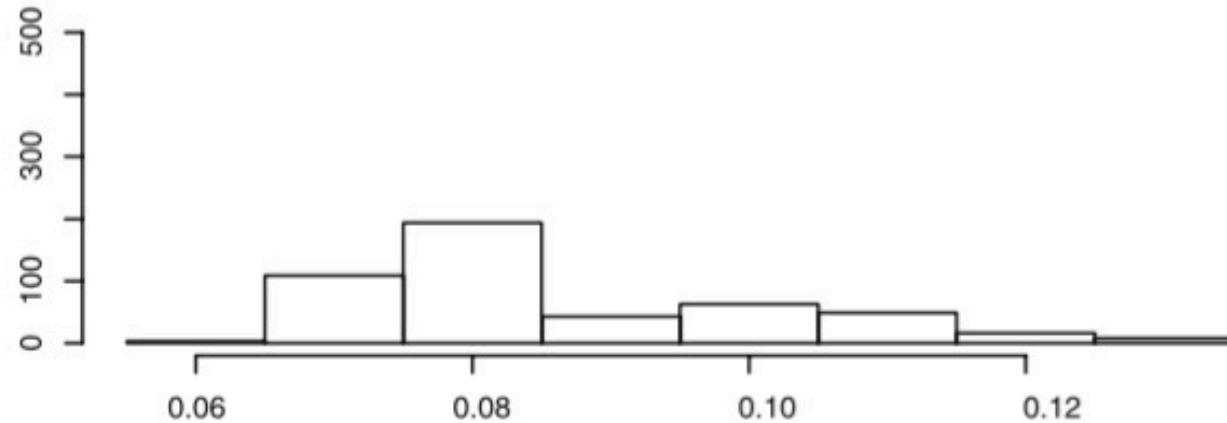
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Minimalist Presentation

1. Above all else show data.
2. Maximize the data-ink ratio
3. Erase non-data-ink.
4. Erase redundant data-ink.



Tufte 2002



Which scale
conveys the
most
information
with the least
ink?

Unwin 2008

