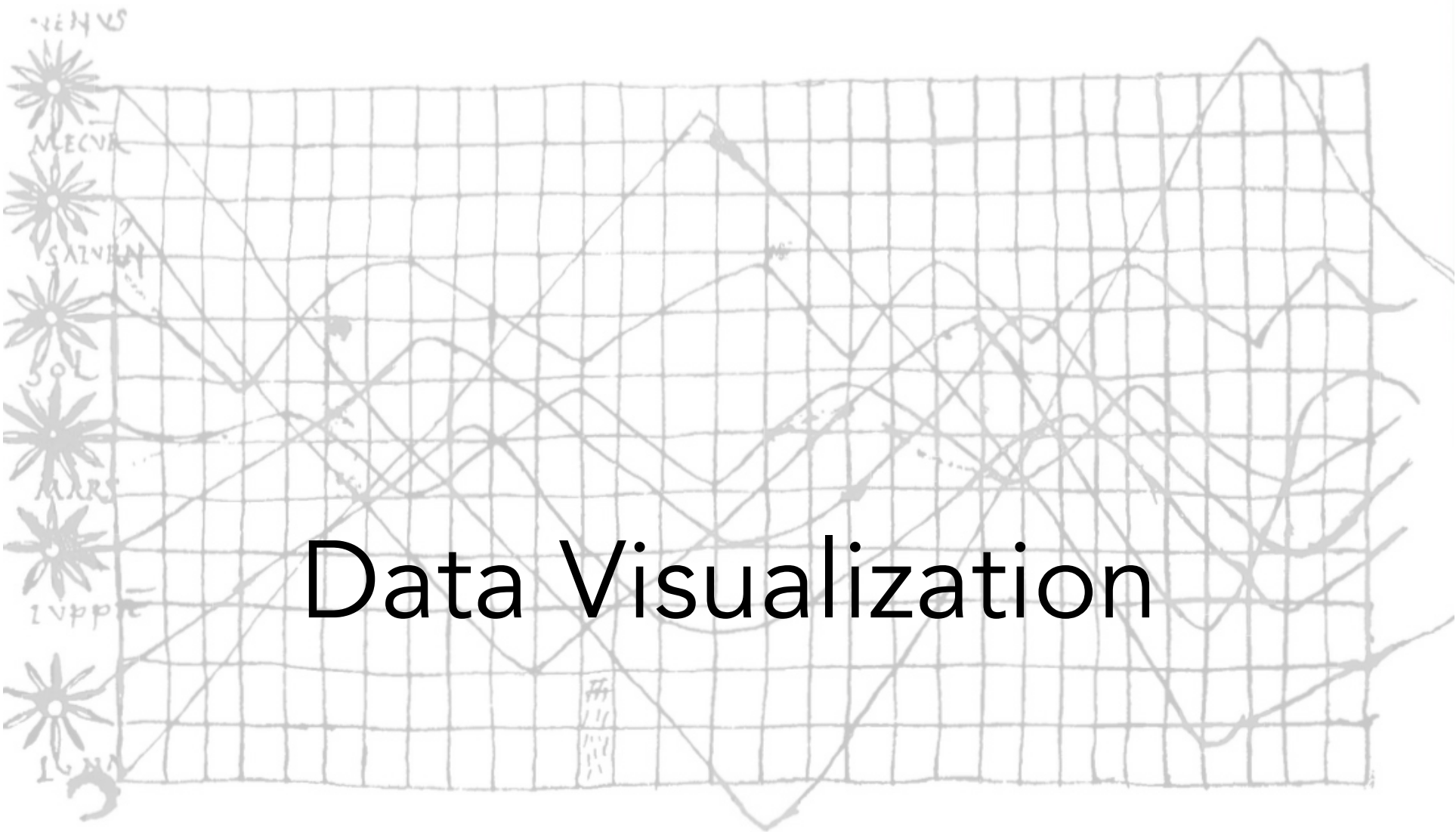


Data Visualization

DATA VISUALIZATION IS COMMUNICATION

Principles of Graphical Excellence

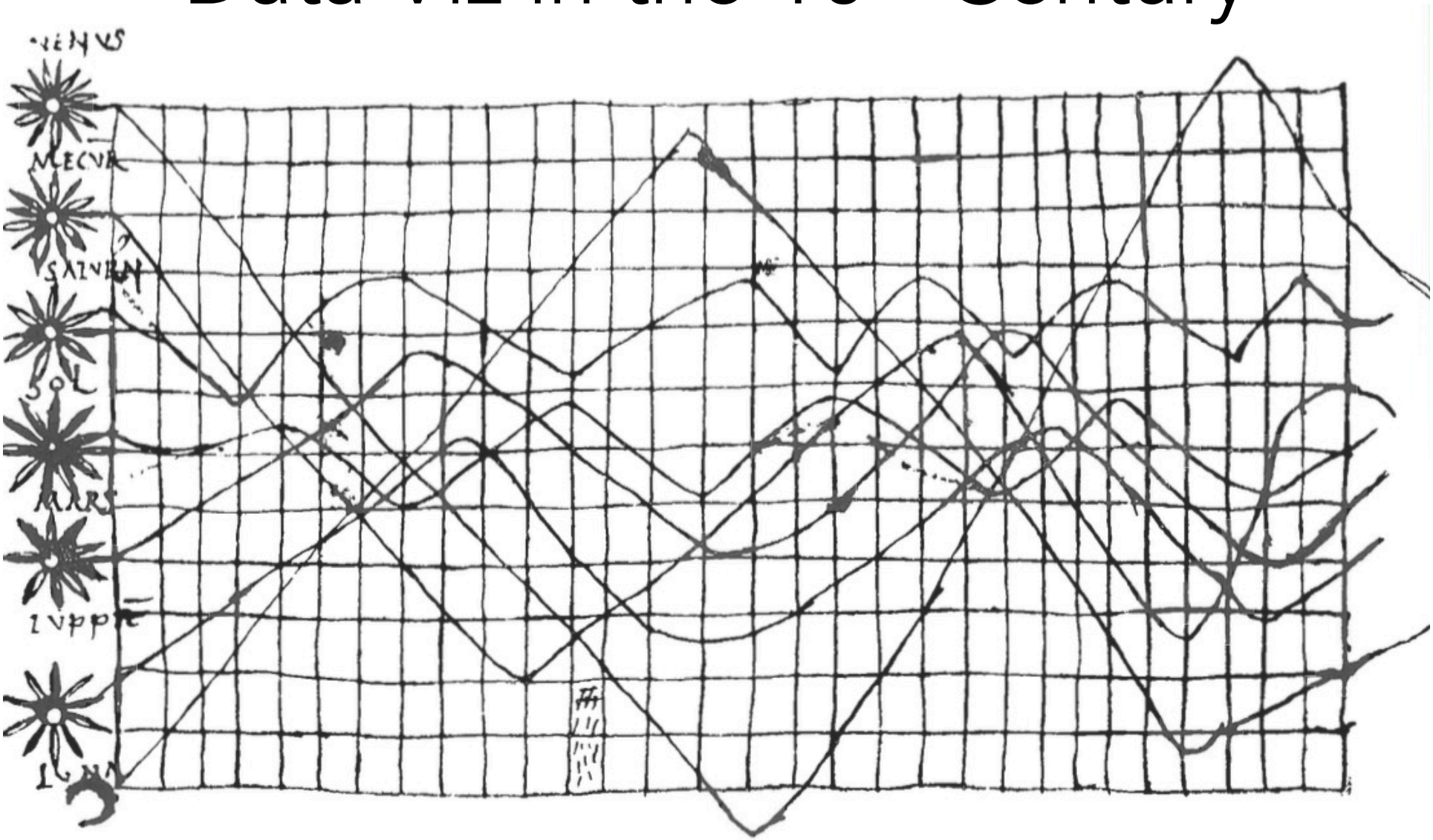
- Clarity
- Precision
- Efficiency
- Maximize ideas, minimize ink

(from Tufte)

Data Viz in a Nutshell

1. History
2. Graphical Basics
3. Minimalist principles

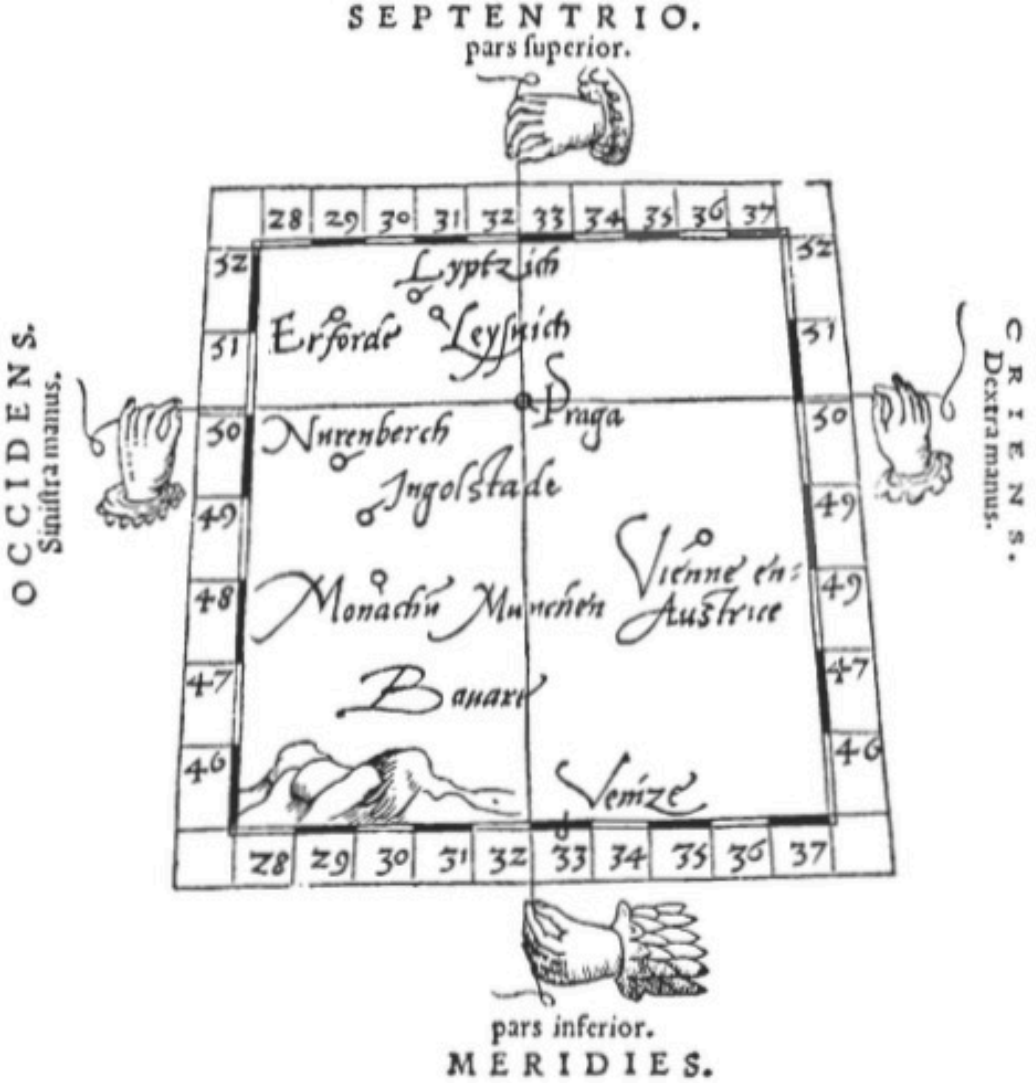
Data Viz in the 10th Century



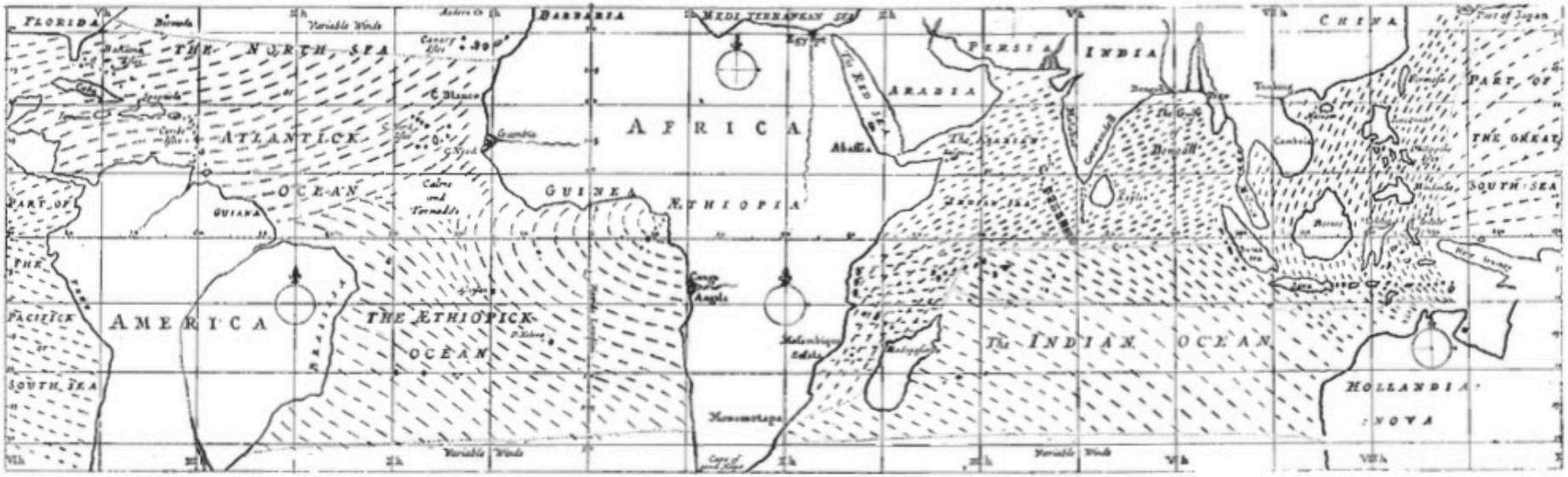
From Funkhouser 1936

Ecce formulam, vſum, atque

ſtructuram Tabularum Ptolomæi, cum quibuſdam locis, in quibus ſtudioſus Geographiæ ſe ſatis exercere poteſt.

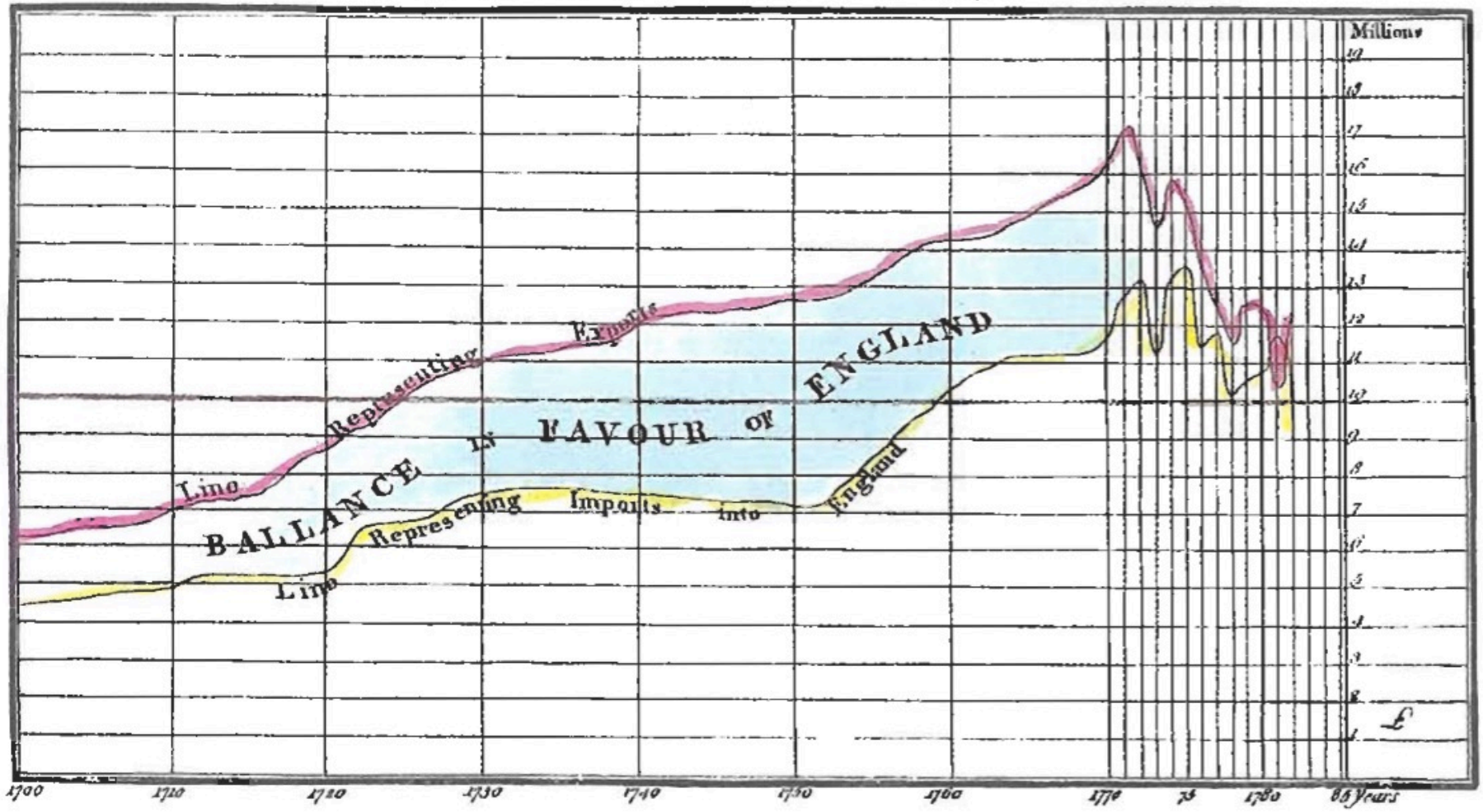


Maps as Rich Information Source




50 0 50 100 150 200 Yards
X Pump
• Deaths from cholera
OXFORD STREET
REGENT STREET
GT. MARLBOROUGH ST.
KING STREET
BROAD STREET
WARWICK STREET
DEAN STREET
CONDUIT STREET
SAVILLE ROW
GOLDEN SQUARE
BREWER STREET
NEW BOND STREET
REGENTS QUADRANT
PICCADILLY

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

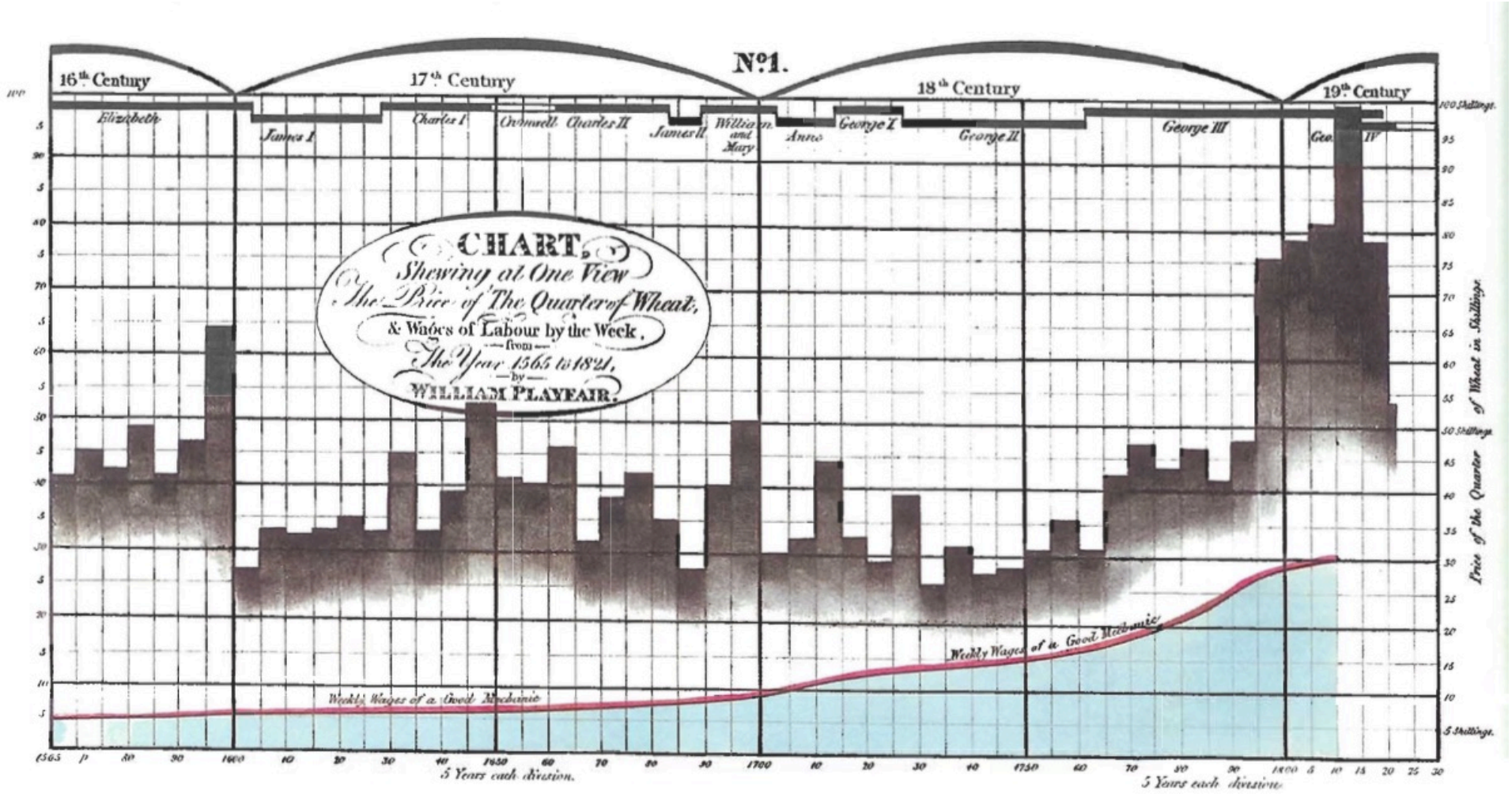


The Divisions at the Bottom, expresss YEARS, & those on the Right hand MILLIONS of POUNDS

