

Cody Dunne
Northeastern University

LECTURE 1: SO IT BEGINS!

CS 7295, FALL 2021

Course Homepage on Canvas

<https://c.dunne.dev/cs7295f21/>

(up soon)

Feel free to interrupt with
questions!

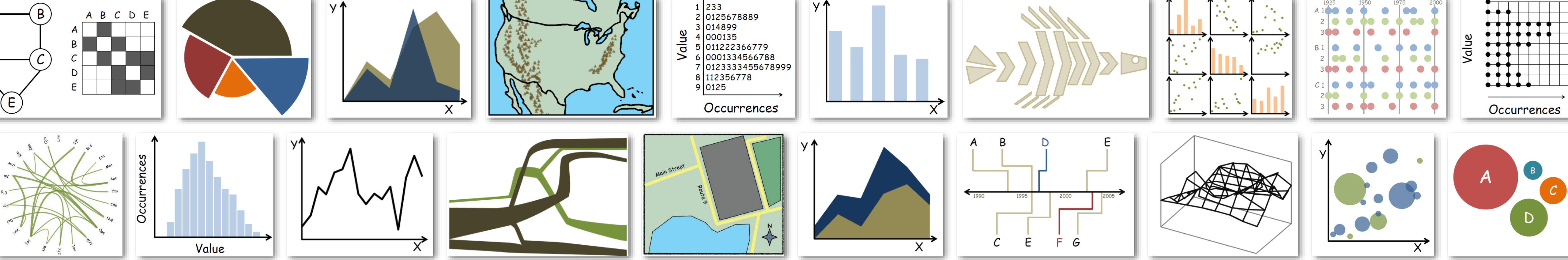
Plan for Today

- Discuss what visualization is & why we care
- Get to know each other
- Begin talking about graphs/networks and visualizing them

For next time, you will read and think about:

- Bastert & Matuszewski (2001) Layered drawings of digraphs. In: *Drawing graphs: methods and models*.
doi: [10.1007/3-540-44969-8_5](https://doi.org/10.1007/3-540-44969-8_5) (EZproxy [metadata](#), [PDF](#))
- Fleischer & Hirsch C. (2001) Graph drawing and its applications. In: *Drawing graphs: methods and models*.
doi: [10.1007/3-540-44969-8_1](https://doi.org/10.1007/3-540-44969-8_1) (EZproxy [metadata](#), [PDF](#))

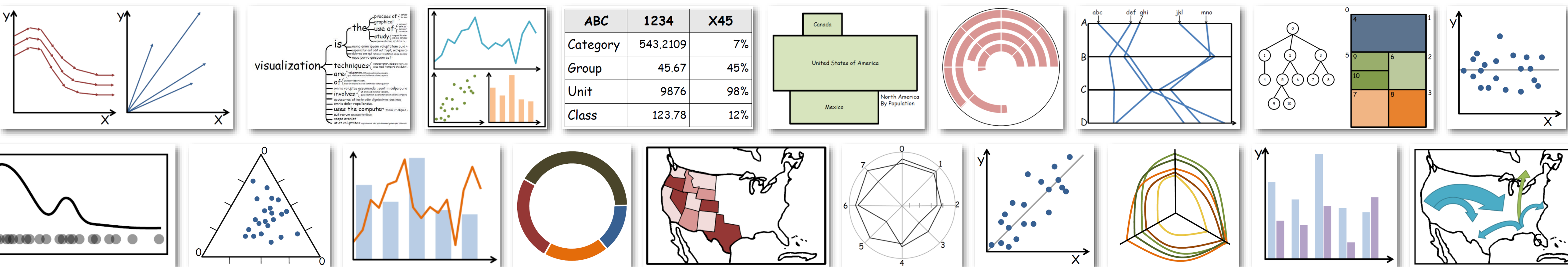
What is visualization
anyway?



(static or interactive)

(abstract or spatial)

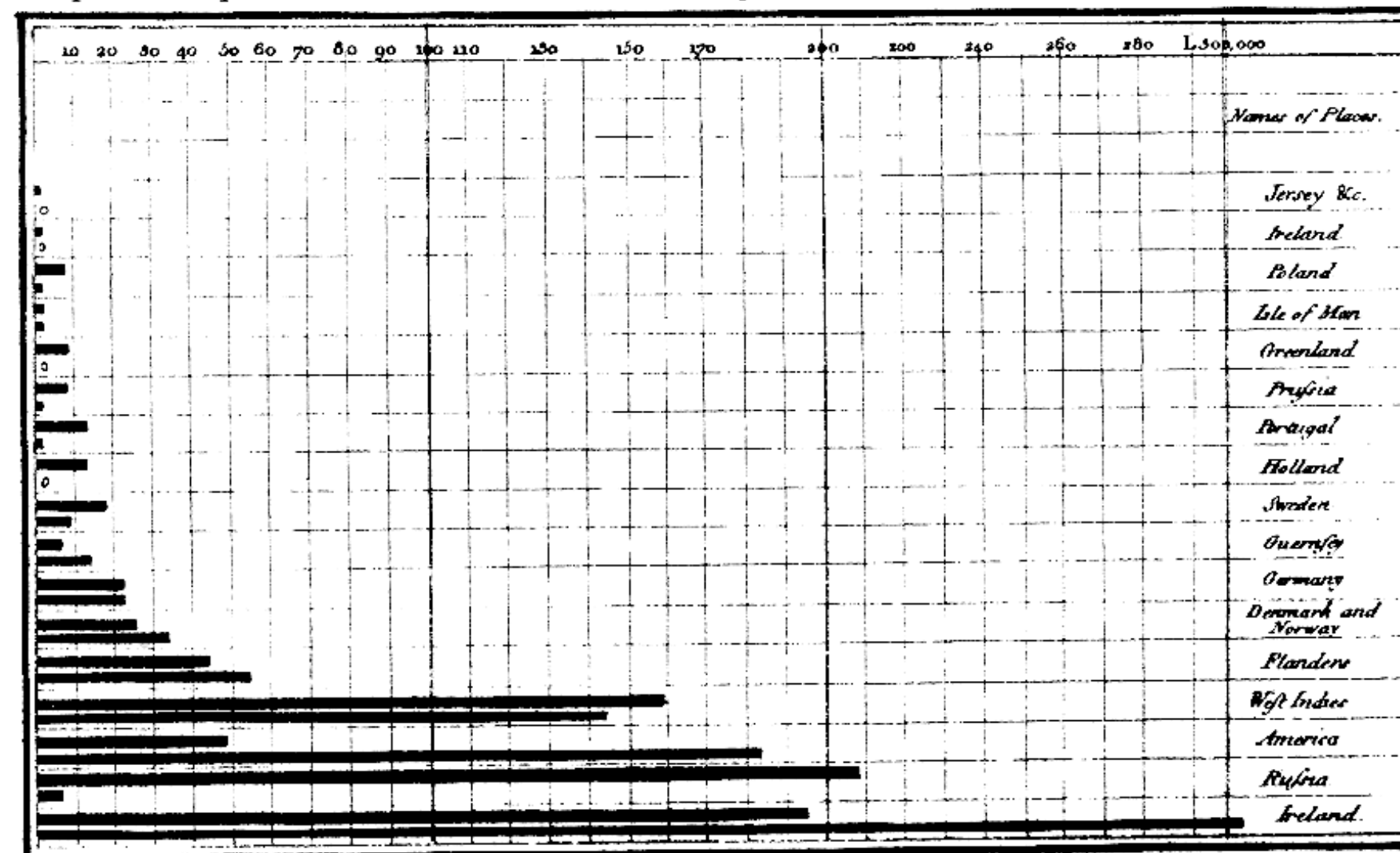
visualization: the visual representation of data to reinforce human cognition





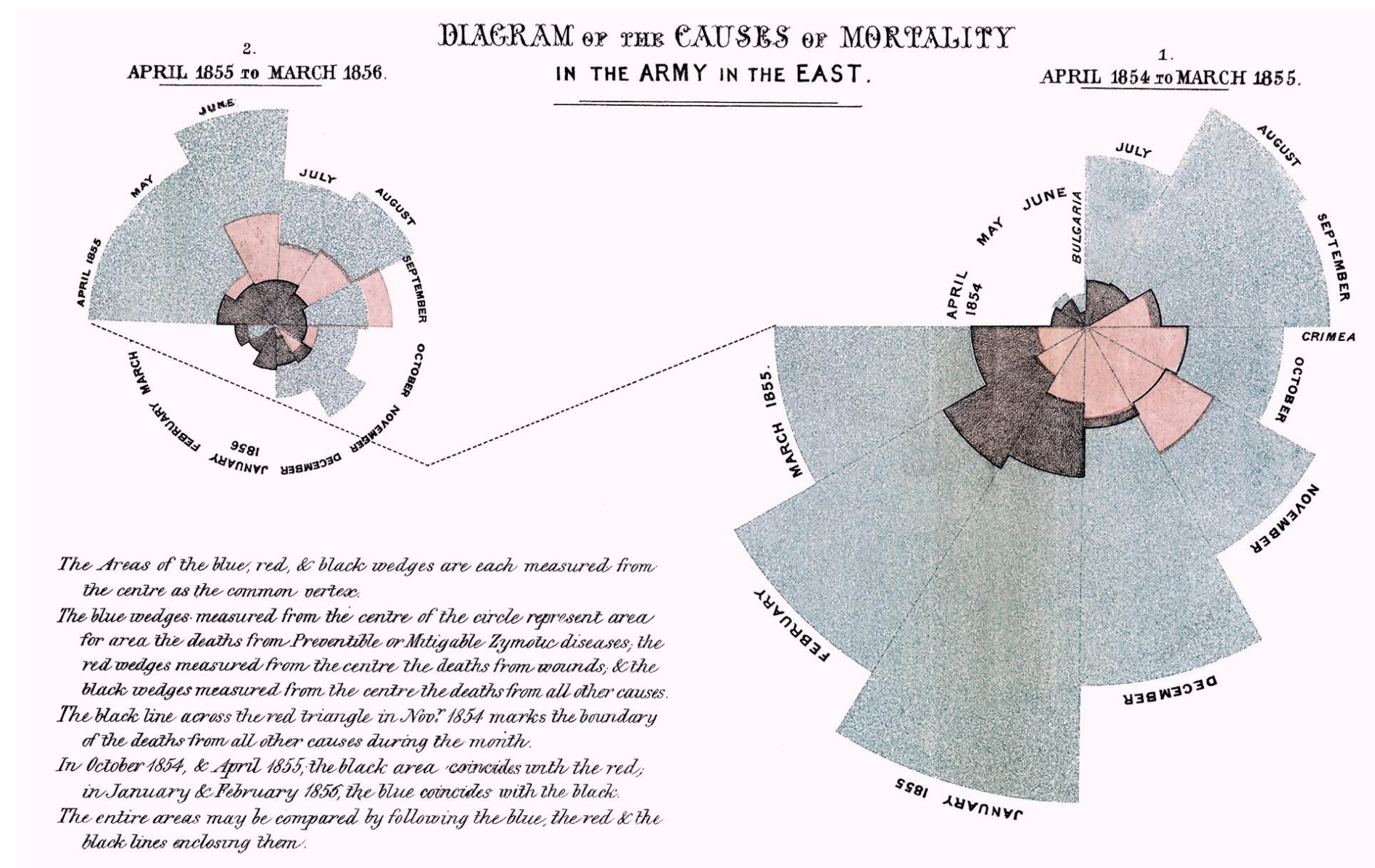
PTOLEMY (c. 150)