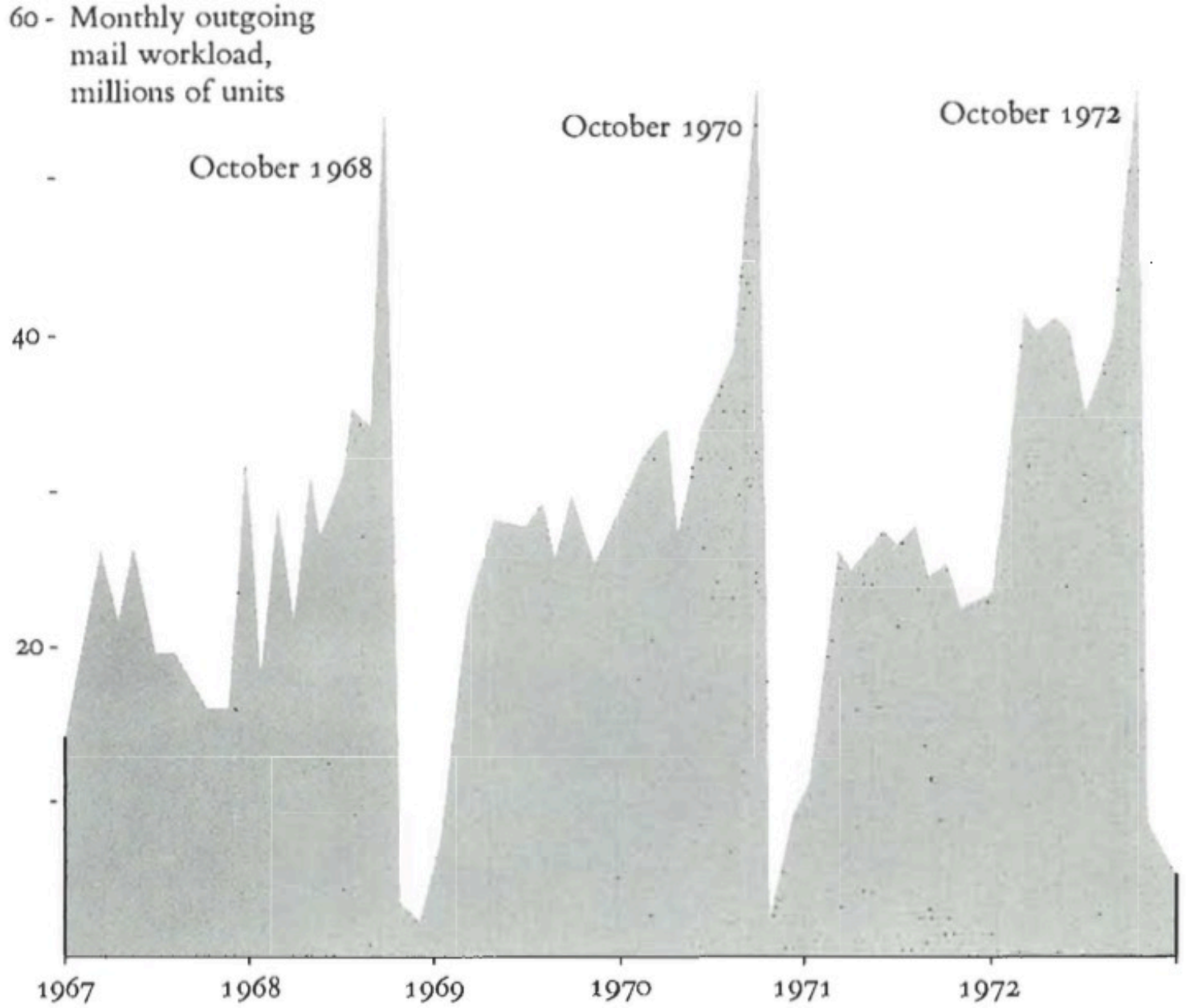
J. Lodge Sculp.t

Publishid as the Act directs 20.th Augst 1785

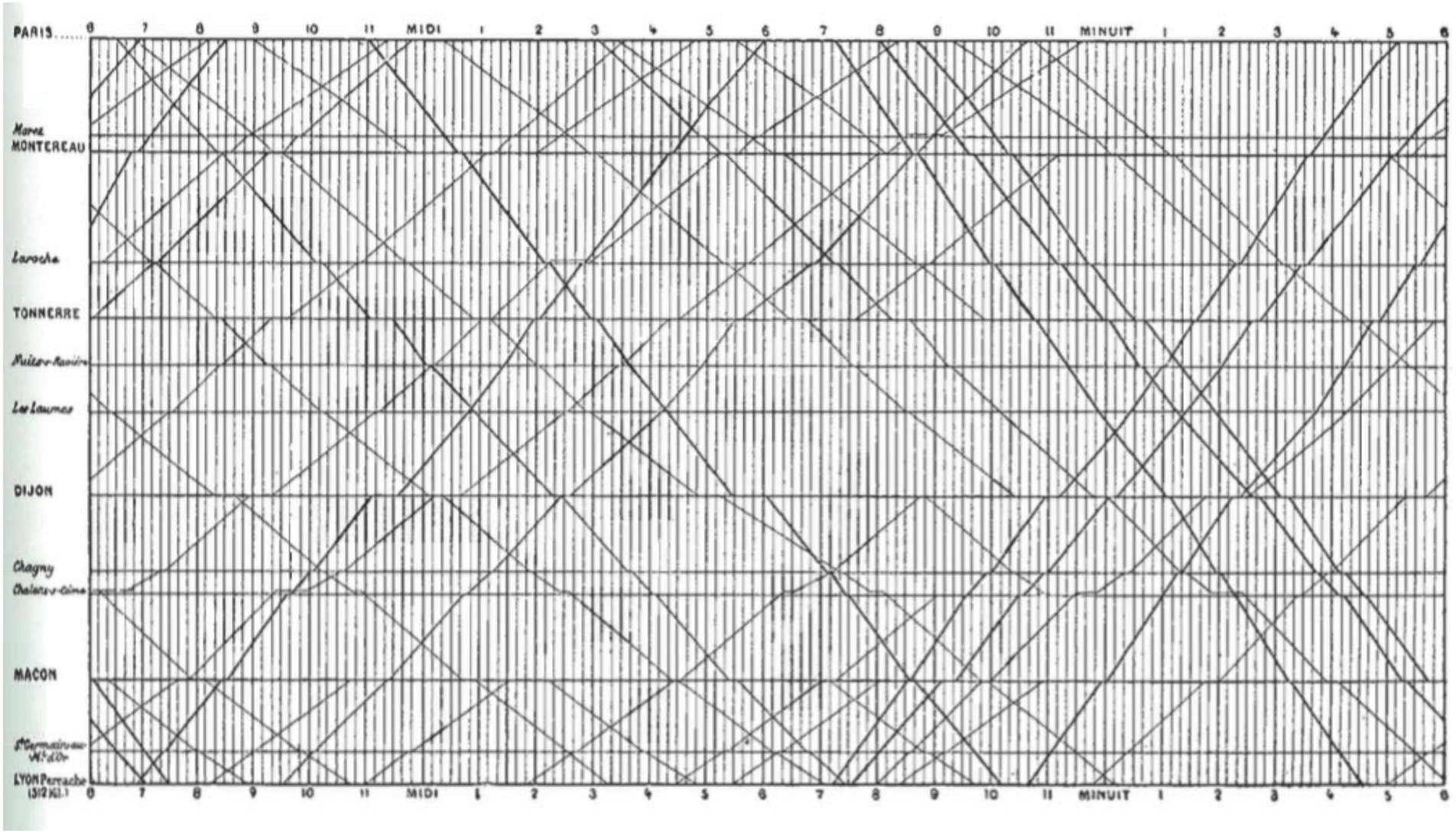
Multiple Data Sources to Make a Point



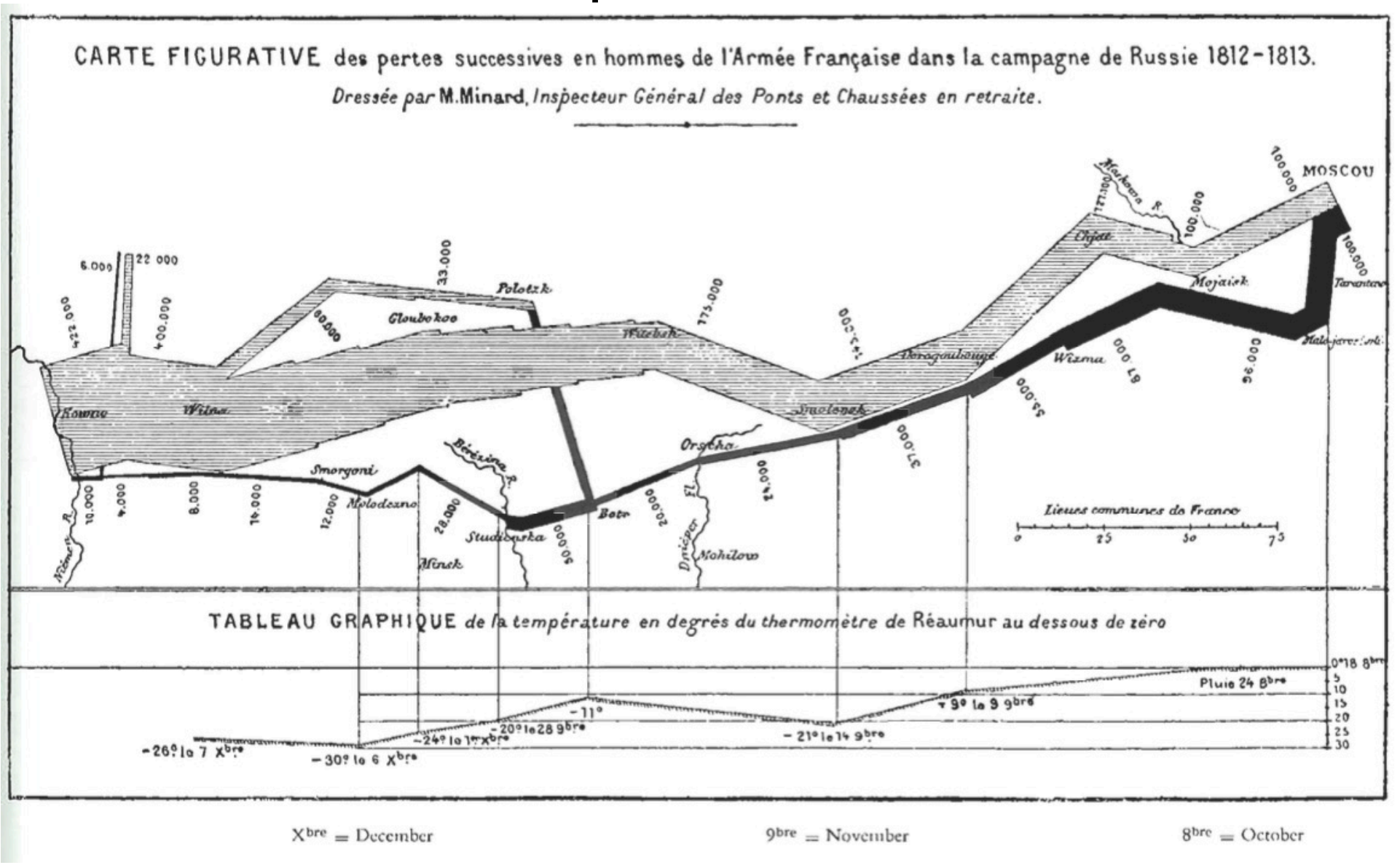
Sometimes One Variable is Enough



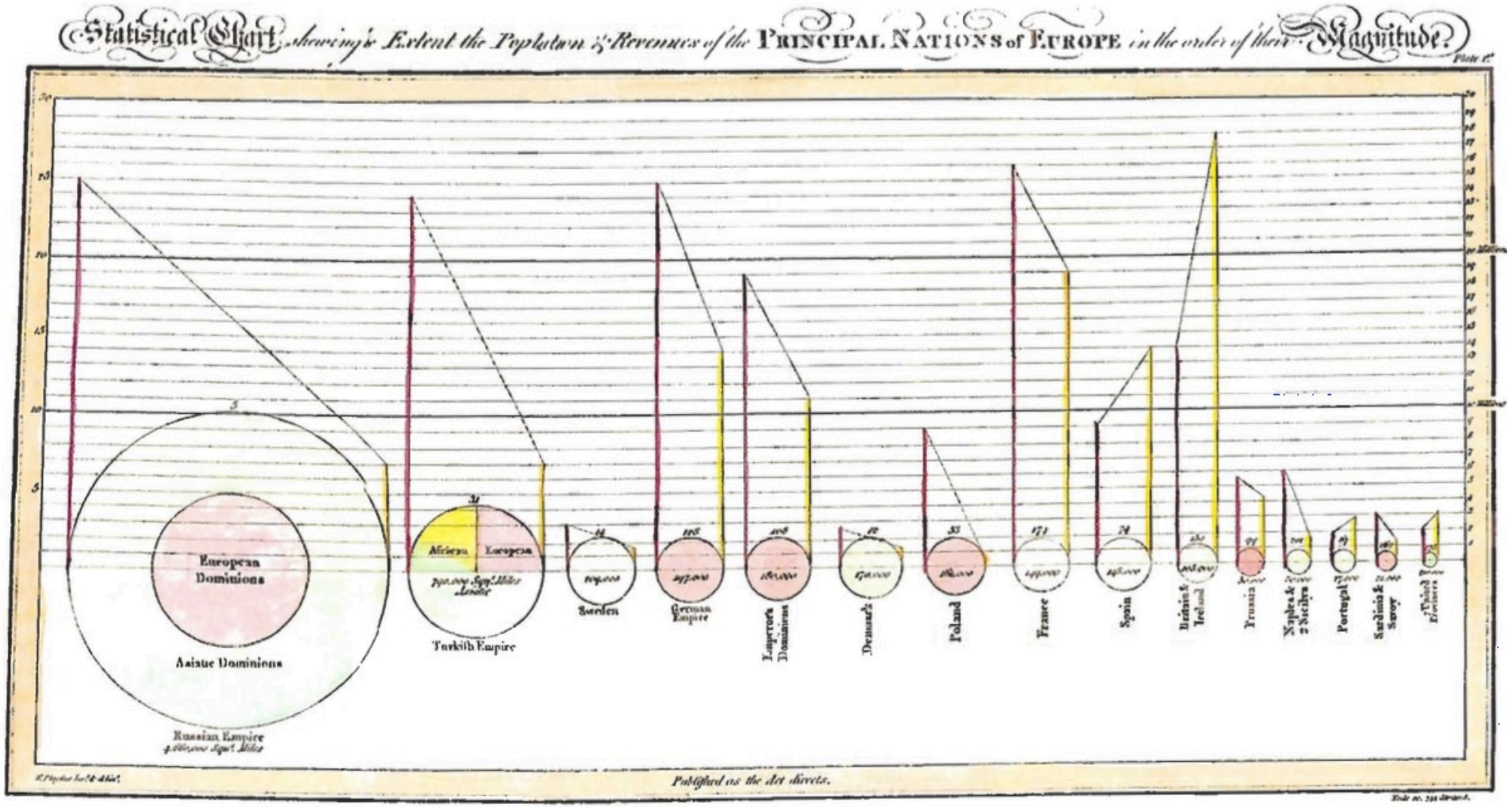
Adding Space to Time



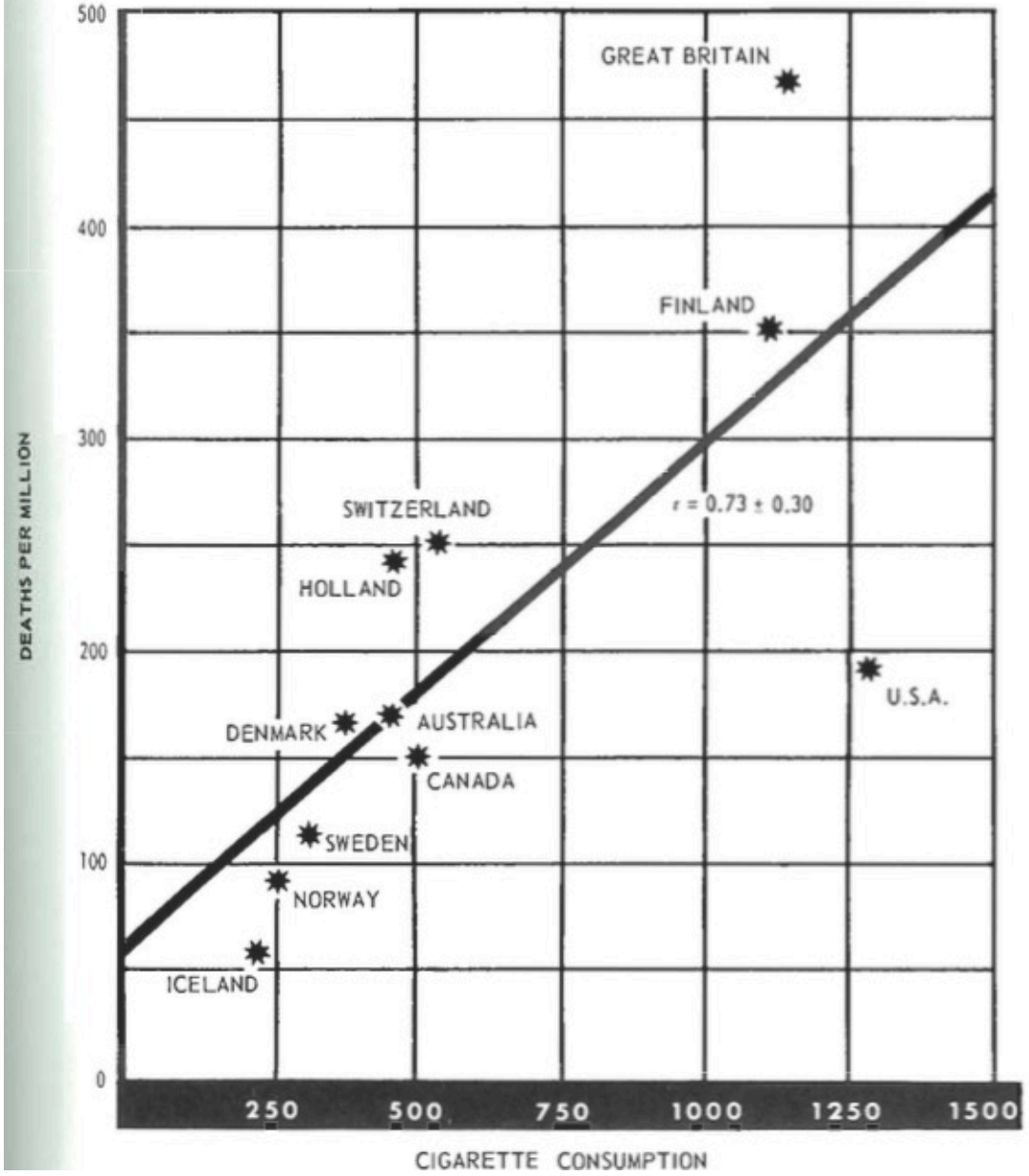
Unifying Maps and Timeseries



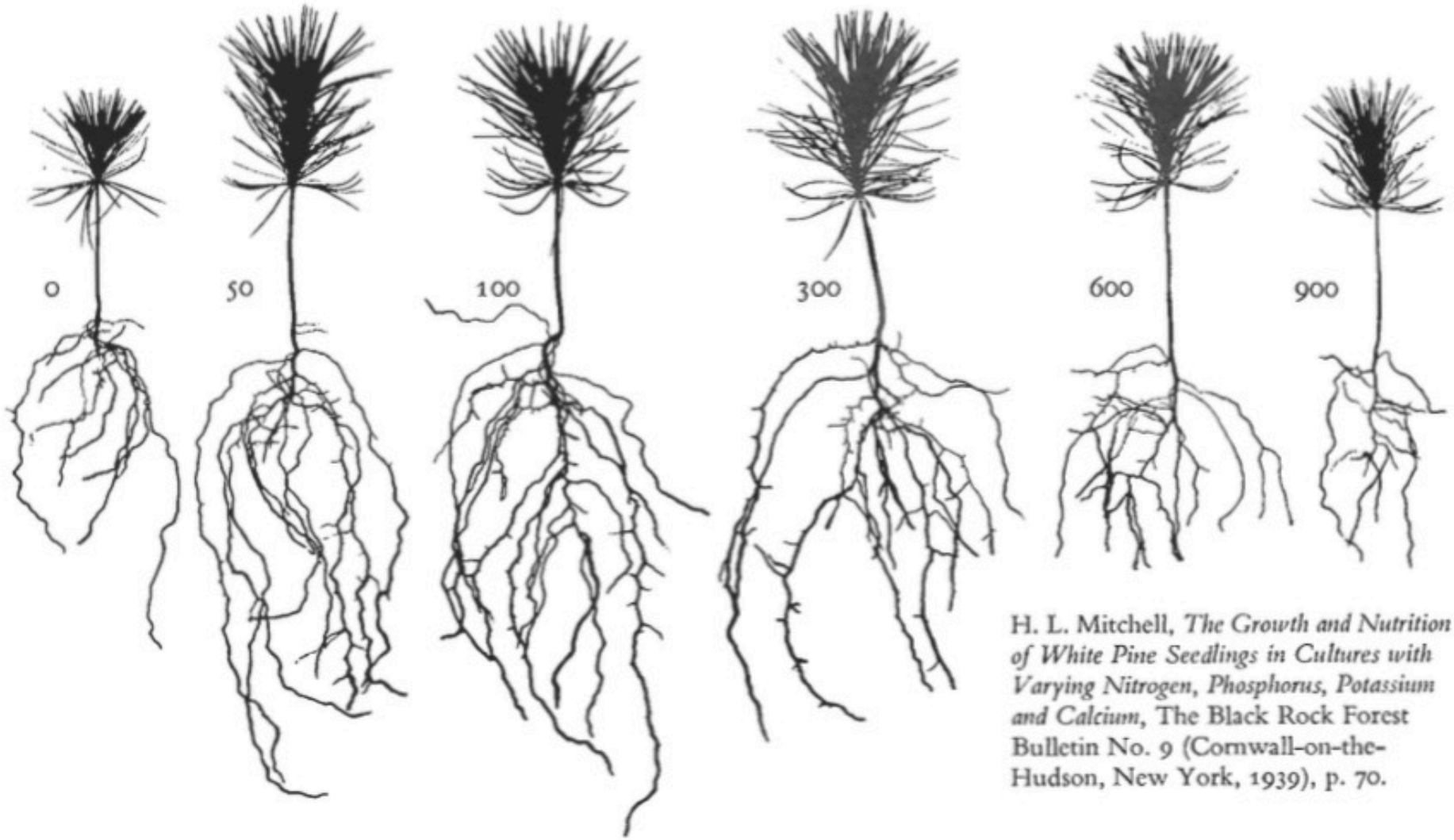
Abstracting Variables to Make a Point



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.