Exports and imports of SCOTLAND to and from different parts for one Year from Christmas 1780 to Christmas 1781.

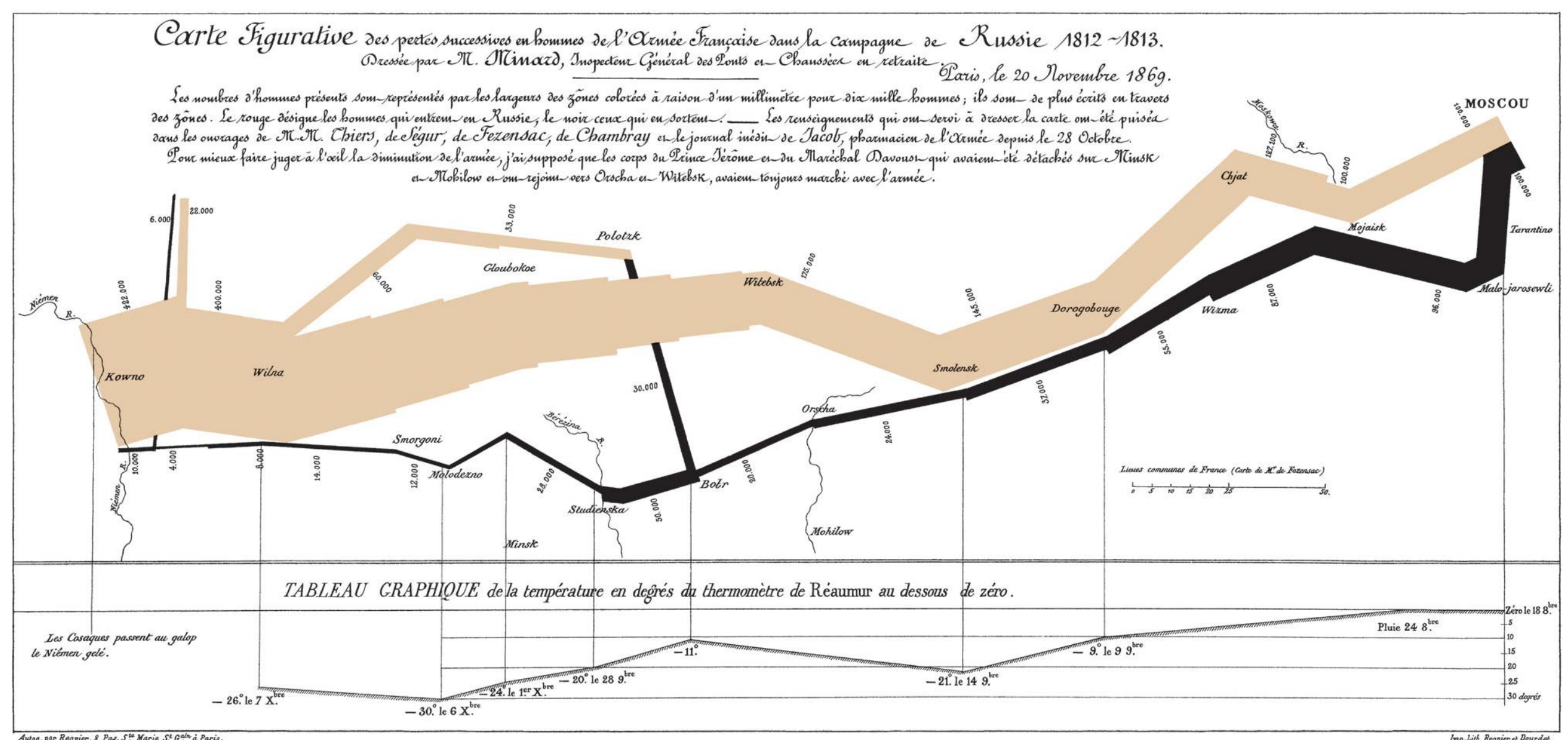


The Upright divisions are Ten Thousand Pounds each. The Black Lines are Exports the Ribbed Lines Imports.
 Published in the Edinburgh Journal June 7th 1782 by W^m Playfair
 Made comp^t 352. 1/2 Londⁿ

WILLIAM PLAYFAIR (c. 1786)



FLORENCE NIGHTINGALE (c. 1858)



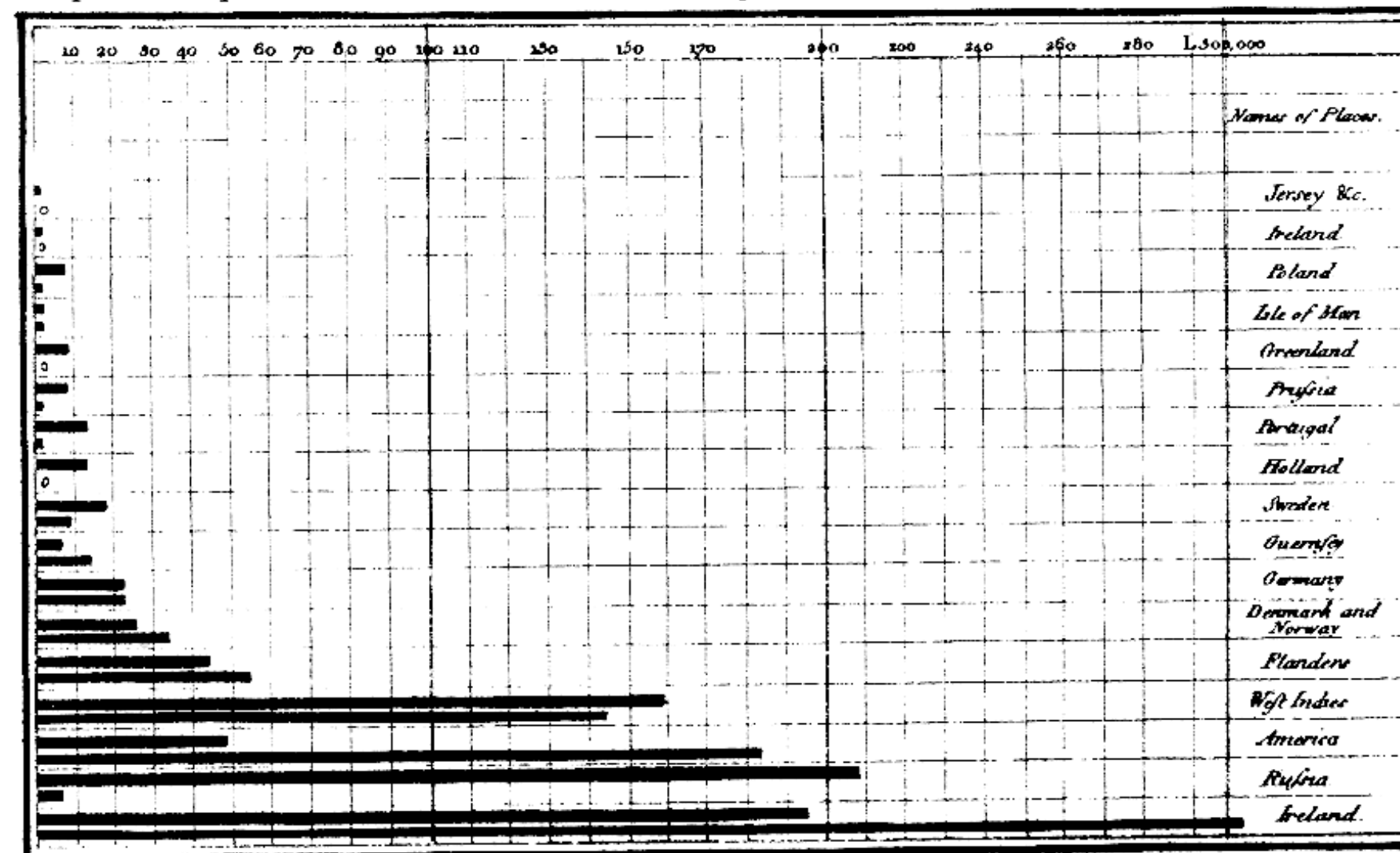
CHARLES MINARD (c. 1869)