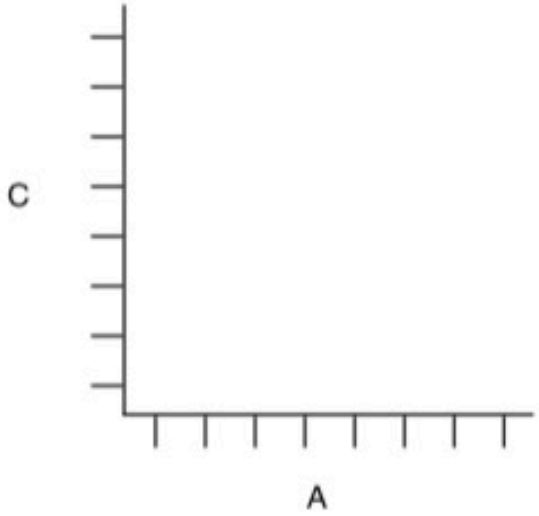
Data Viz in a Nutshell

1. History
2. Graphical Basics
3. Minimalist principles

Elements of a Plot

Geometric Objects

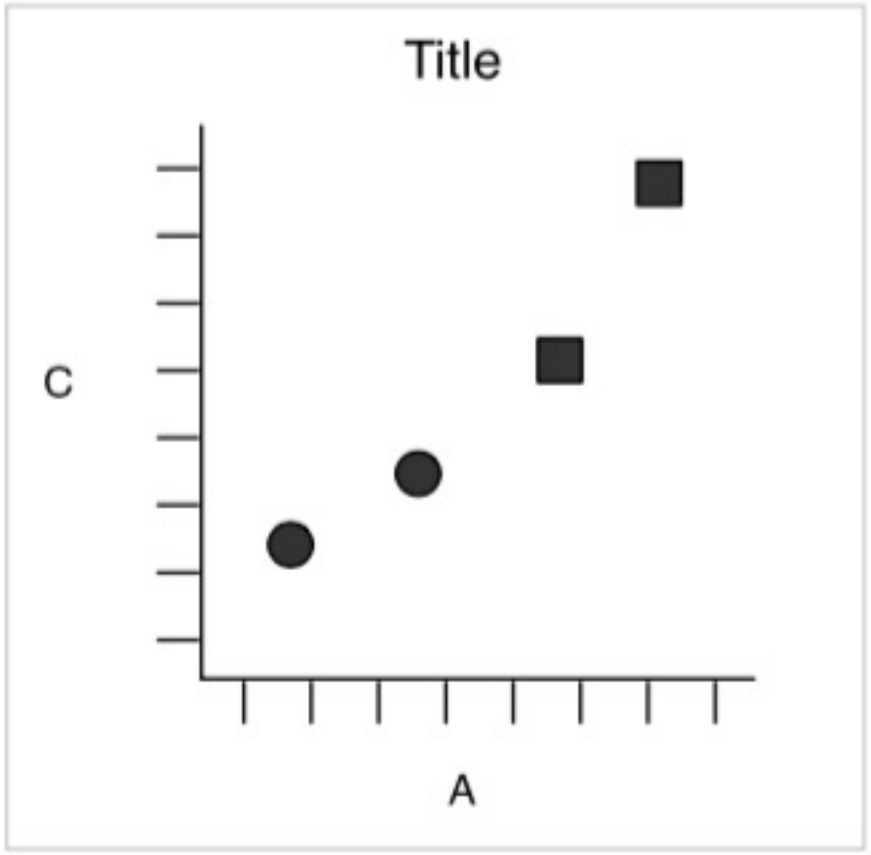
Scales & Coordinates



Annotations

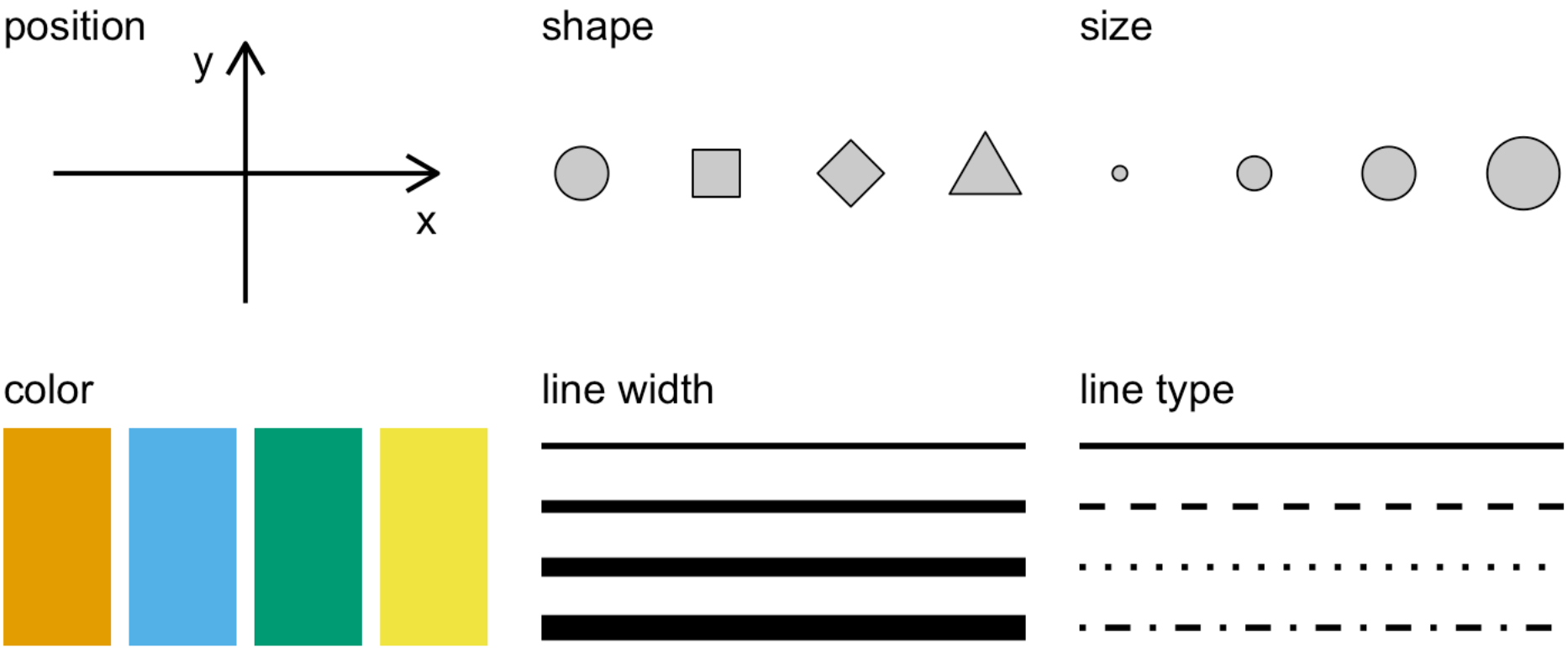
Wickham 2010

Elements of a Plot



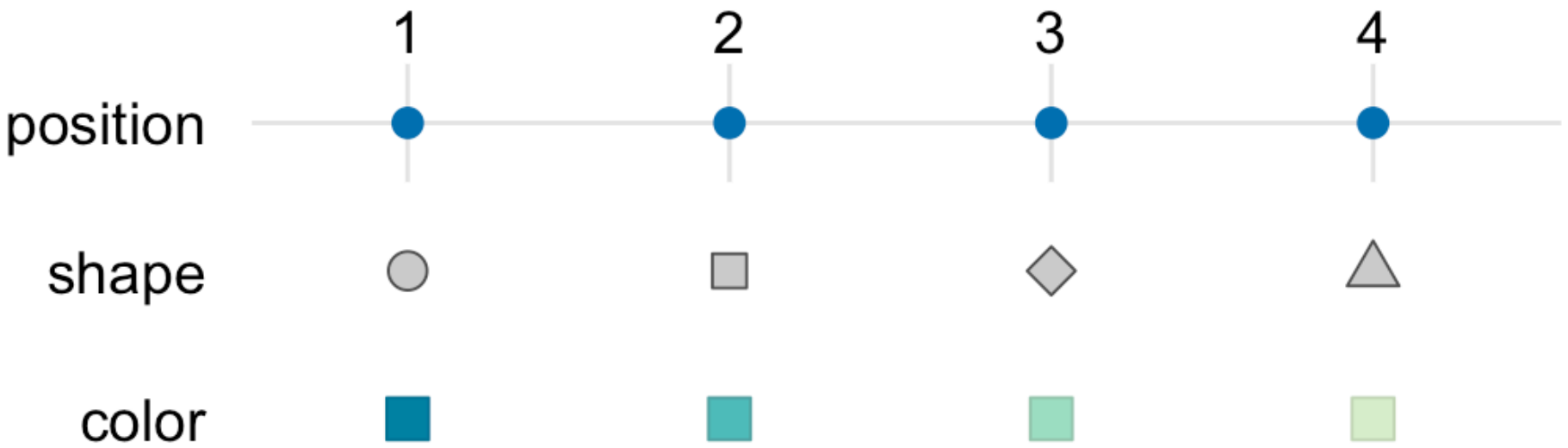
Wickham 2010

Aesthetics of a Plot



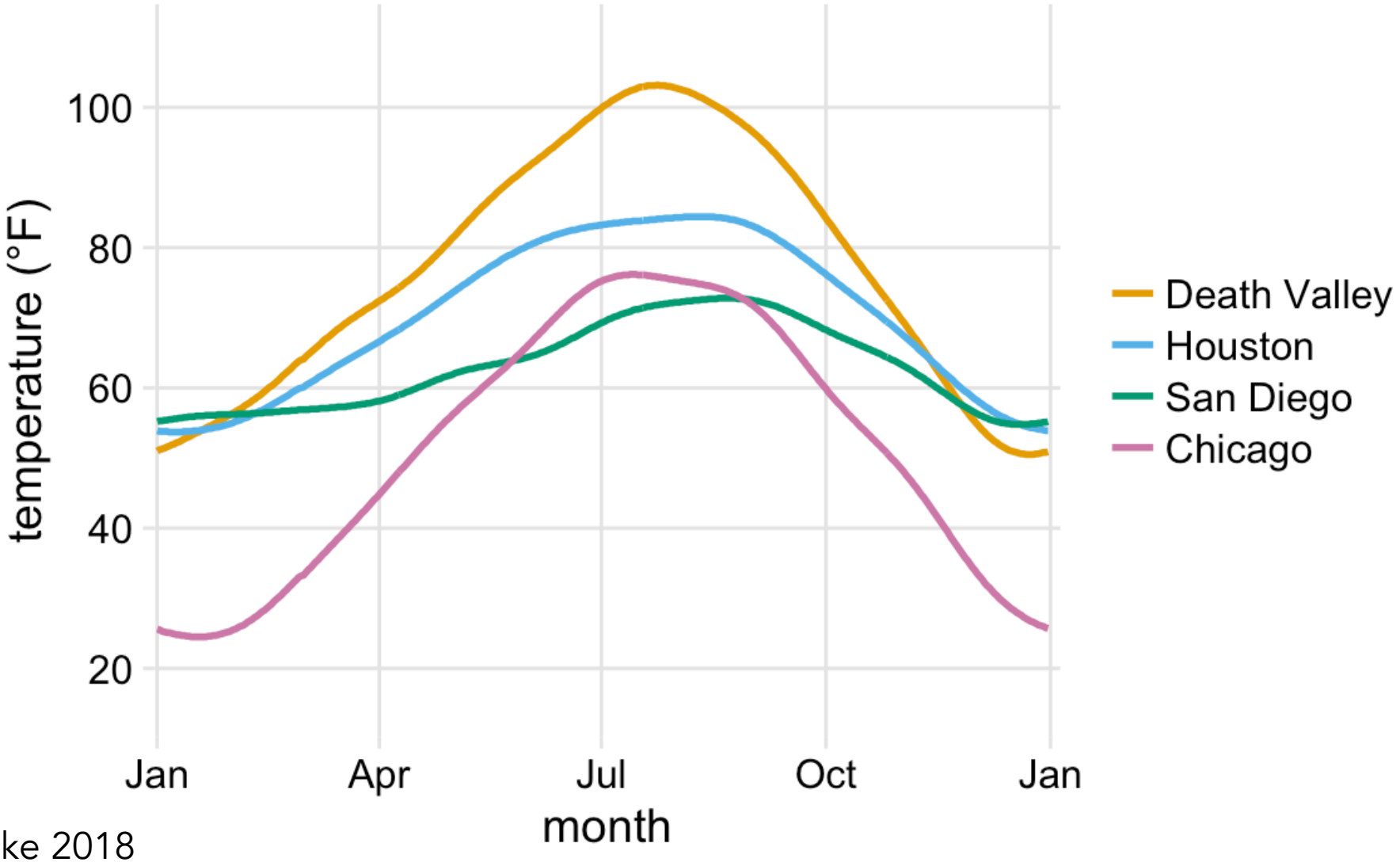
Wilke 2018

Aesthetics Map Data to Visual Representation



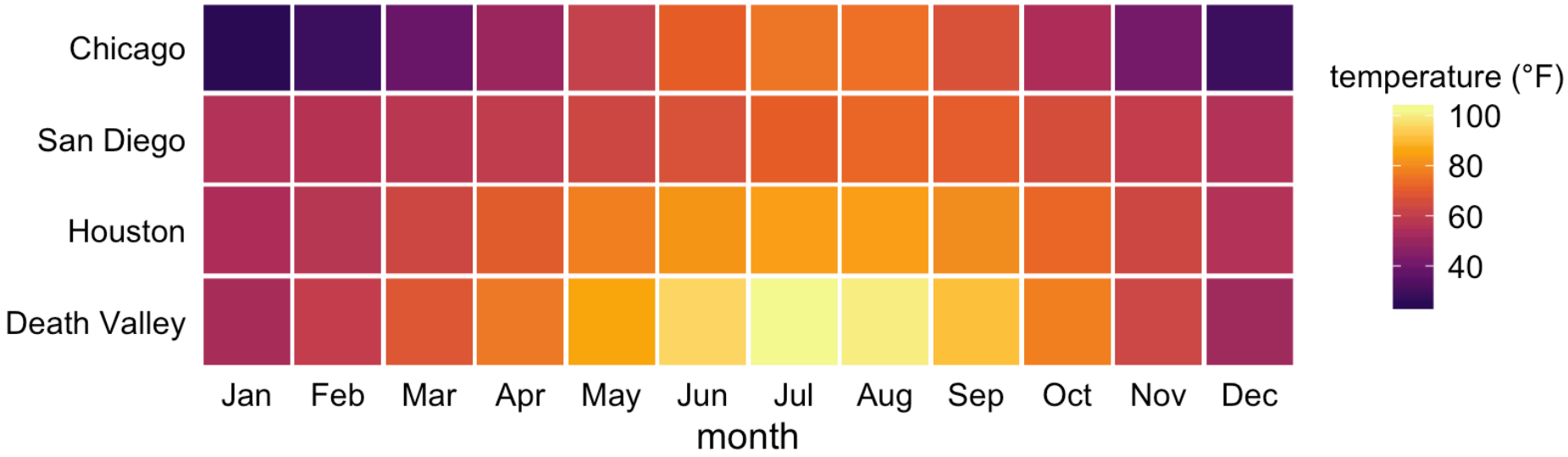
Wilke 2018

Aesthetics Map Data to Visual Representation



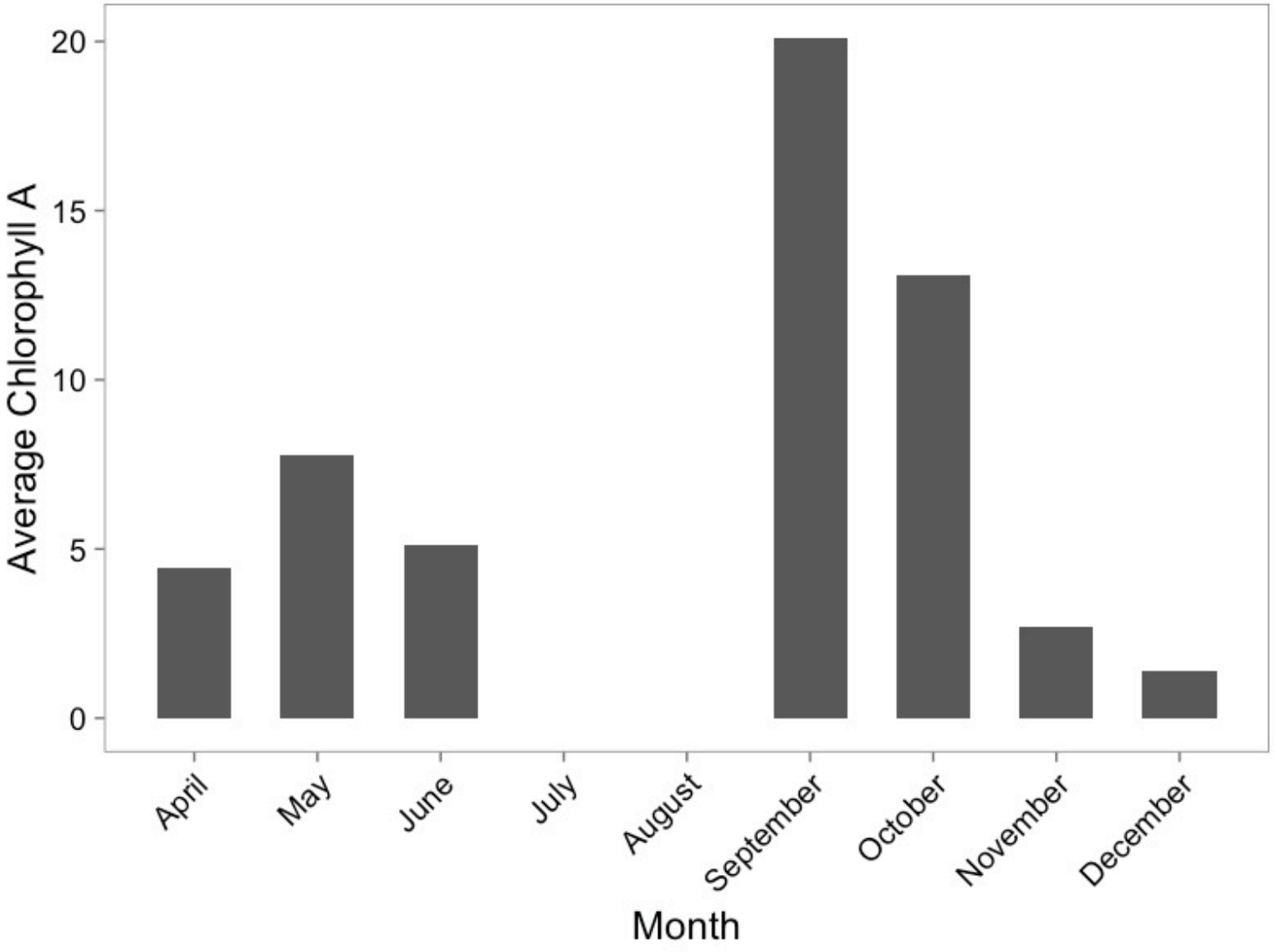
Wilke 2018

Aesthetics Map Data to Visual Representation

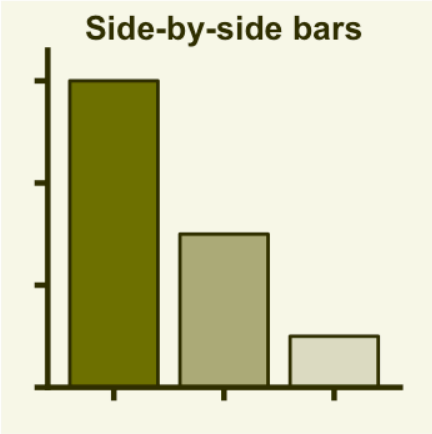


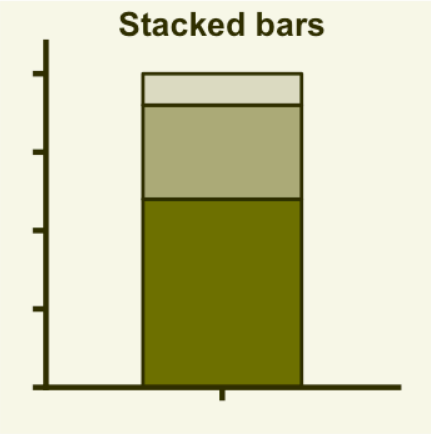
Wilke 2018

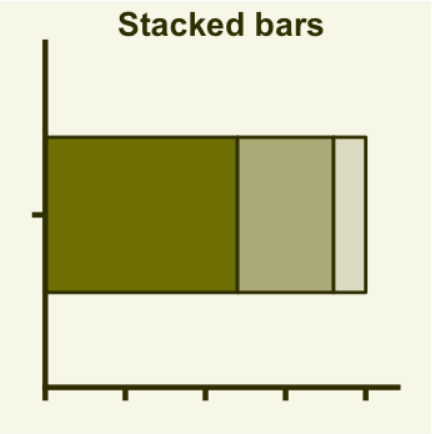
Barplots


Average Chlorophyll A
20
15
10
5
0
April
May
June
July
August
September
October
November
December
Month