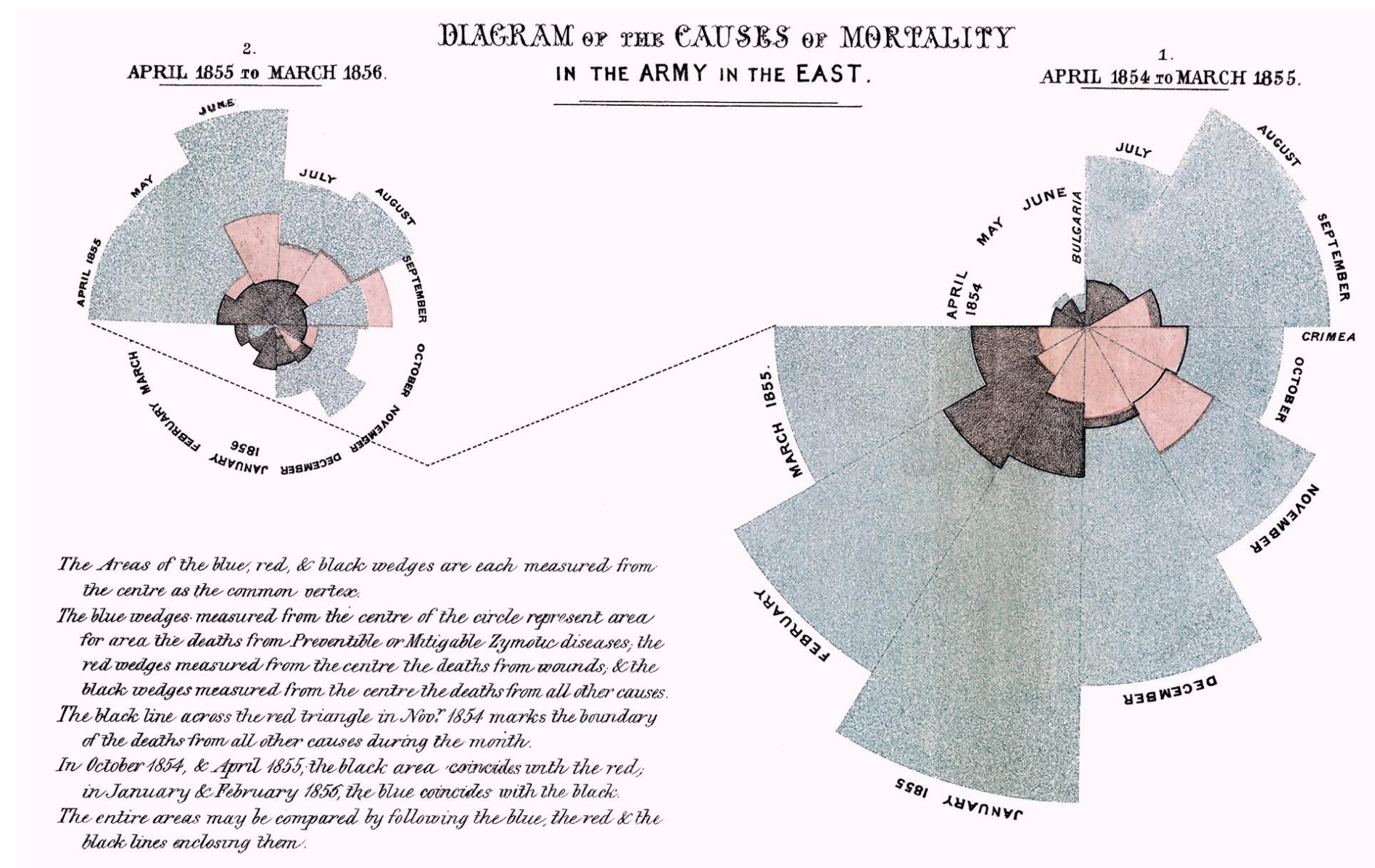
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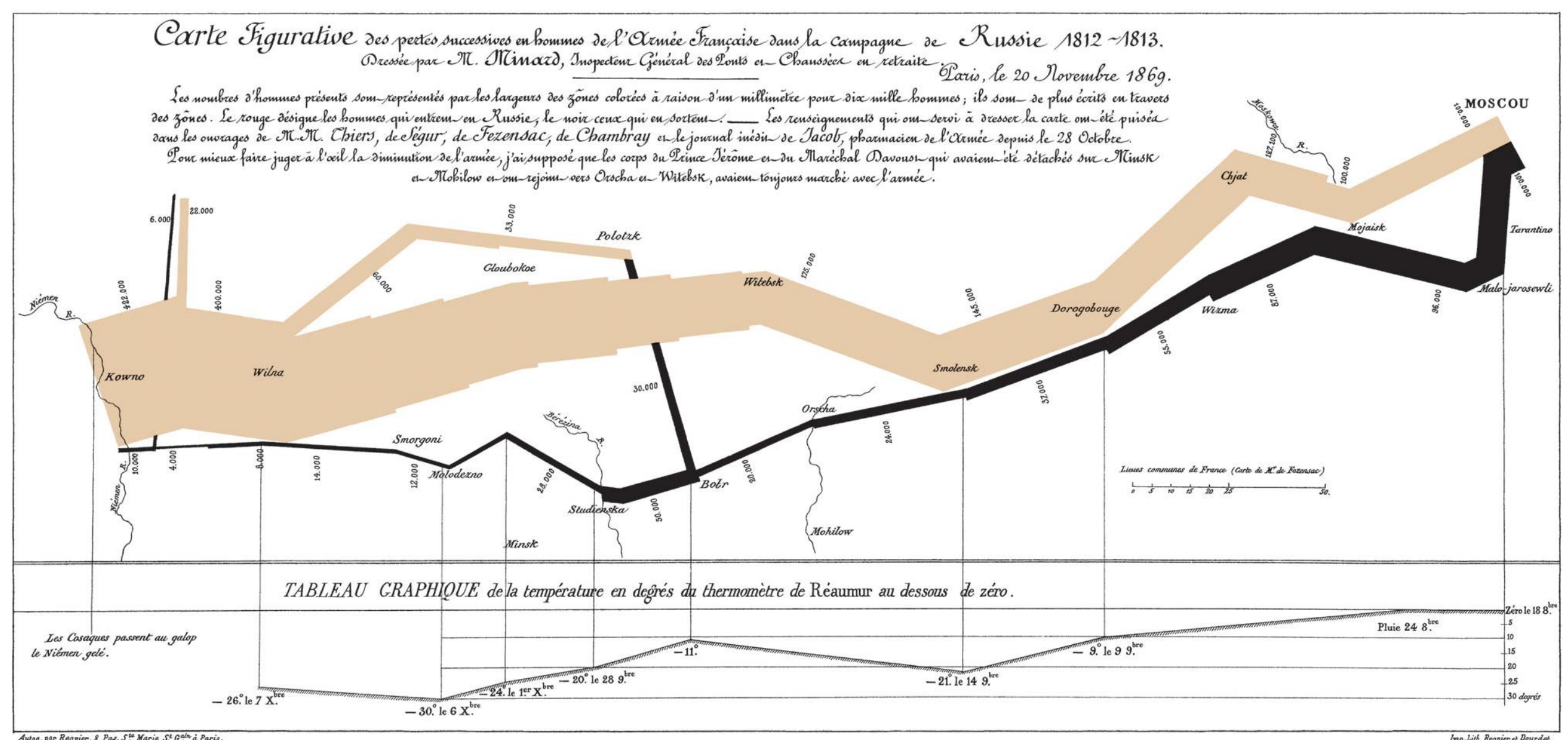