Types of Visualizations: Proportions

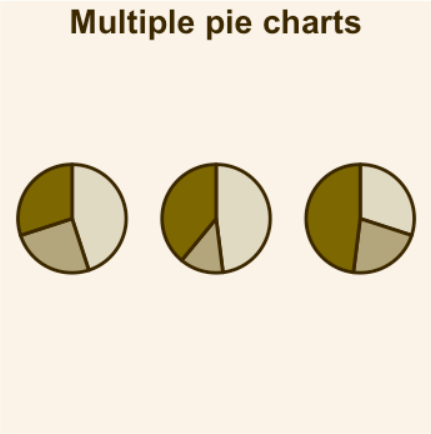


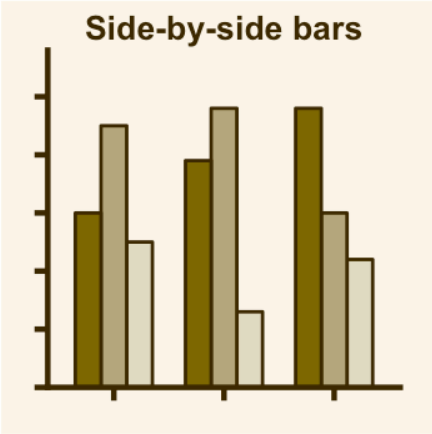


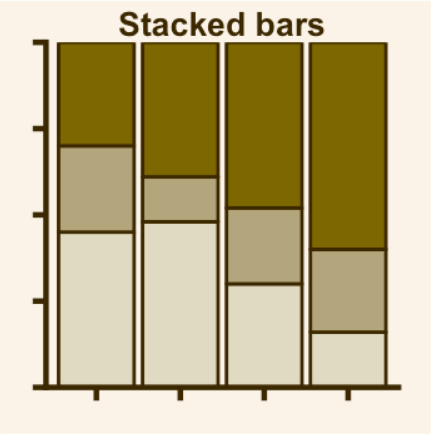


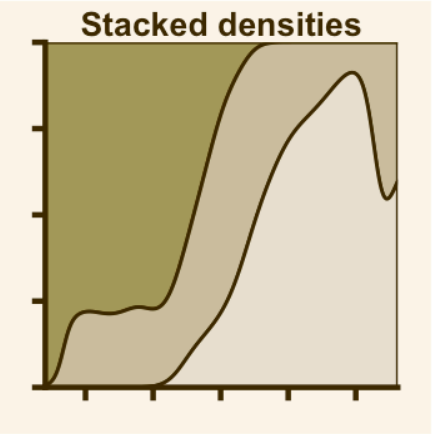
Wilke 2018

Types of Visualizations: Multiple Proportions



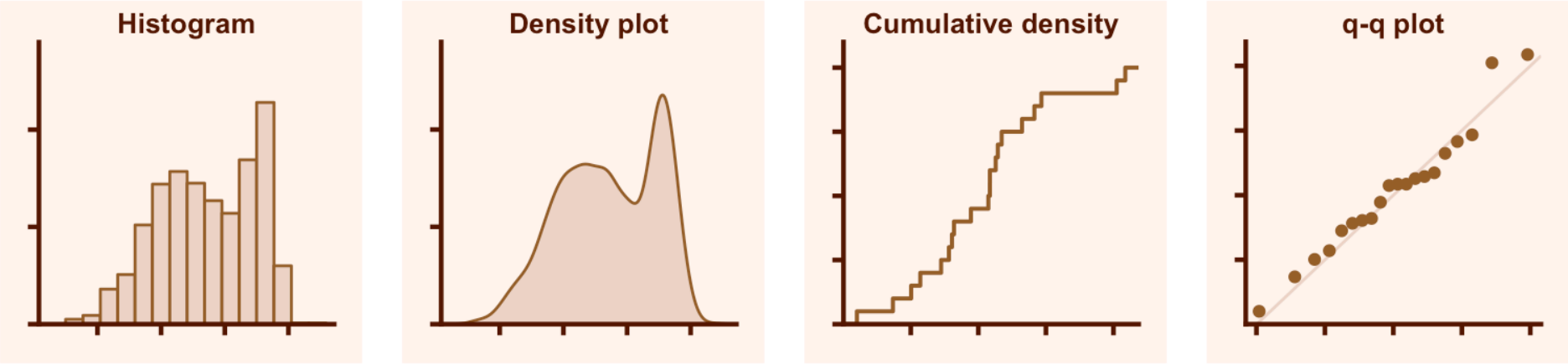






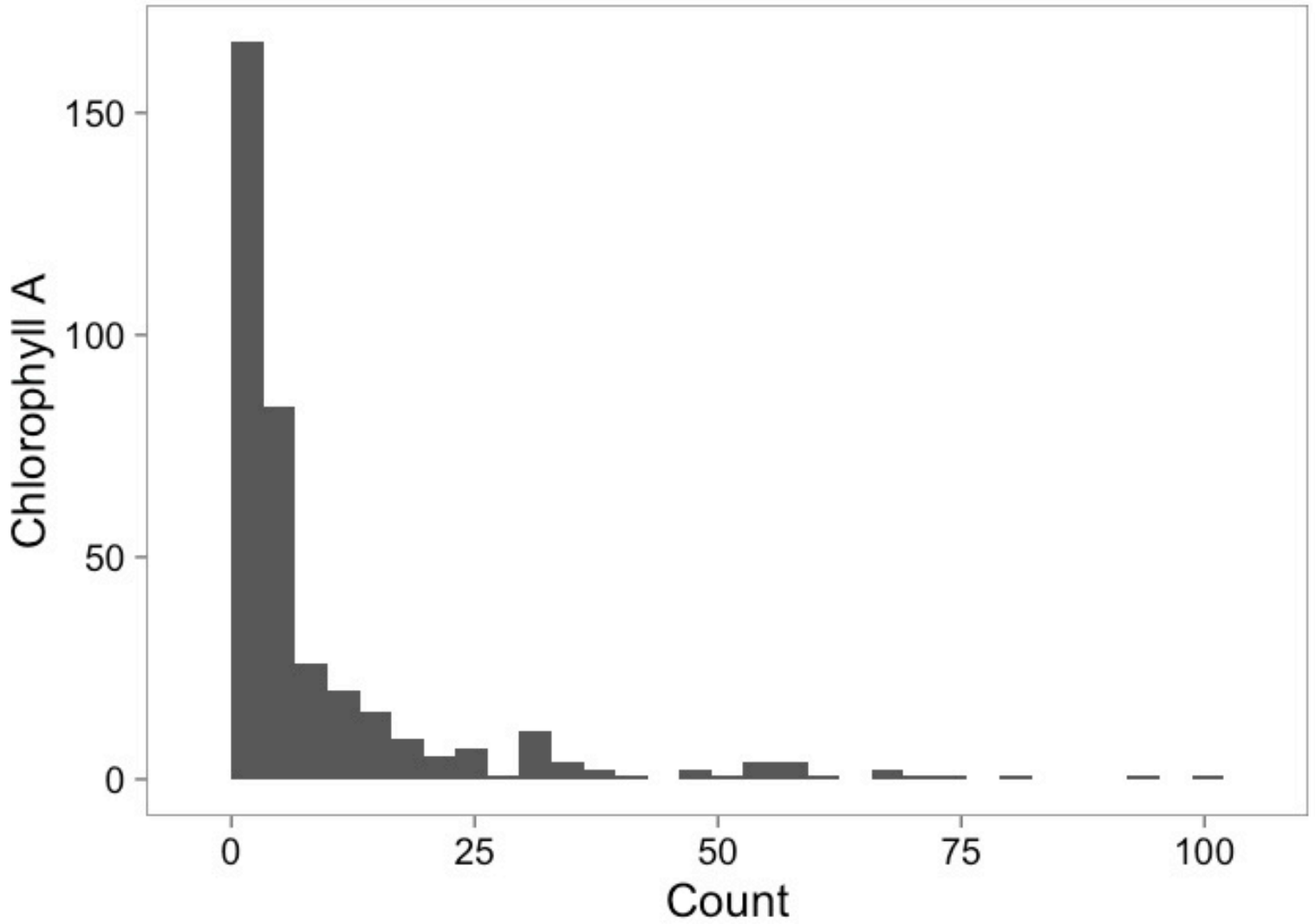
Wilke 2018

Types of Visualizations: Distributions

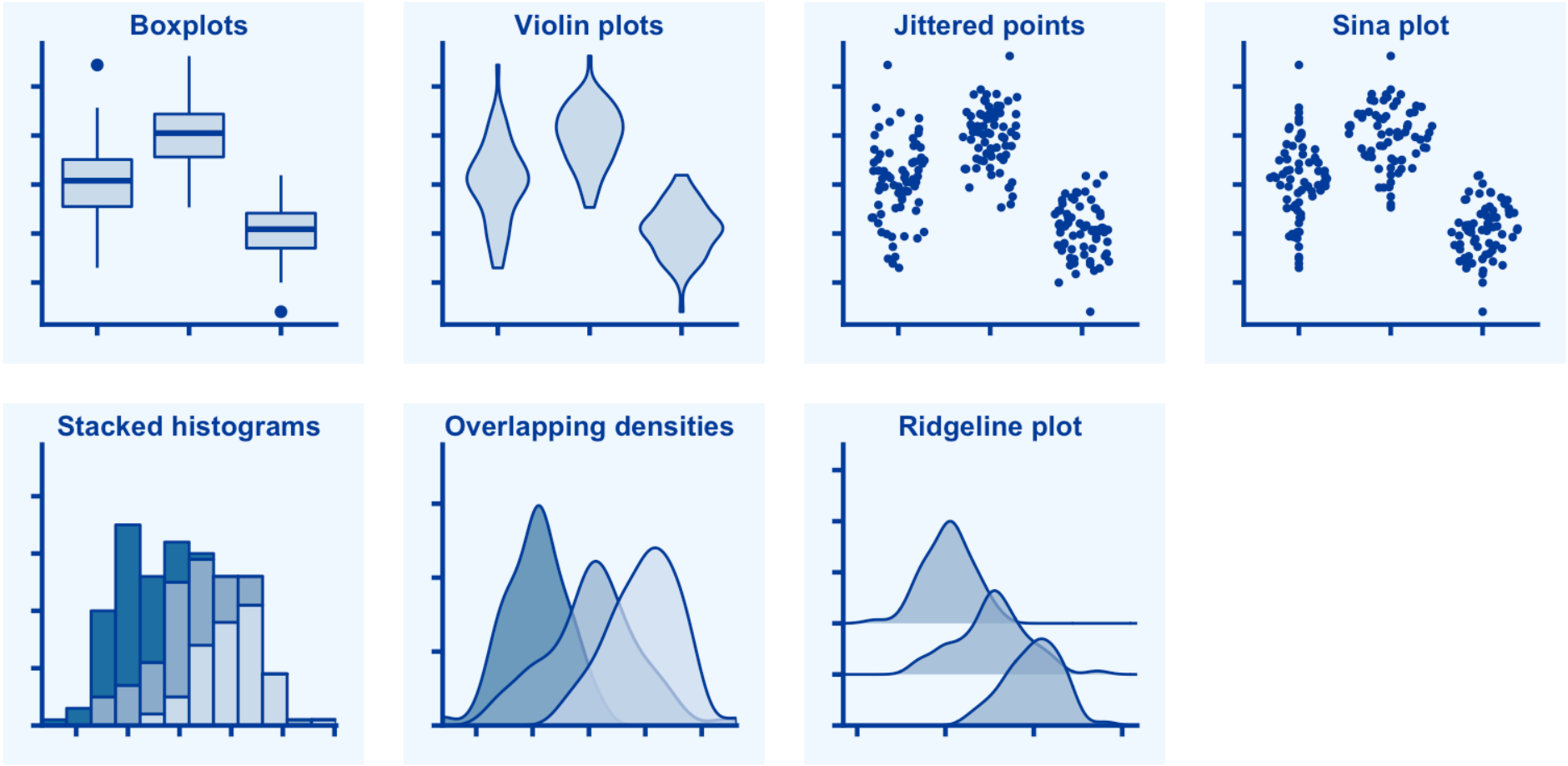


Wilke 2018

Histograms Show Frequency

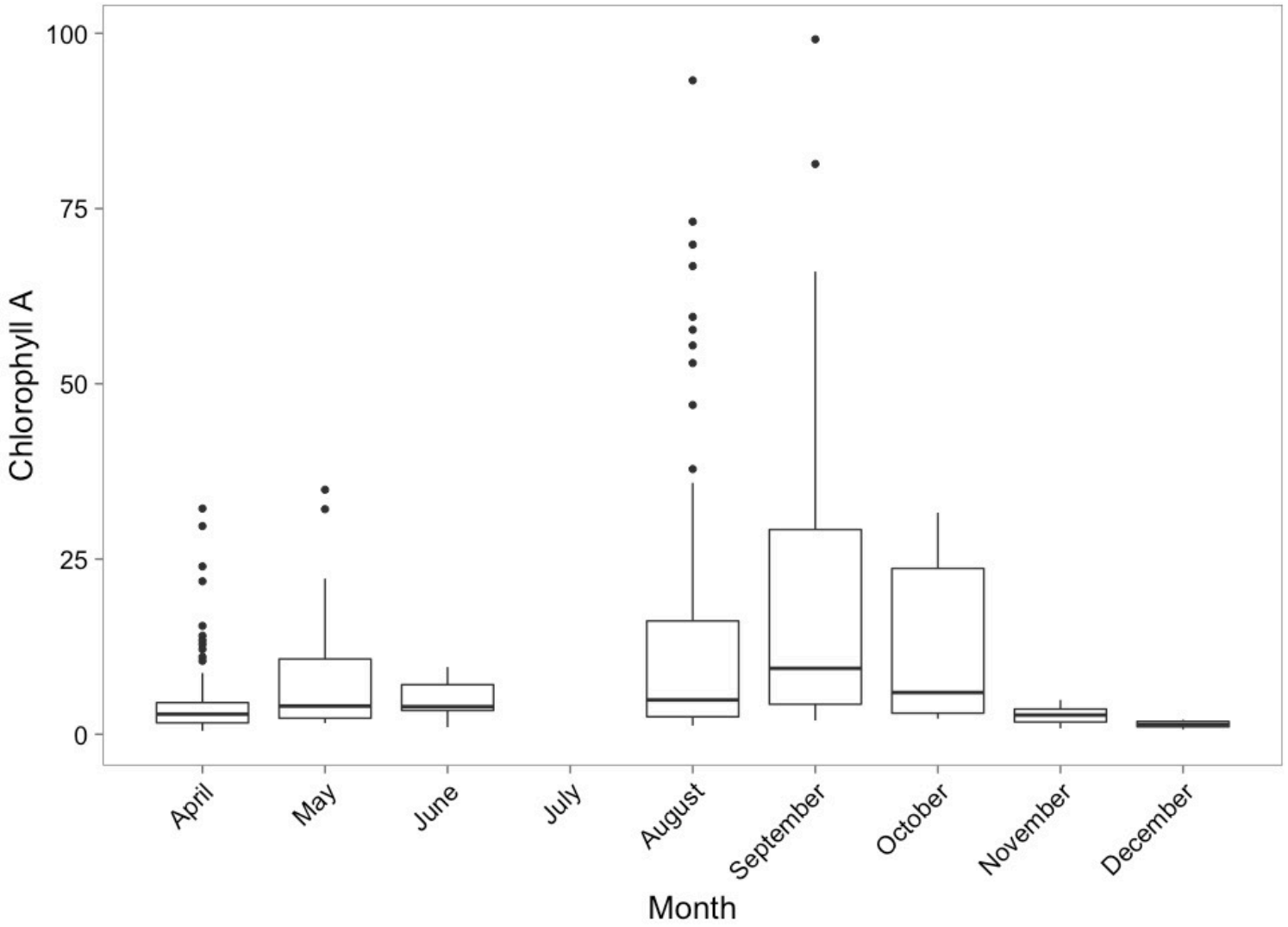


Types of Visualizations: Multiple Distributions

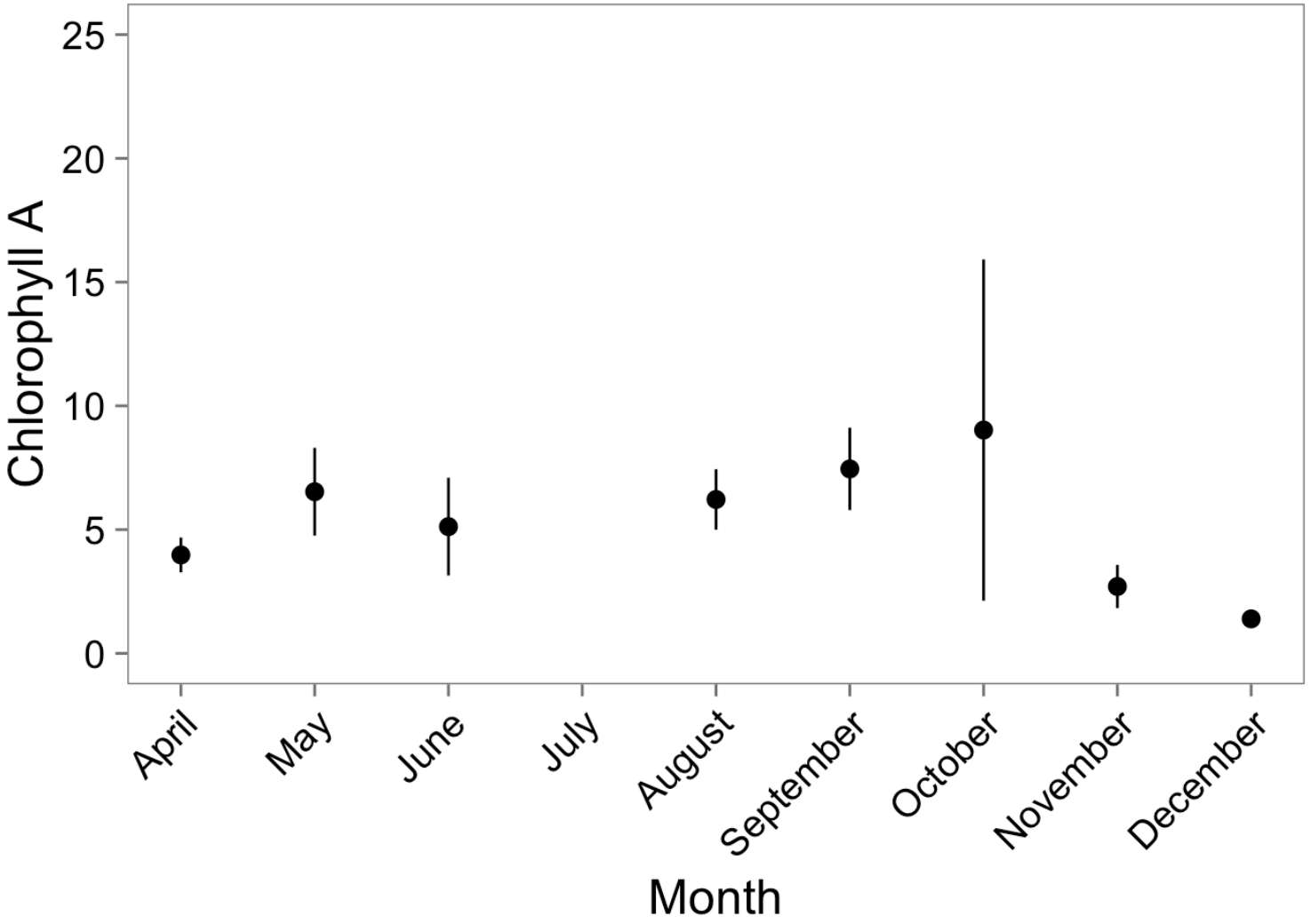


Wilke 2018

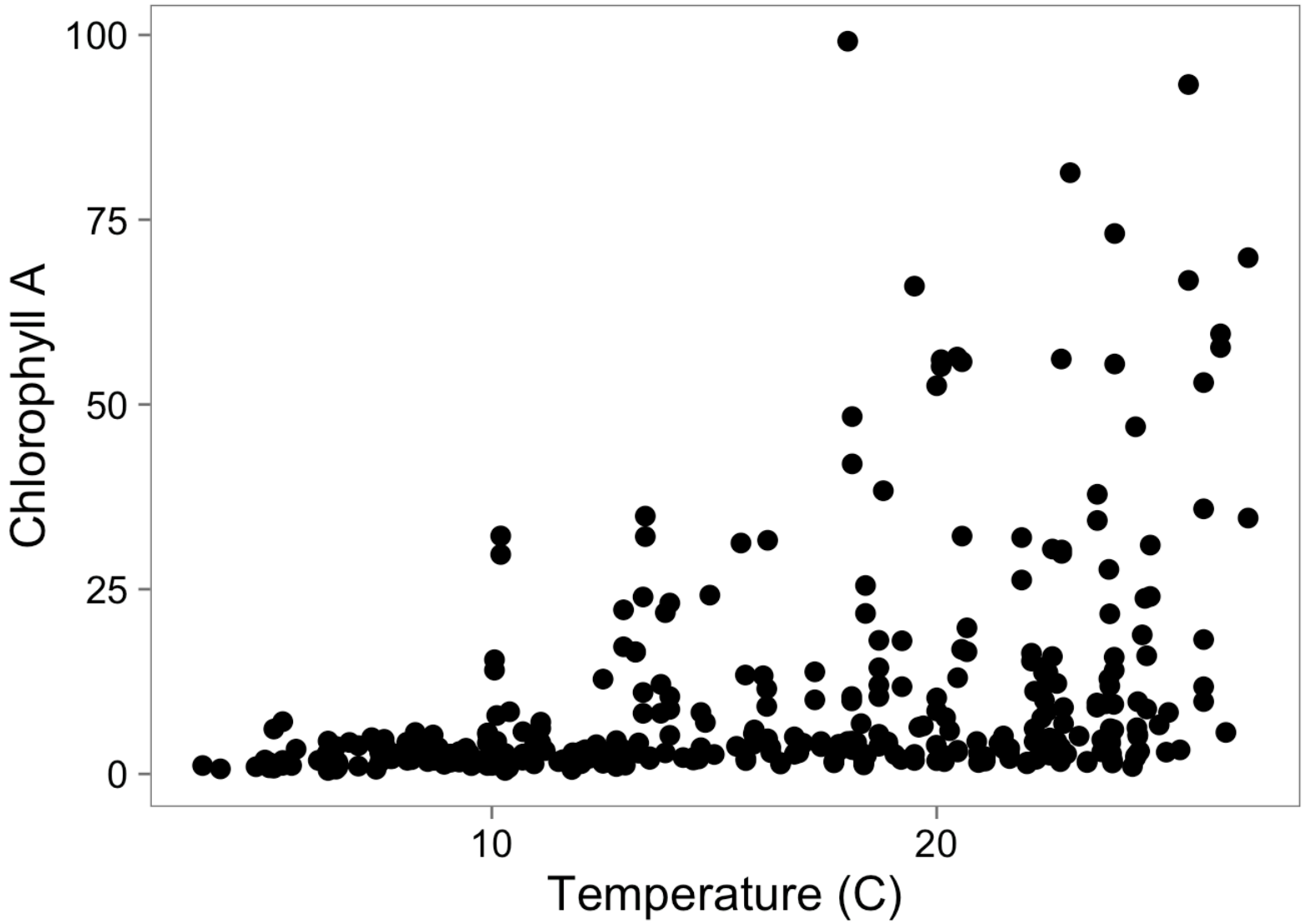
Boxplots to Show Variation



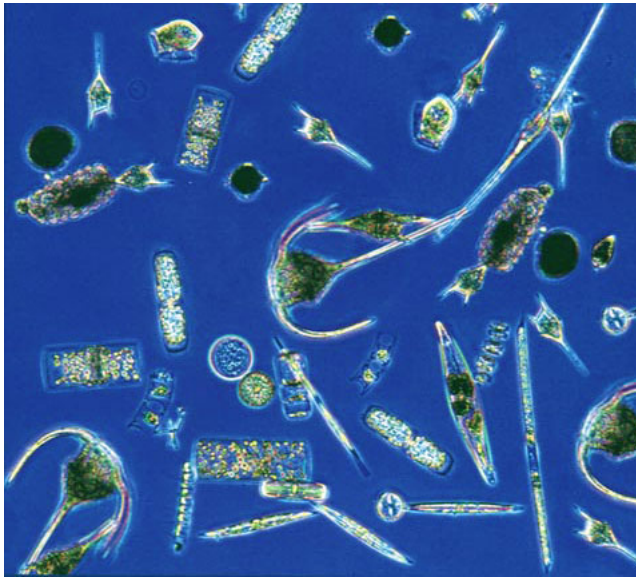
…Or Point-Ranges

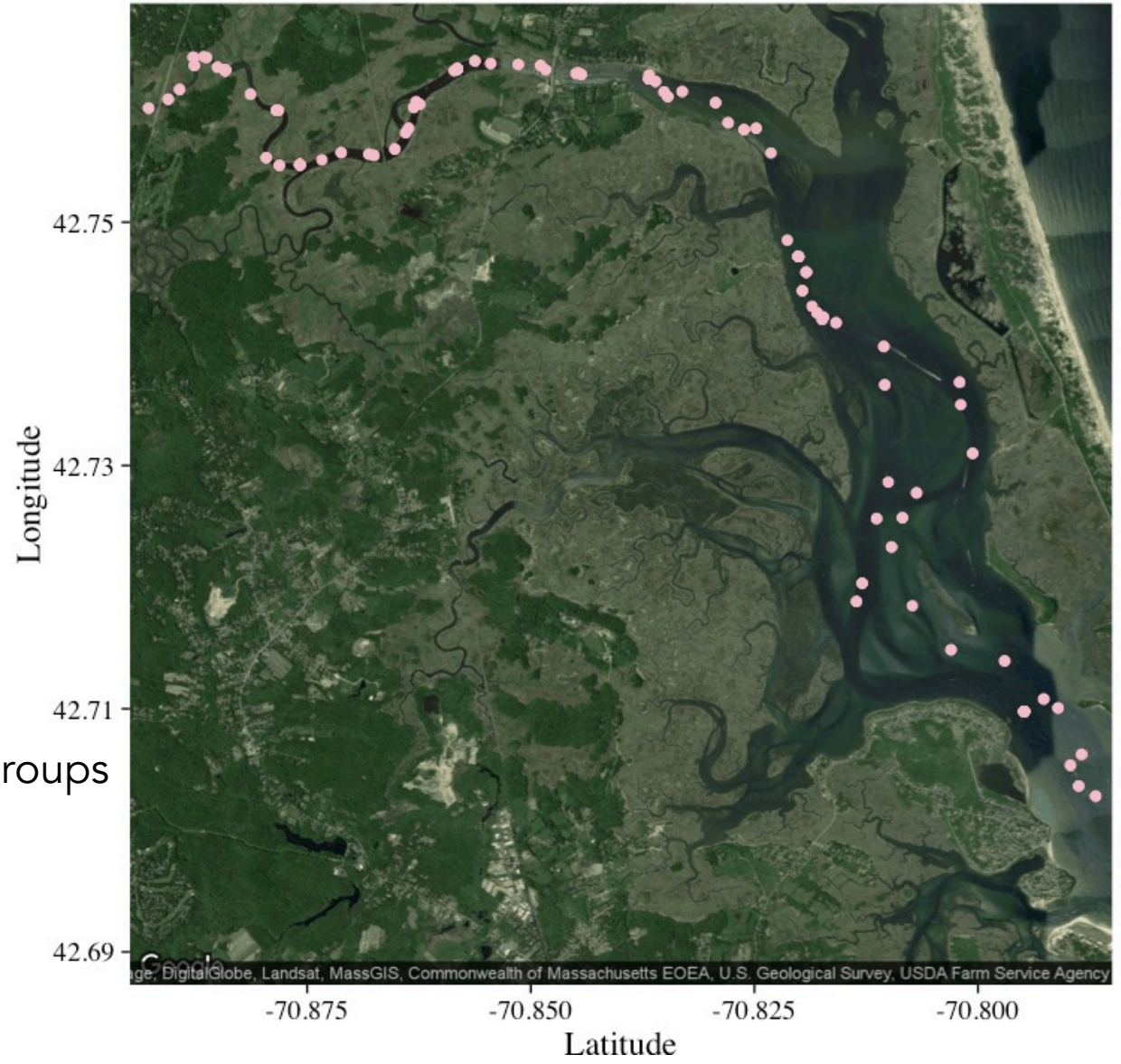


Scatterplots Show Relationships



Combining Data Sources and Maps

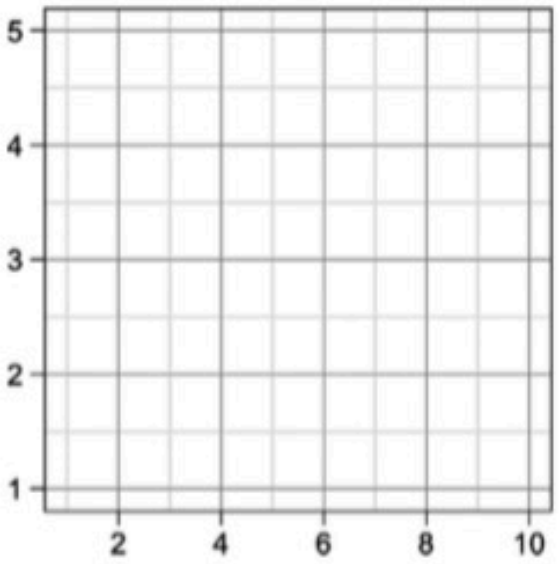


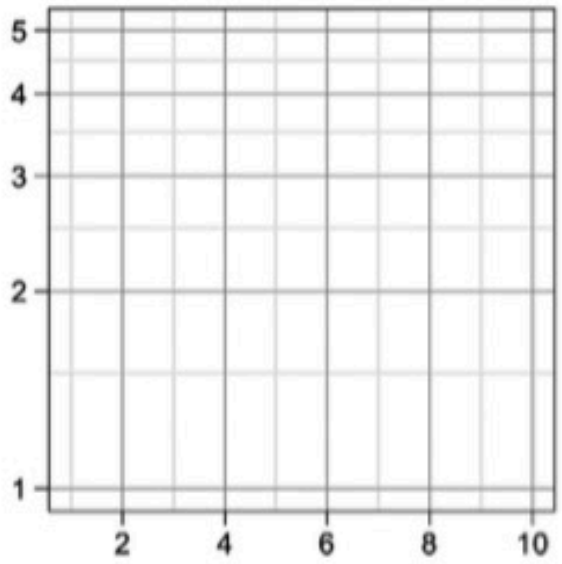


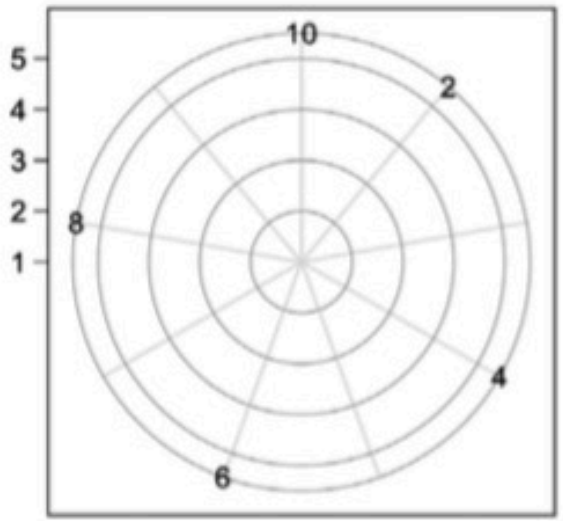
- Chlorophyll *a*
- Abundance of taxonomic groups
- Temperature
- Salinity

Hopkinson and Hobbie 2012 http://ecosystems.mbl.edu/PIE/data/EST/EST-PR-ChemTax.html

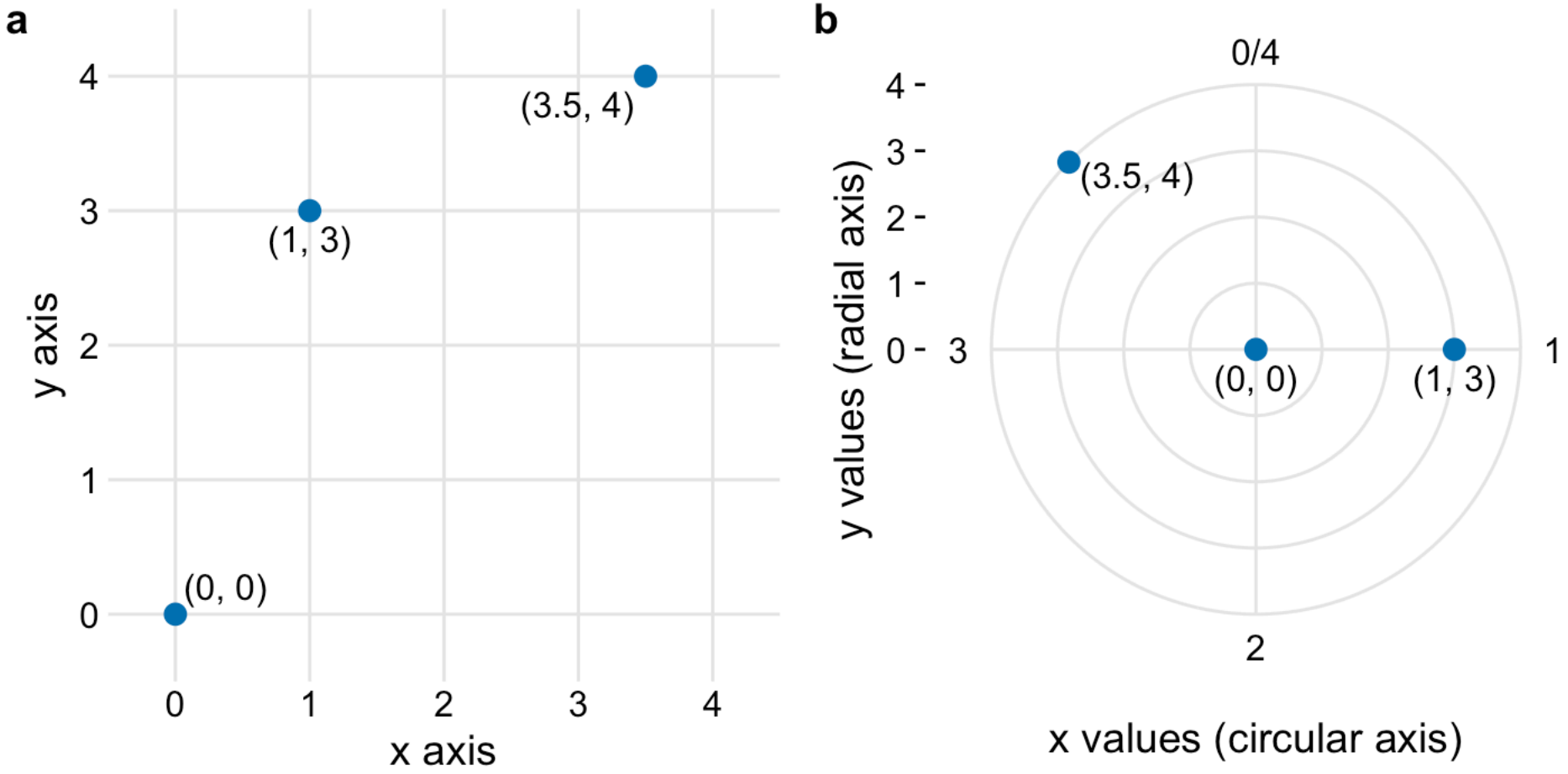
Coordinate Systems Transform Relationships





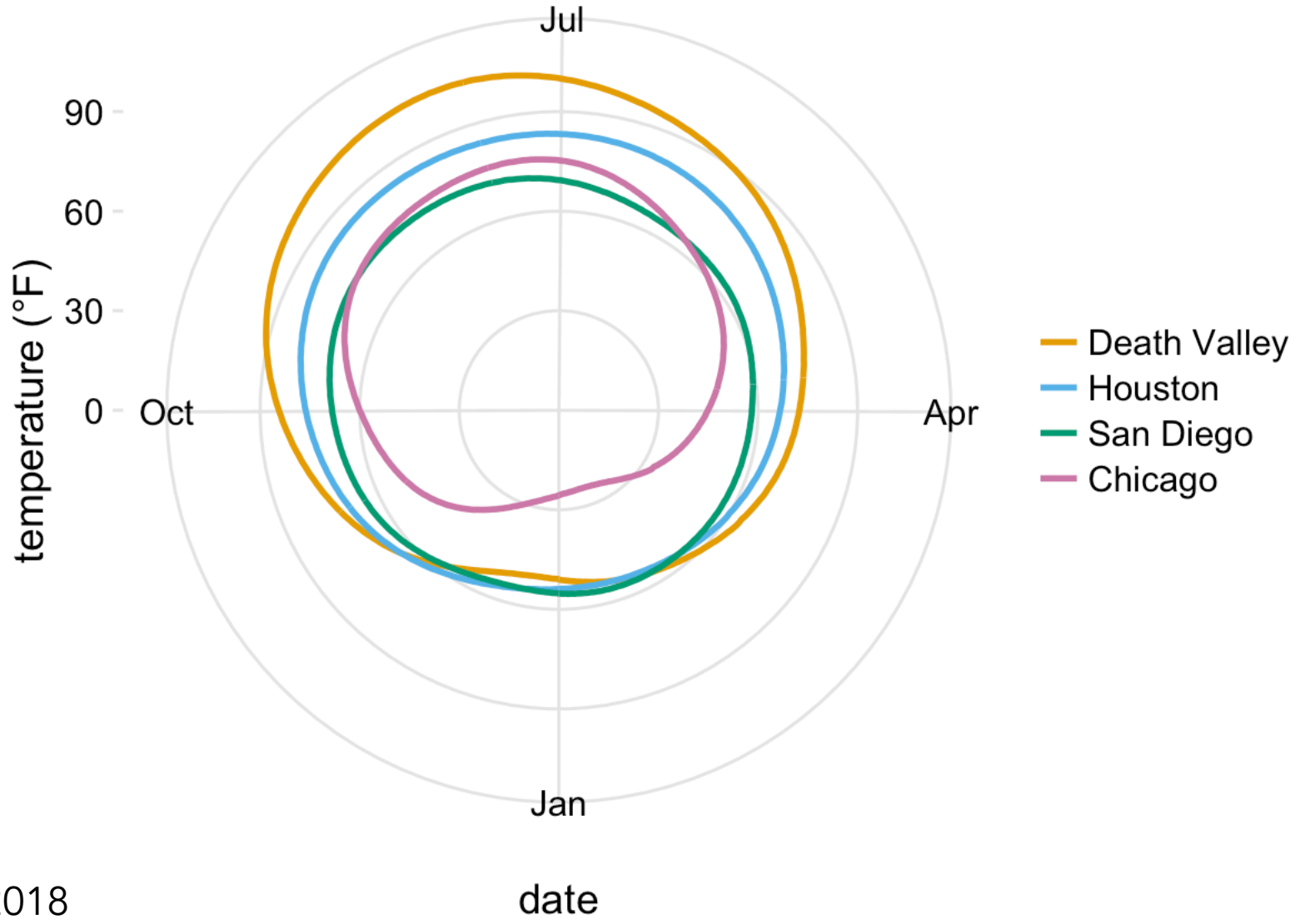


The Polar Coordinate System is Useful



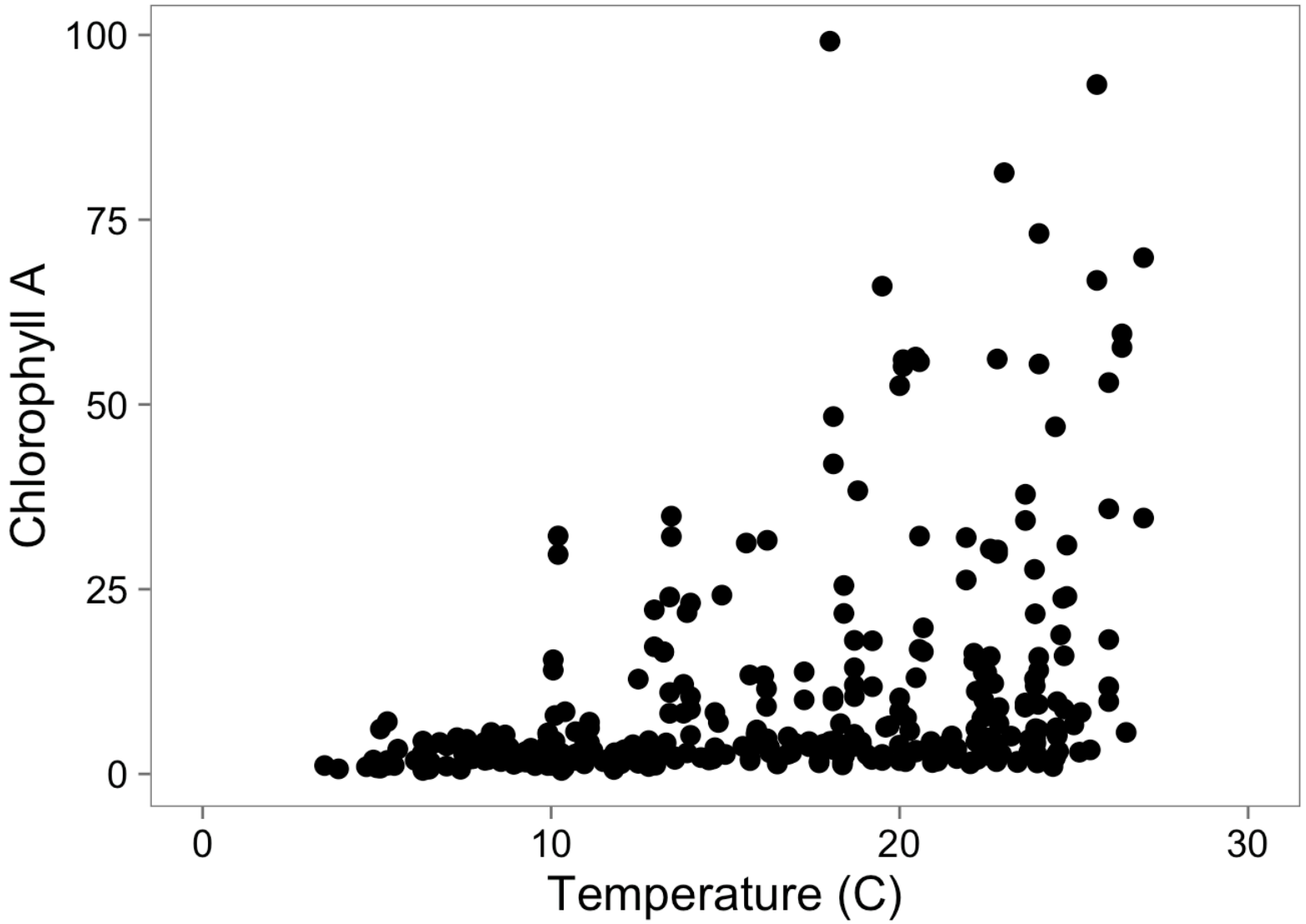
Wilke 2018

The Polar Coordinate System is Useful!