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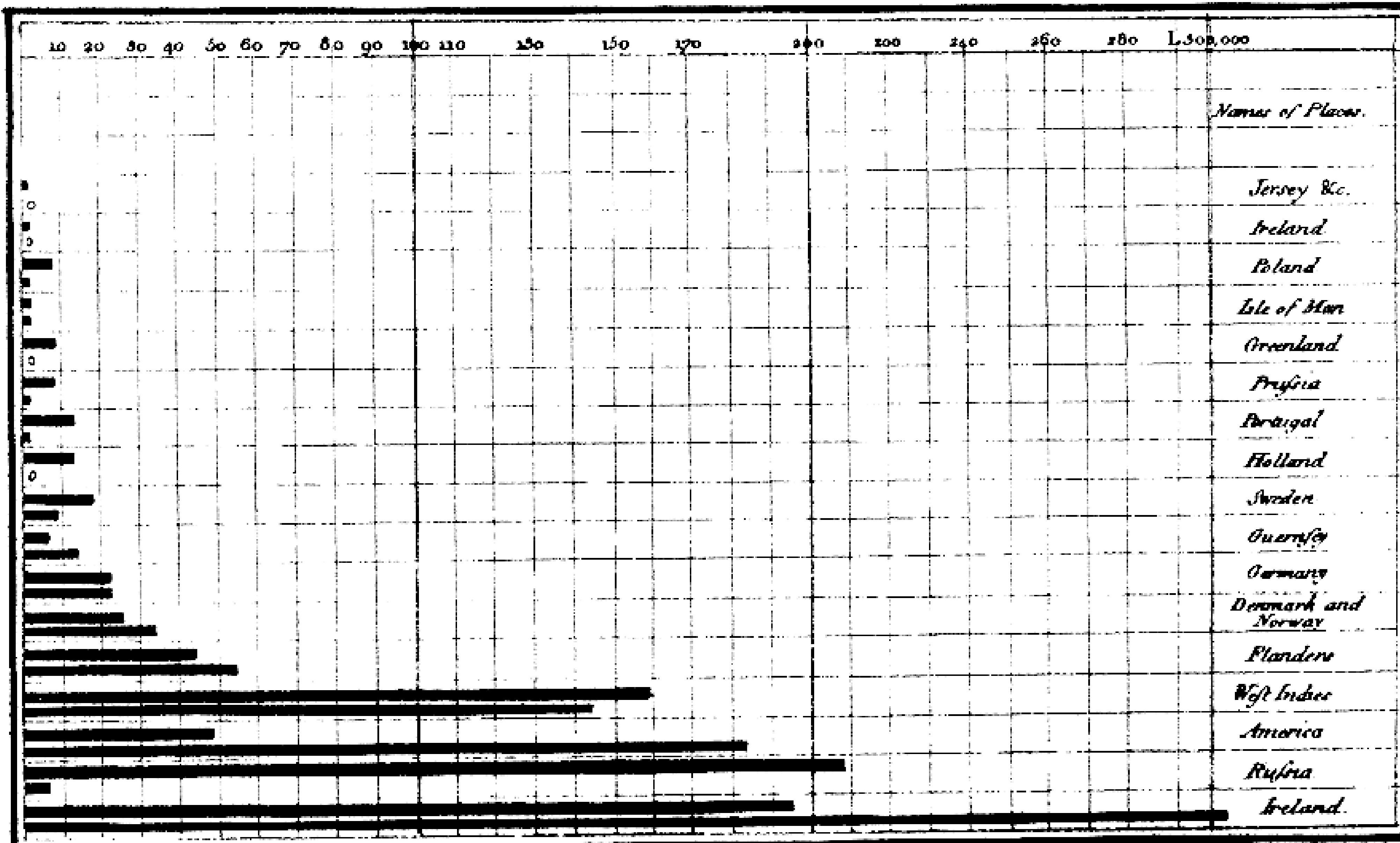