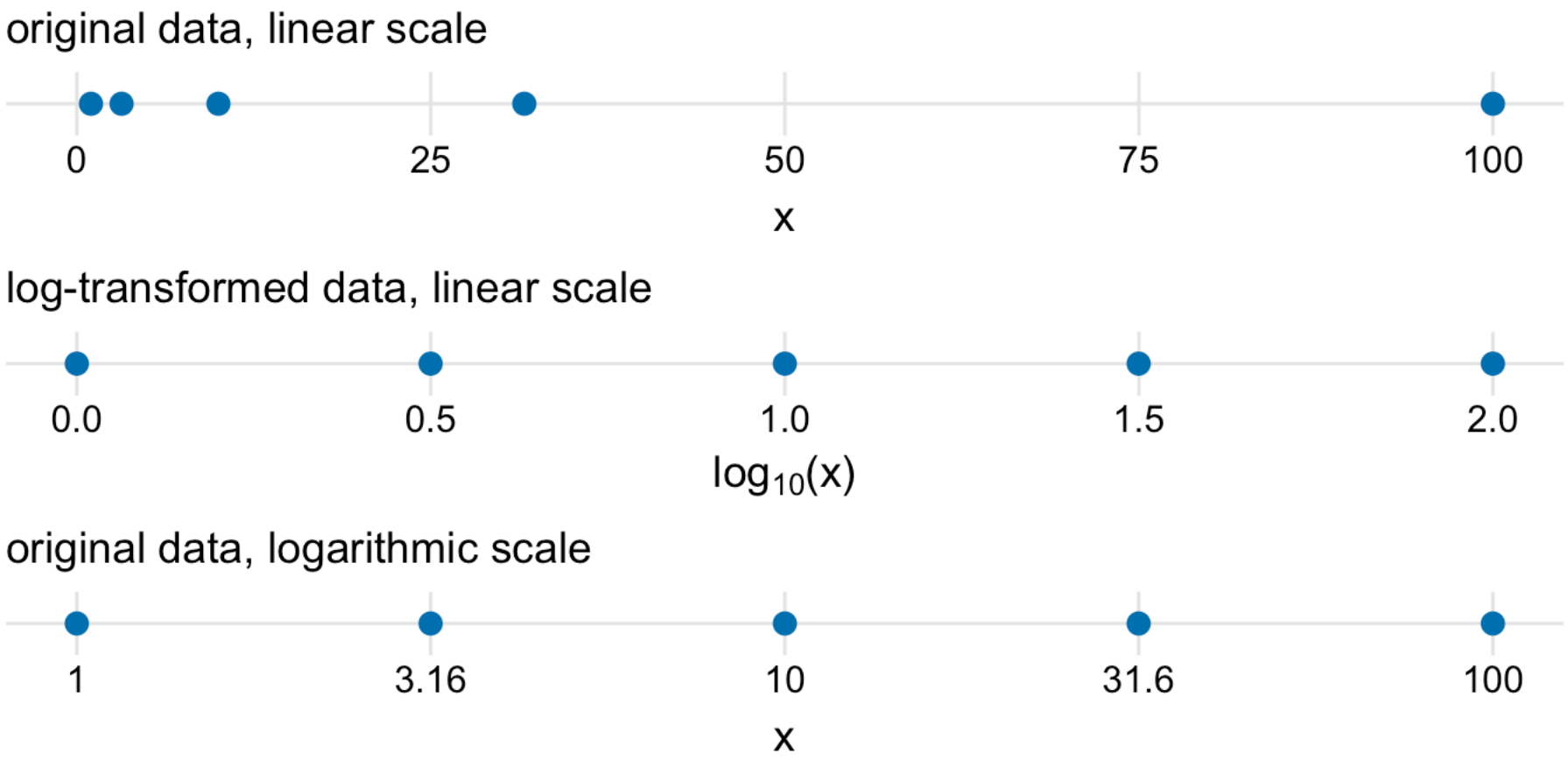


Wilke 2018

Adding Full Scale to 0

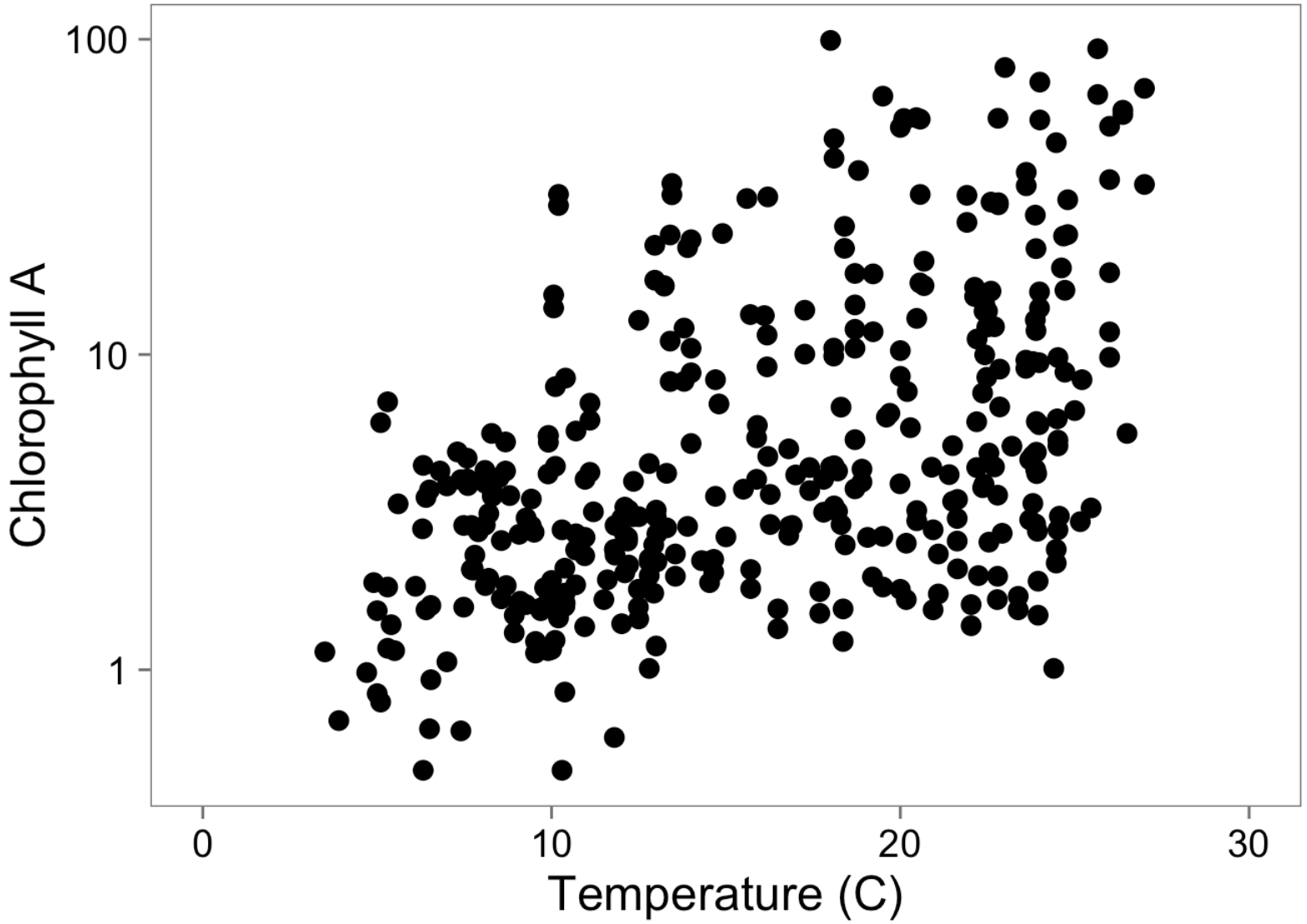


Why Transform?

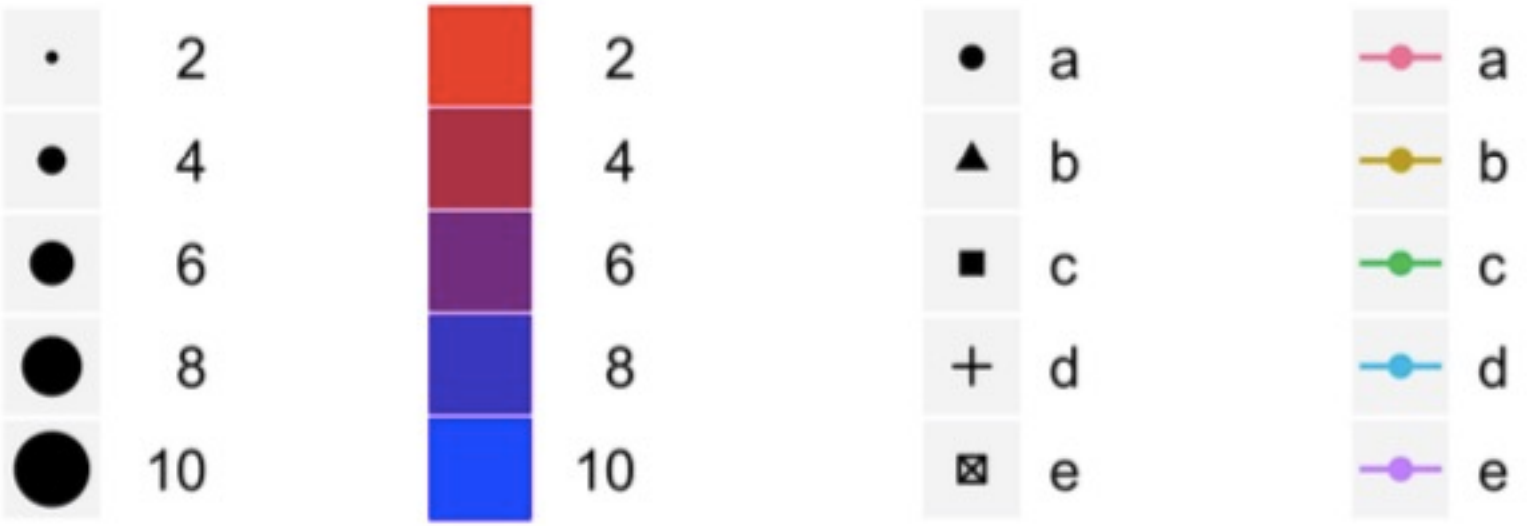


Wilke 2018

Log-Transformation To See Relationship



Scales to Add Dimensions of Data



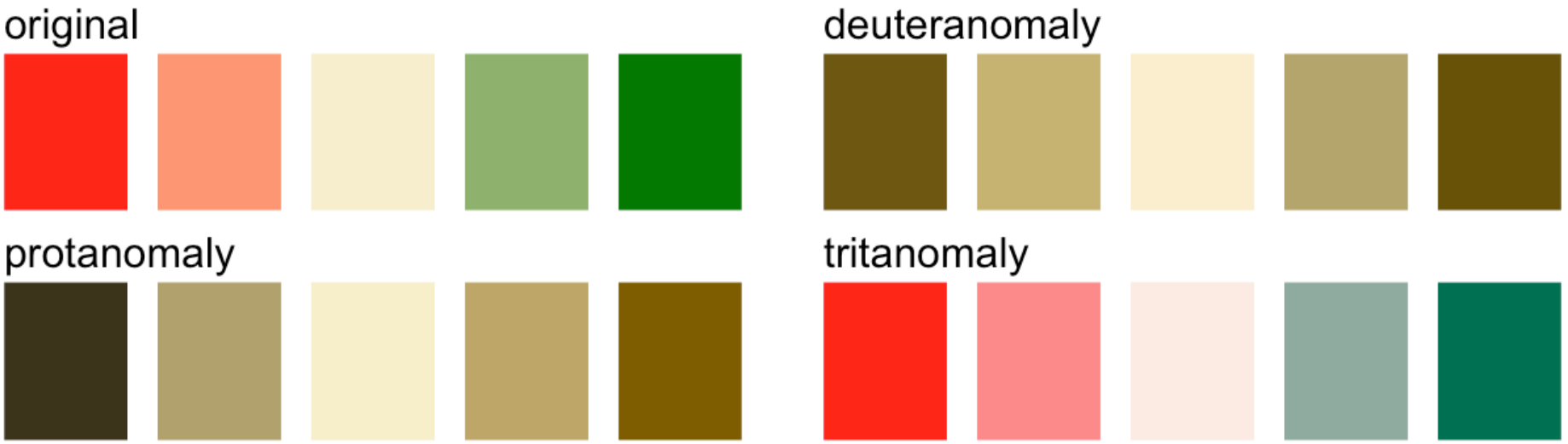
Colors Can Distinguish Groups

Wilke 2018

Colors Can Show Data

Wilke 2018

Beware Not Thinking About Color Blindness

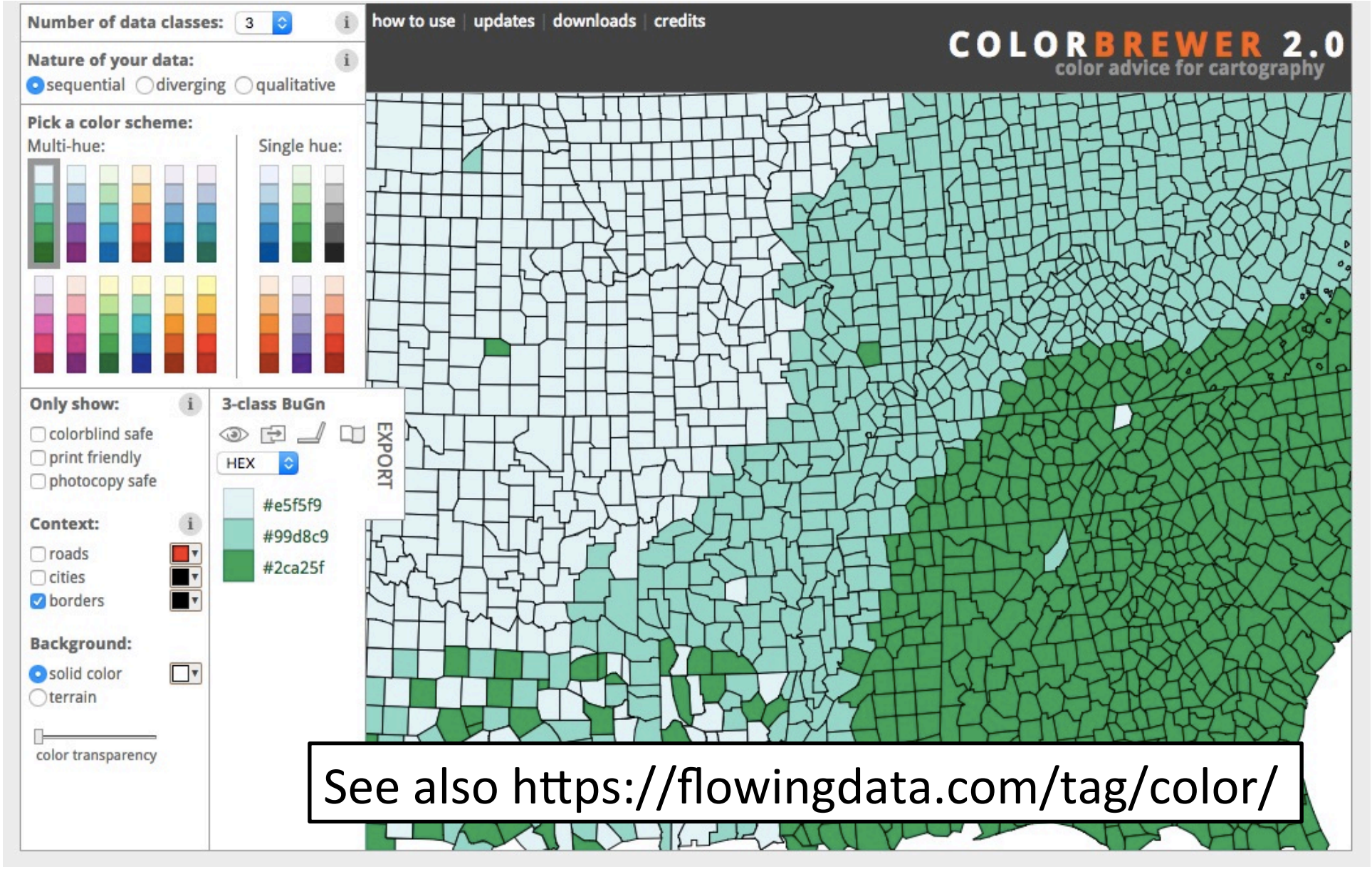


Never use Red-Green!

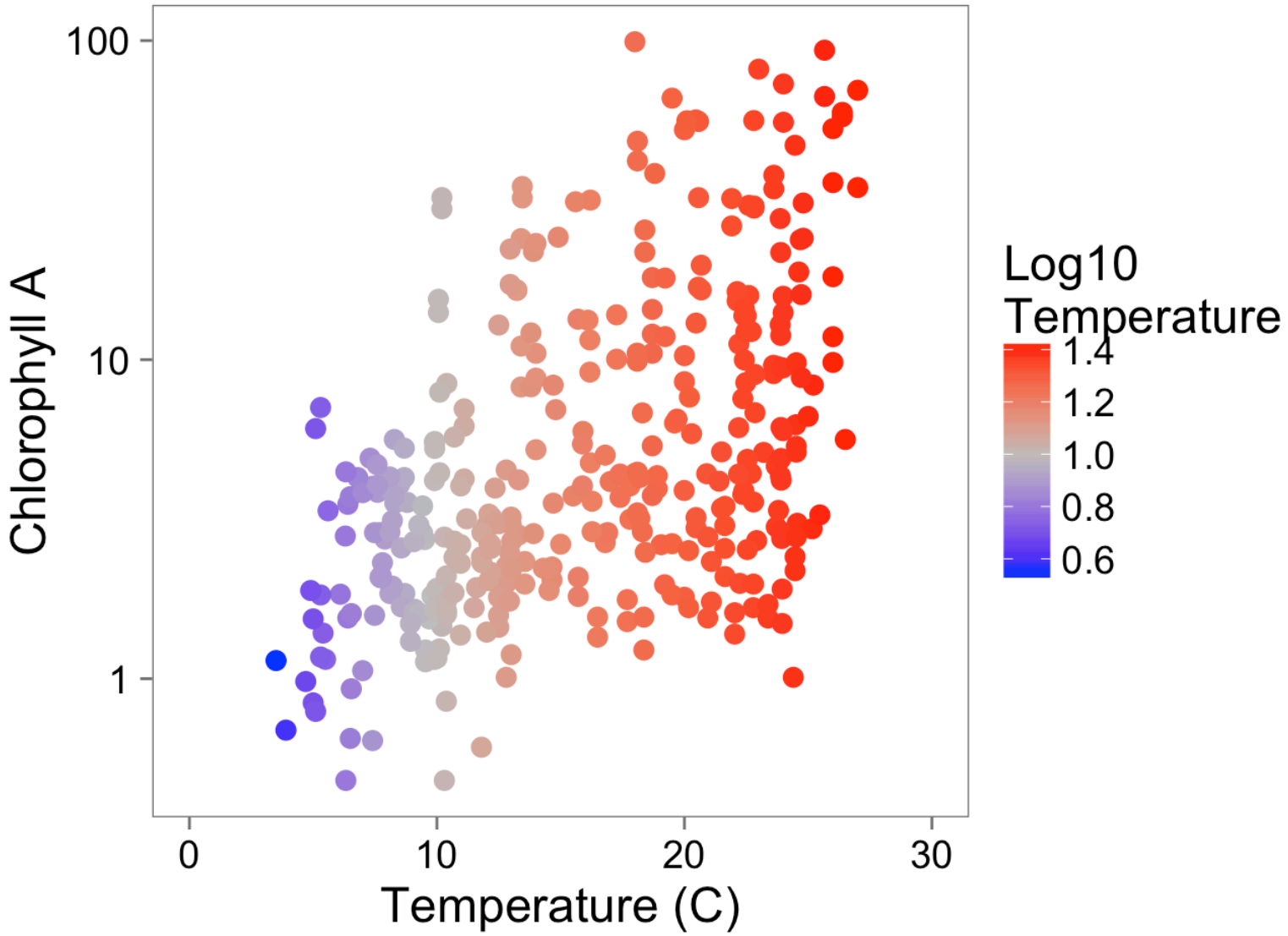
Use redundant coding: shapes, sizes, etc.

Wilke 2018

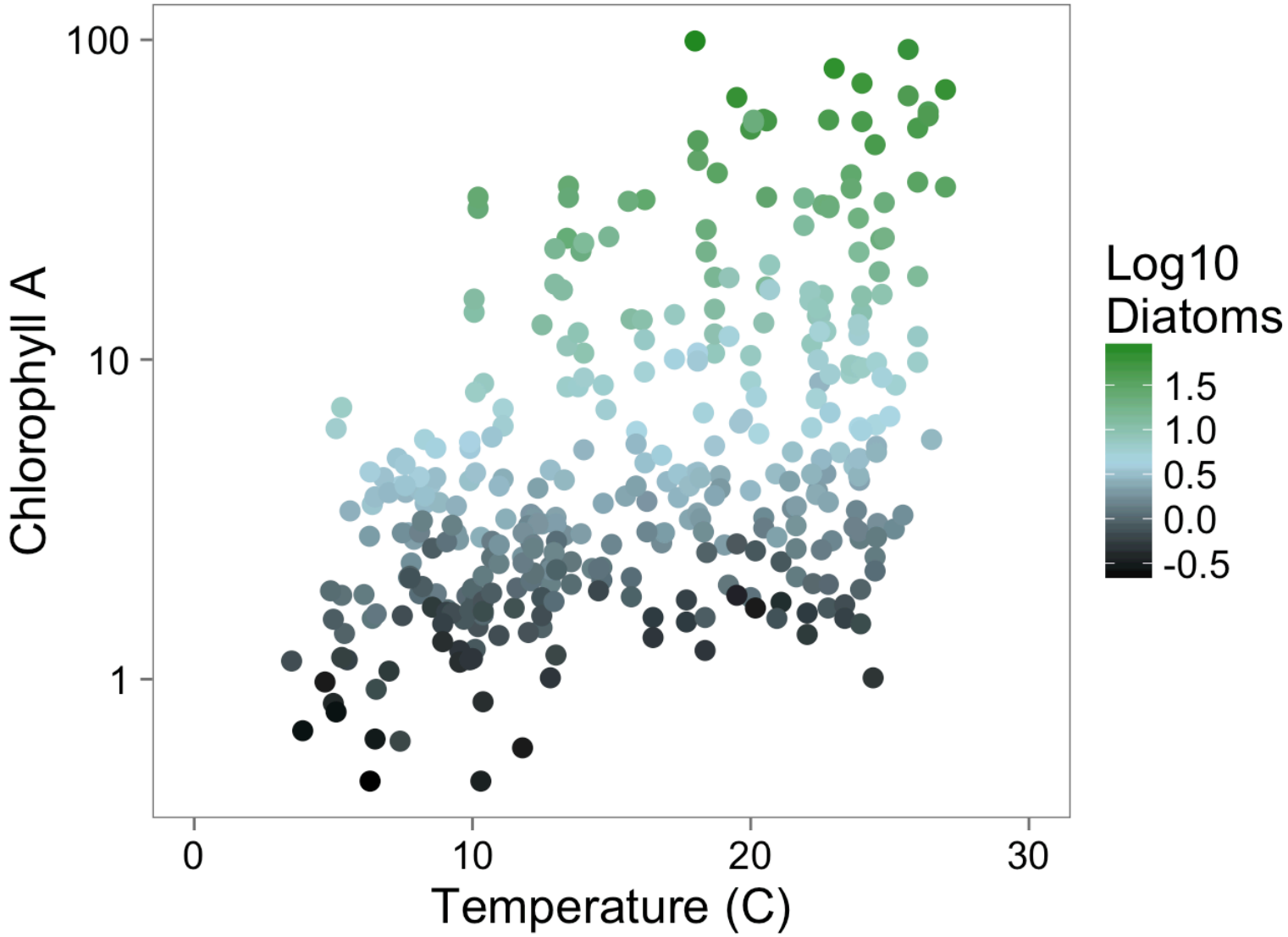
Colorbrewer.org



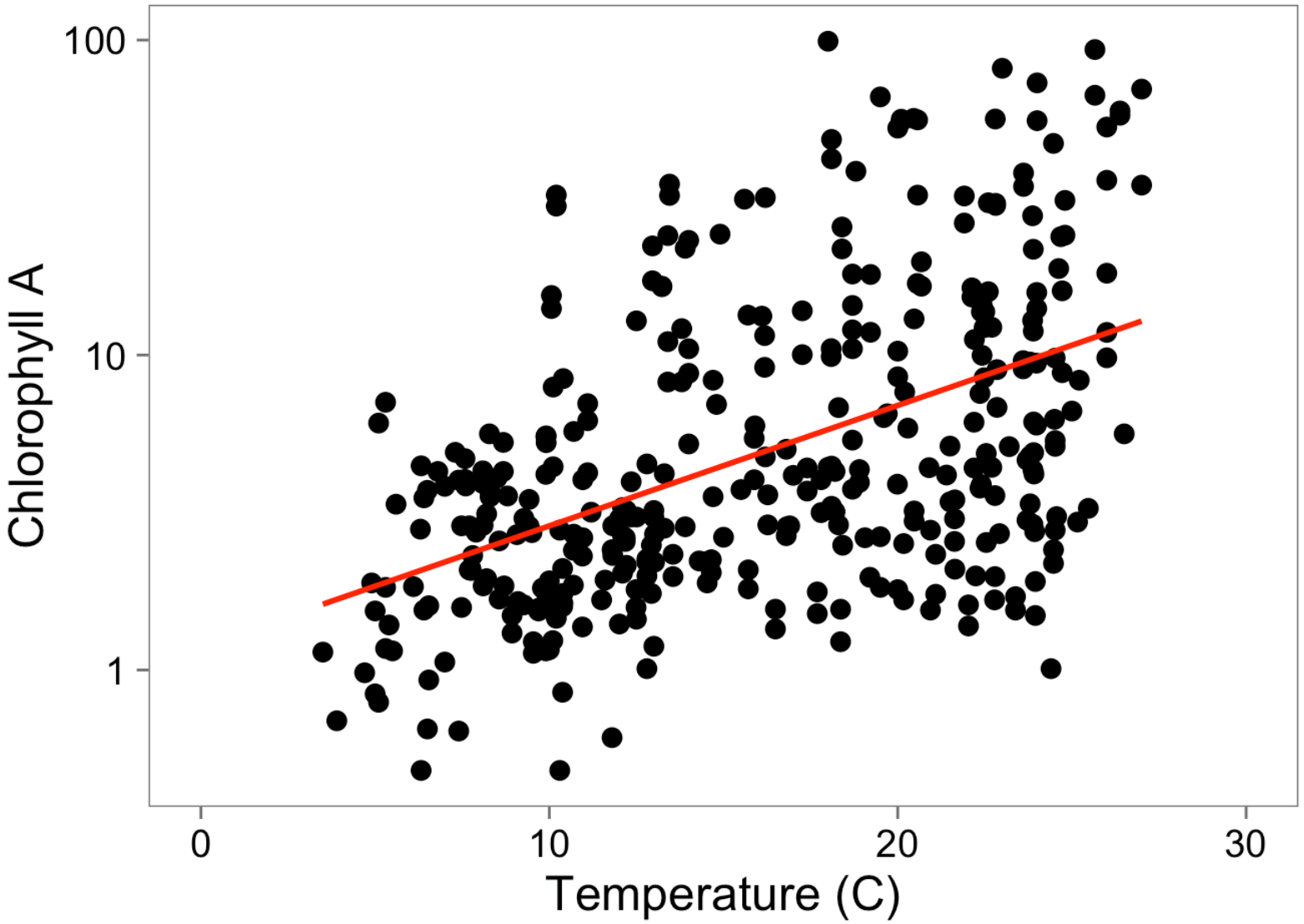
A Touch of Color!