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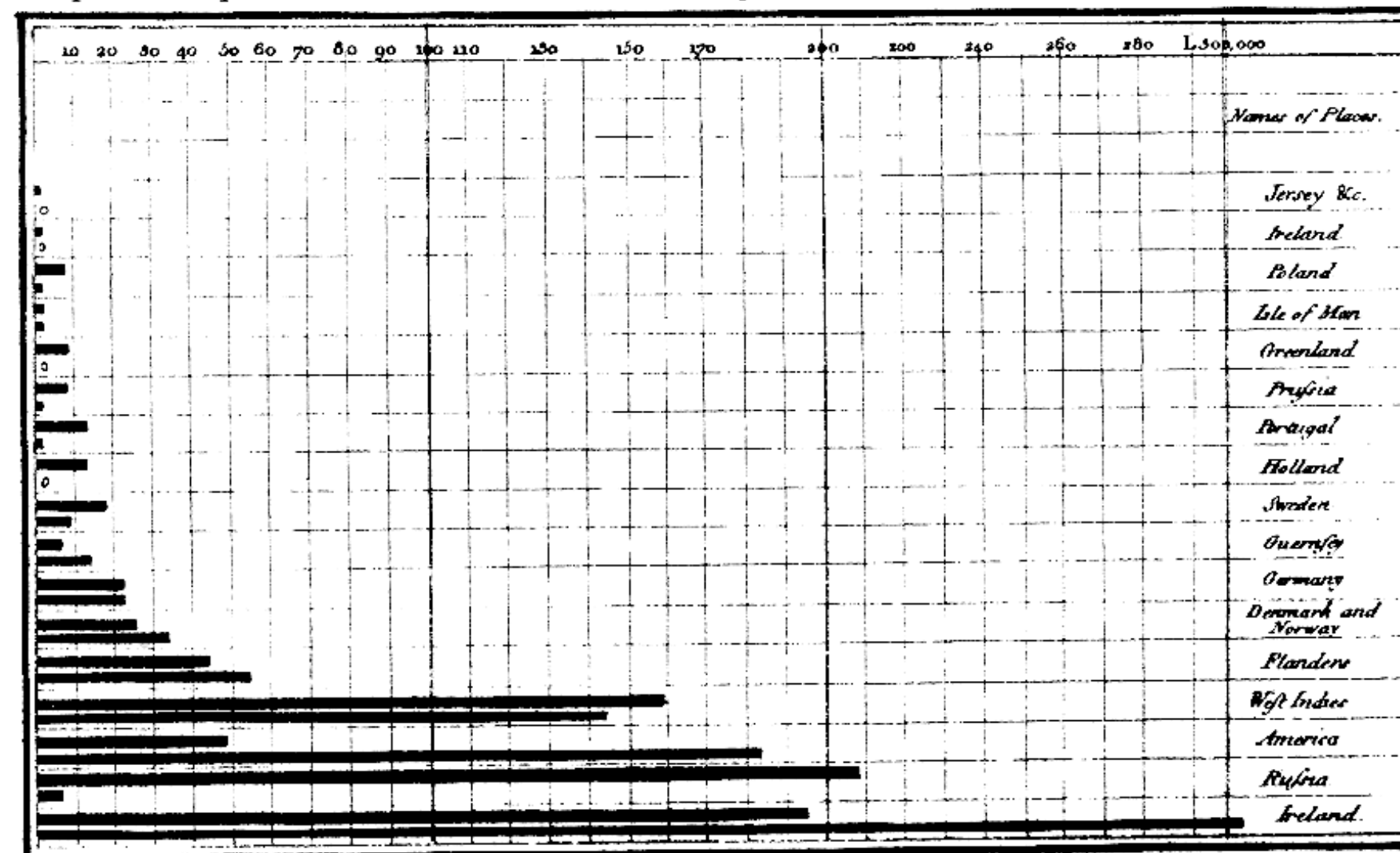