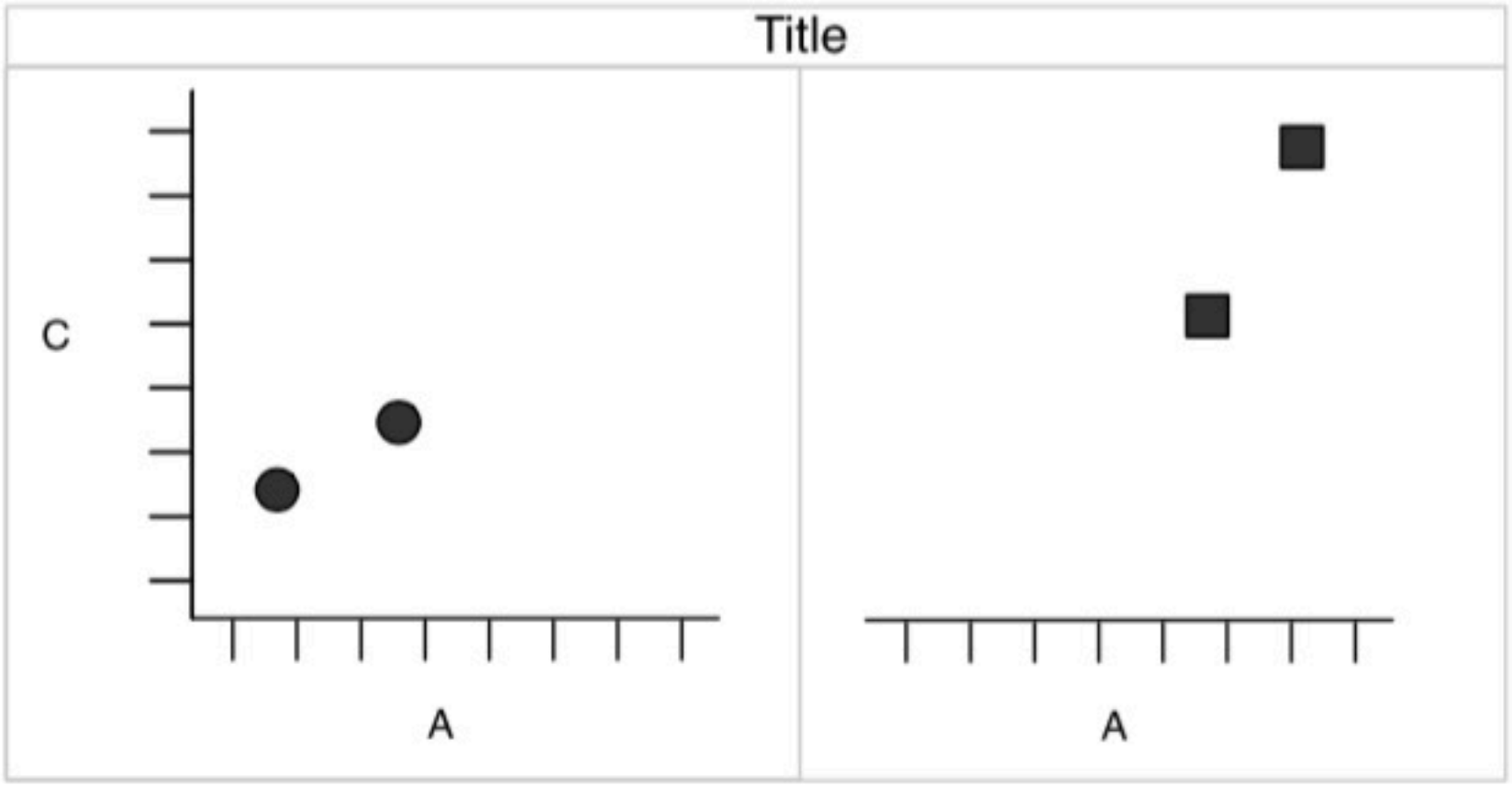
Color Can Bring in Another Dimension



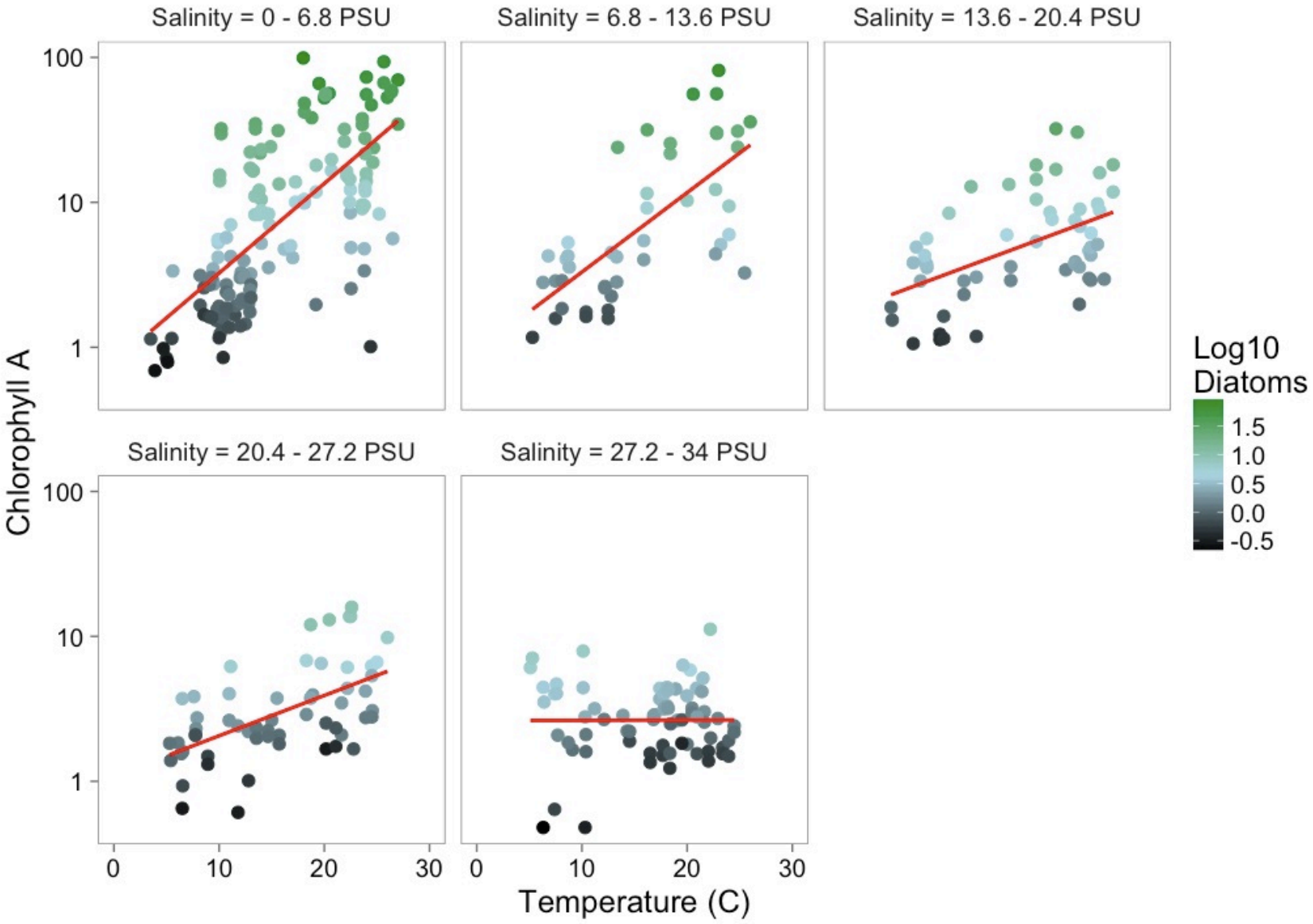
Statistical Fit to Aid Understanding



Facets to Add Fine-Grained Information or New Dimensions



Facets Add Information



Data Viz in a Nutshell

1. History
2. Graphical Basics
3. Minimalist principles

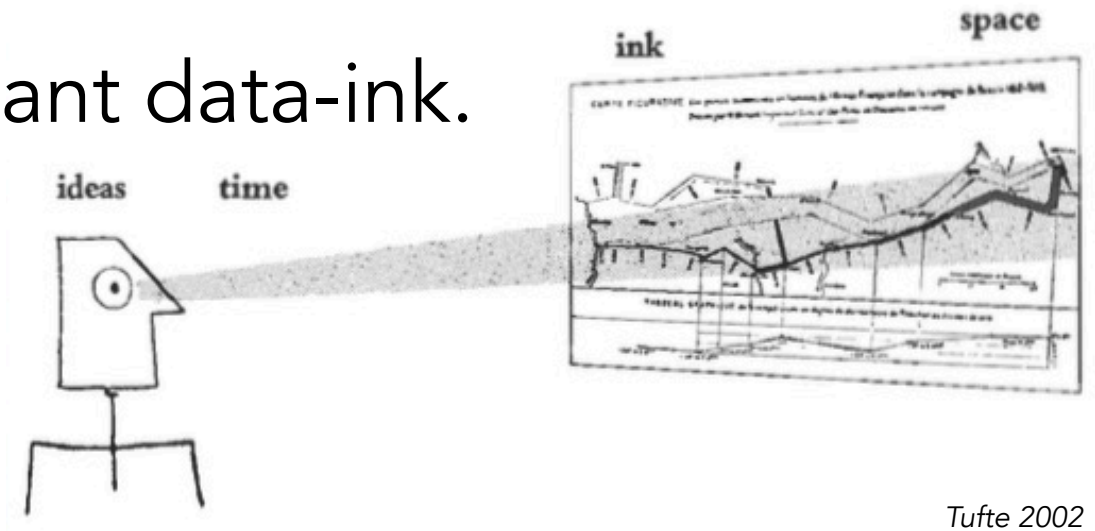
Minimalist Presentation

1. Above all else show data.

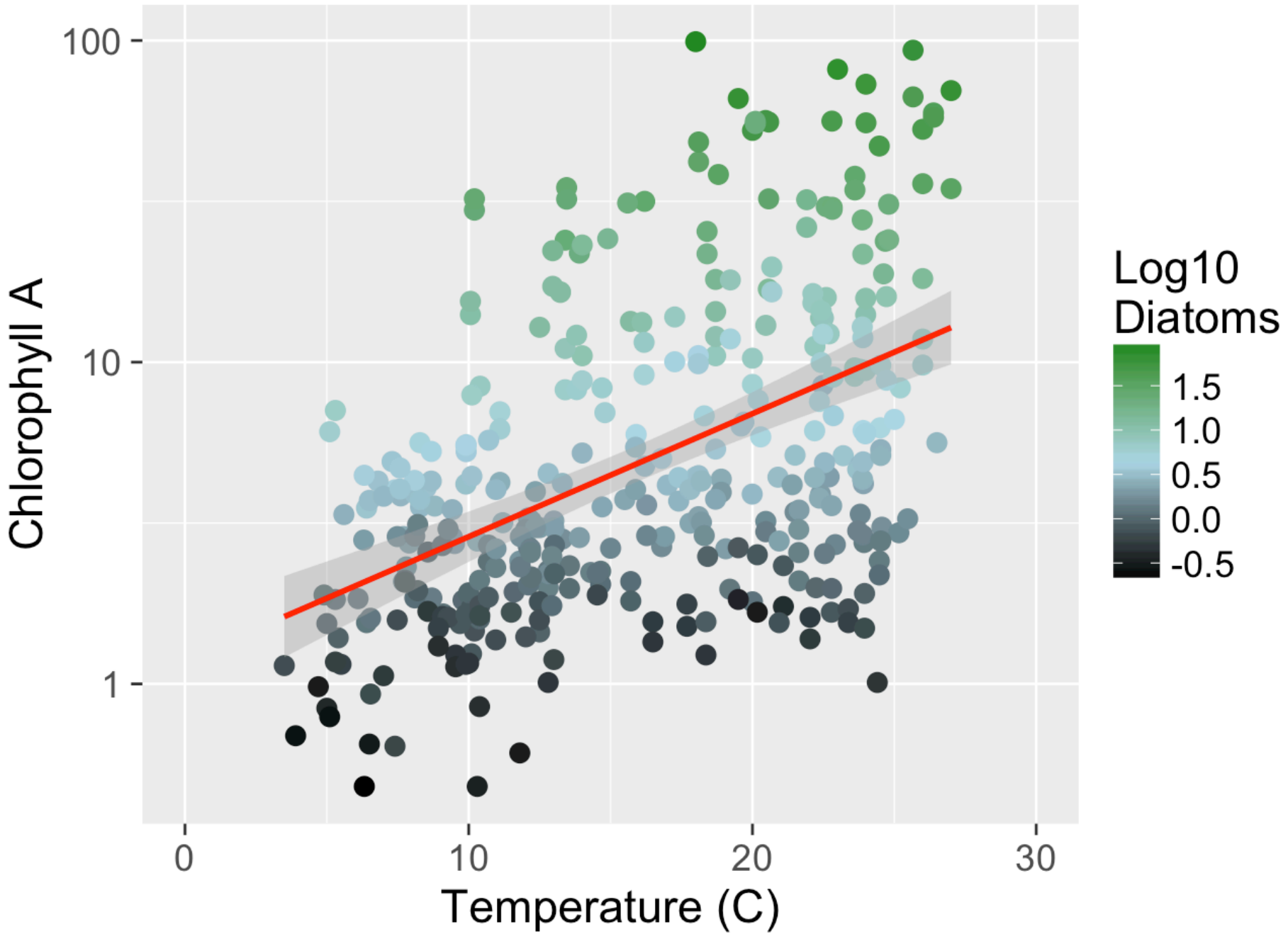
2. Maximize the data-ink ratio

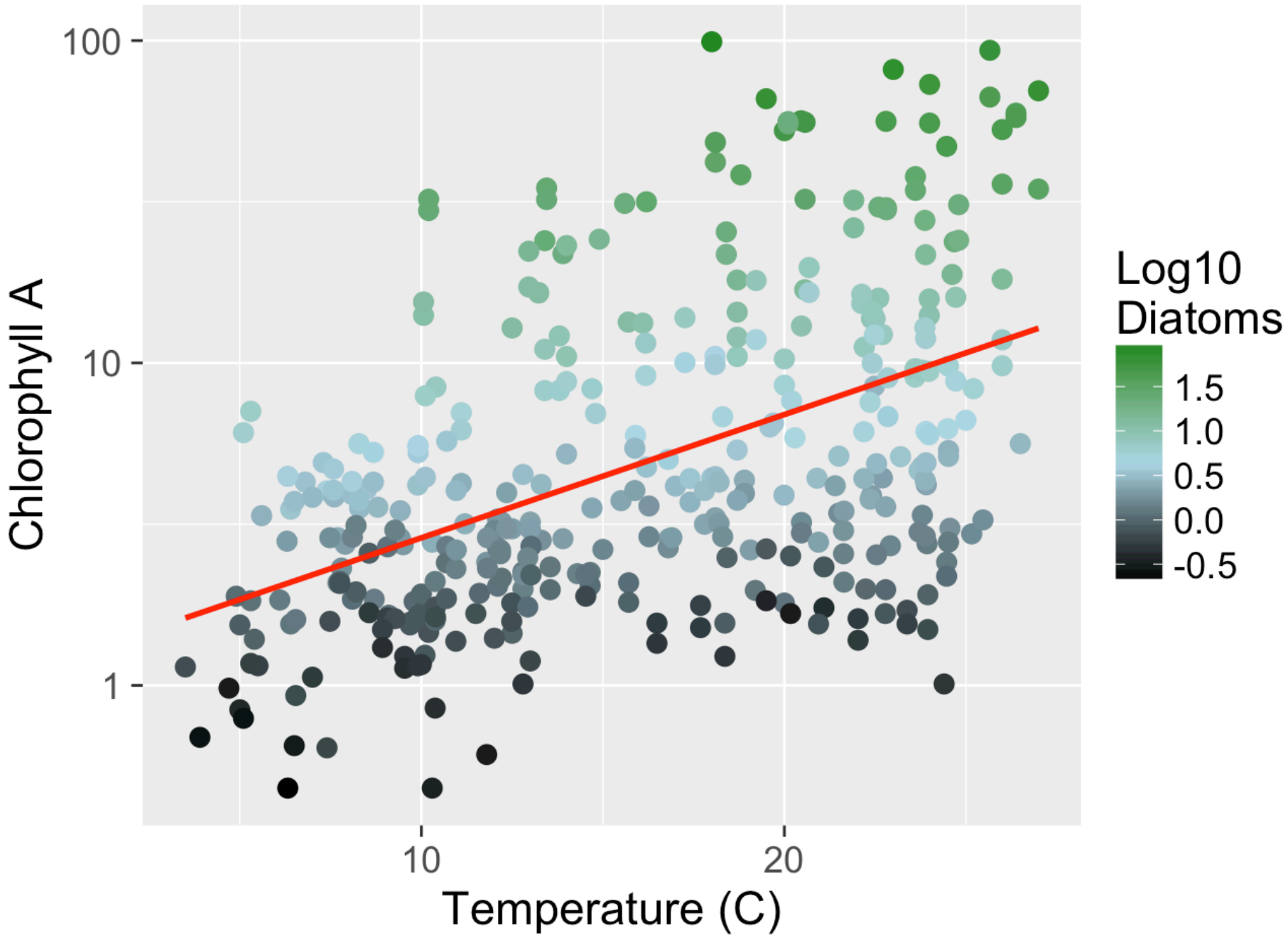
3. Erase non-data-ink.

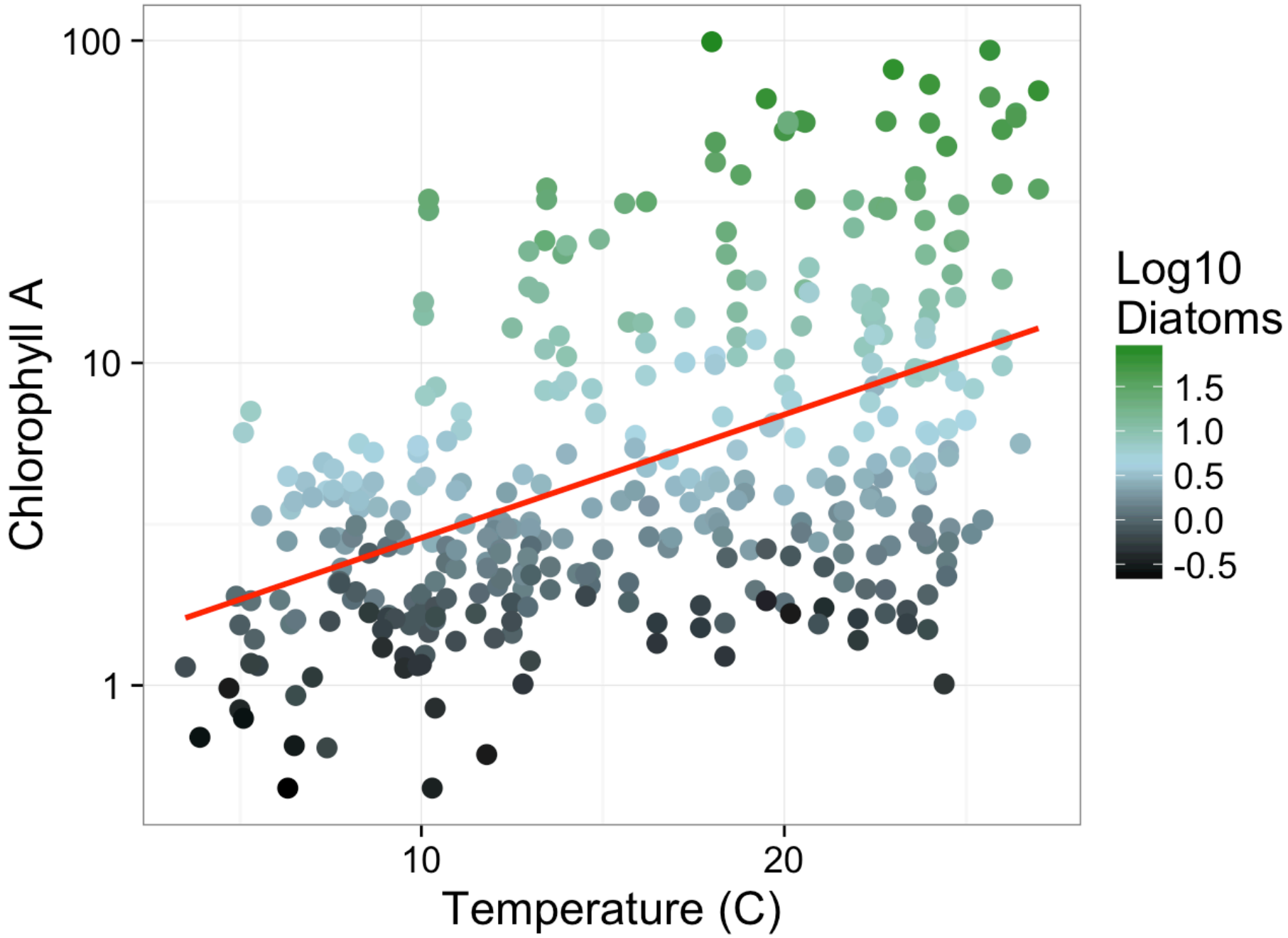
4. Erase redundant data-ink.

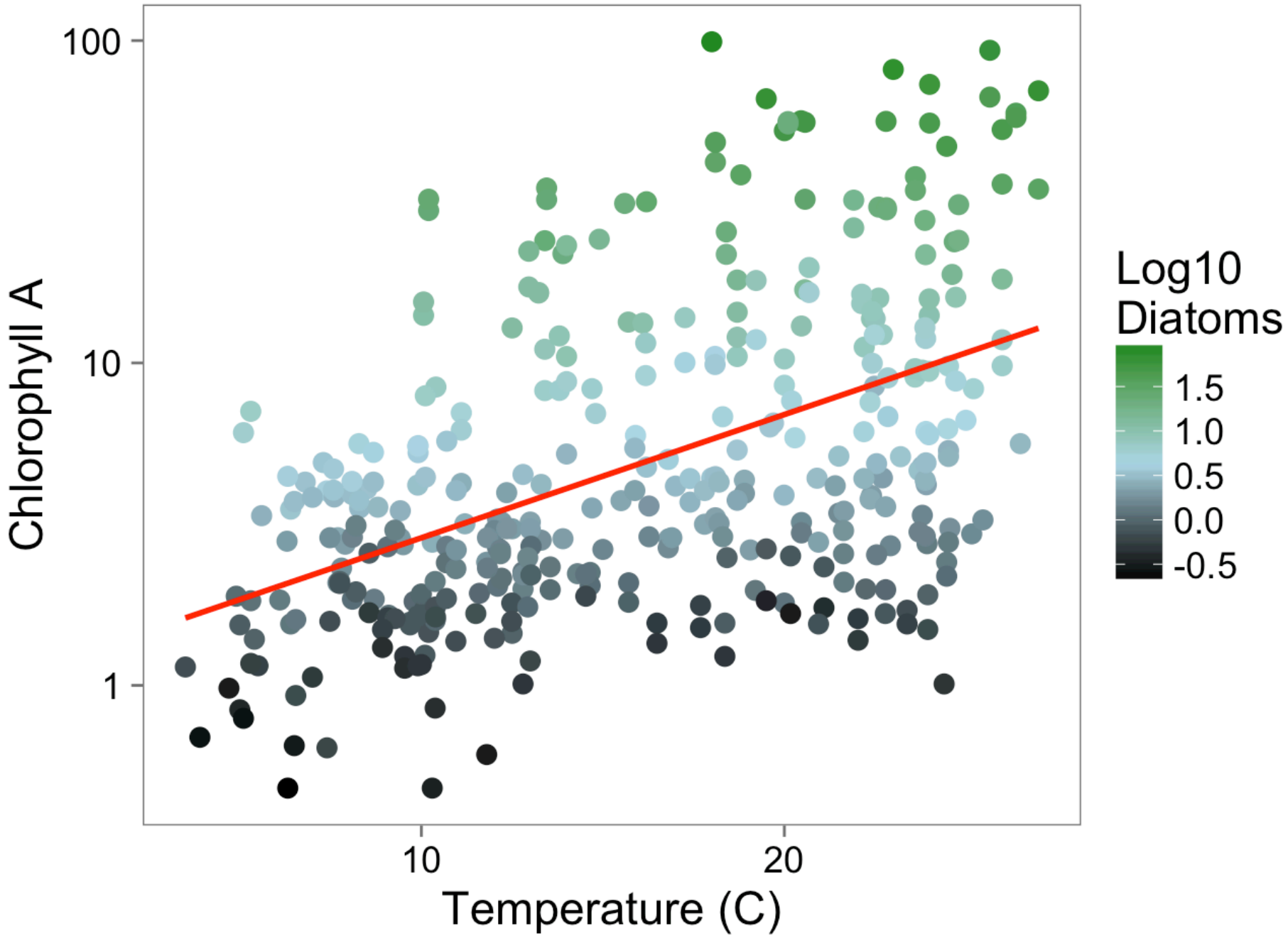


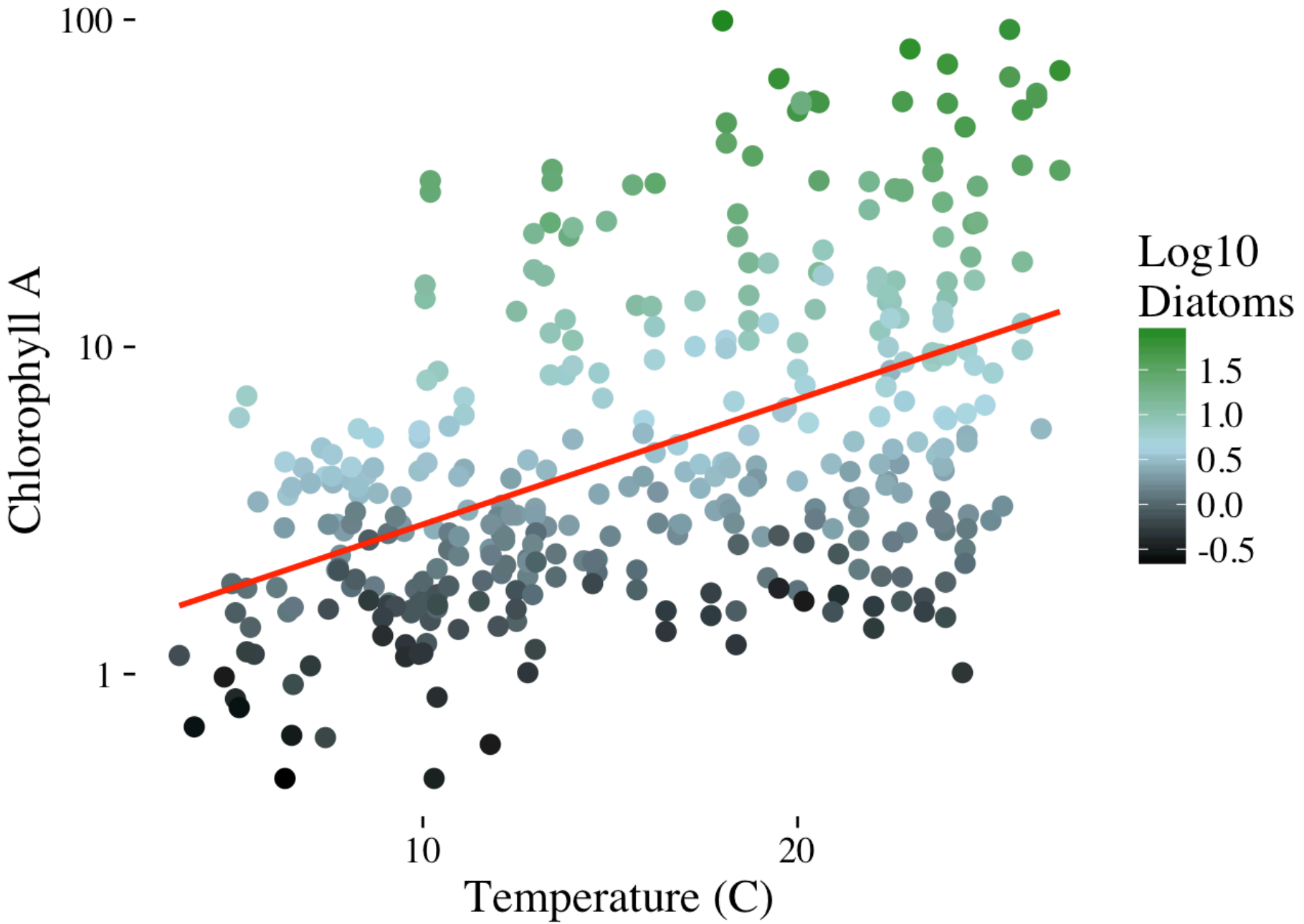
Tufte 2002

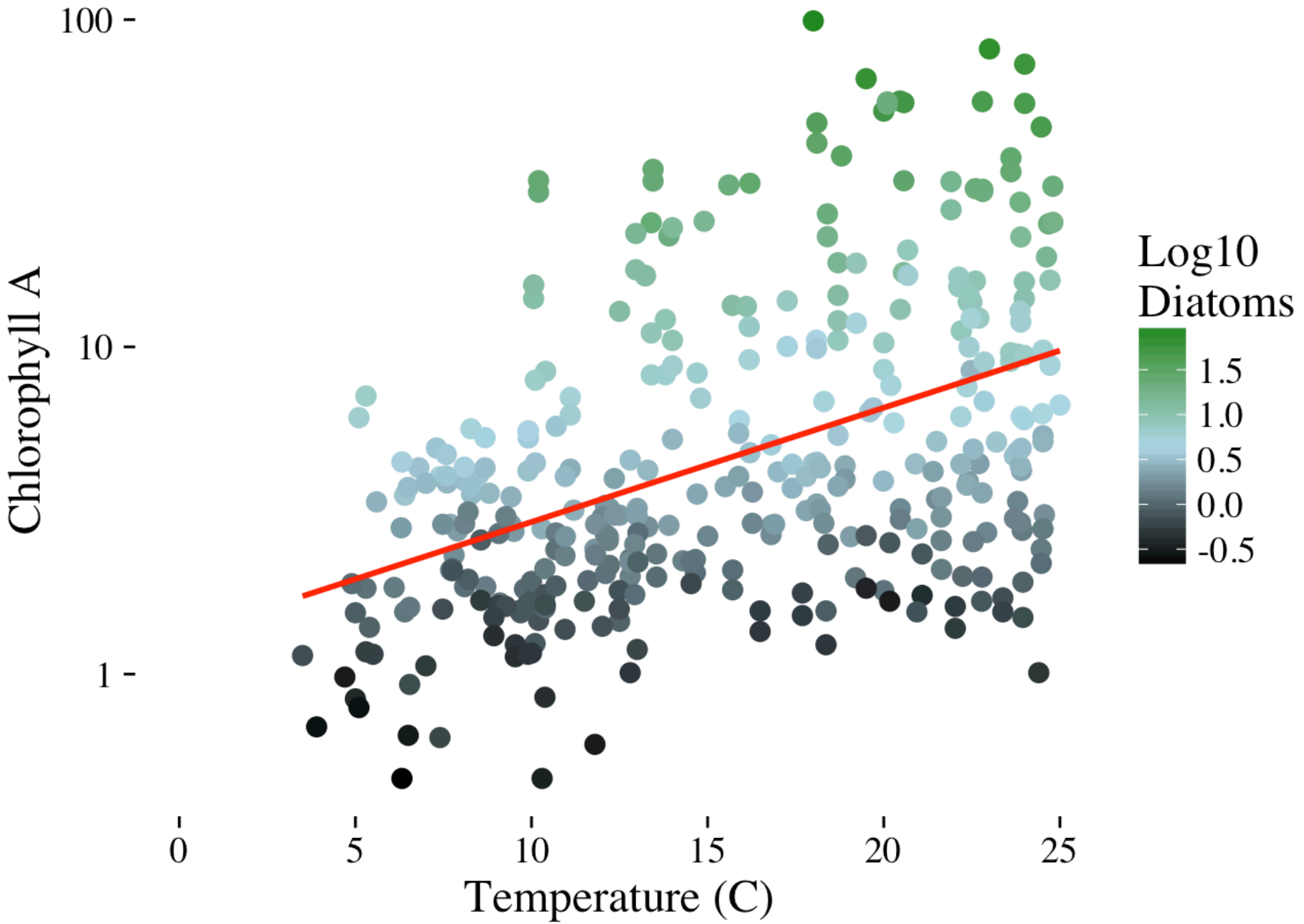

100
10
1
Chlorophyll A
0
10
20
30
Temperature (C)
Log10
Diatoms
1.5
1.0
0.5
0.0
-0.5


100
10
1
Chlorophyll A
10
20
Temperature (C)
Log10
Diatoms
1.5
1.0
0.5
0.0
-0.5


100
10
1
Chlorophyll A
10
20
Temperature (C)
Log10
Diatoms
1.5
1.0
0.5
0.0
-0.5


100
10
1
Chlorophyll A
10
20
Temperature (C)
Log10
Diatoms
1.5
1.0
0.5
0.0
-0.5


100
10
1
Chlorophyll A
10
20
Temperature (C)
Log10
Diatoms
1.5
1.0
0.5
0.0
-0.5


100
10
1
Chlorophyll A
0
5
10
15
20
25
Temperature (C)
Log10
Diatoms
1.5
1.0
0.5
0.0
-0.5