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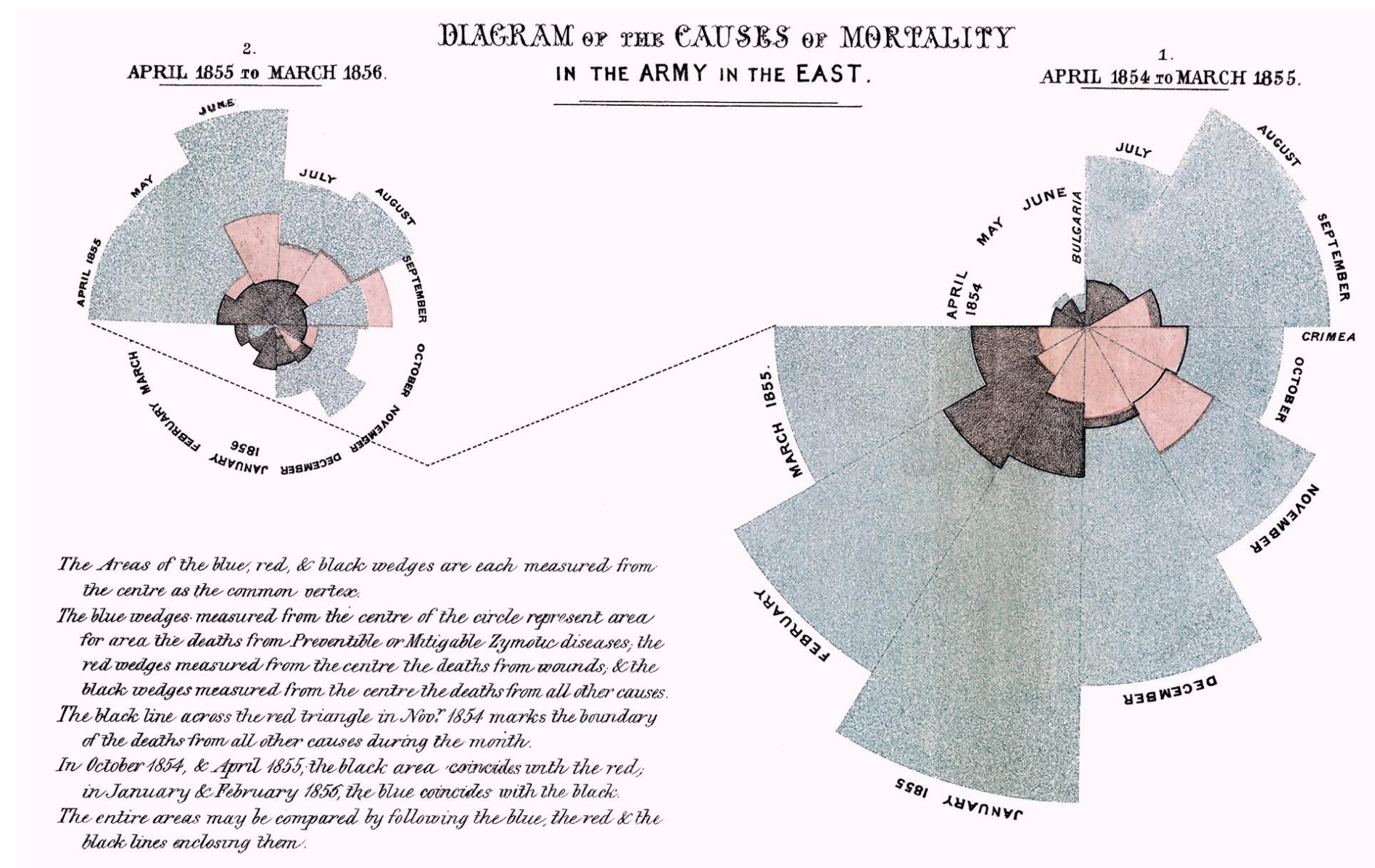
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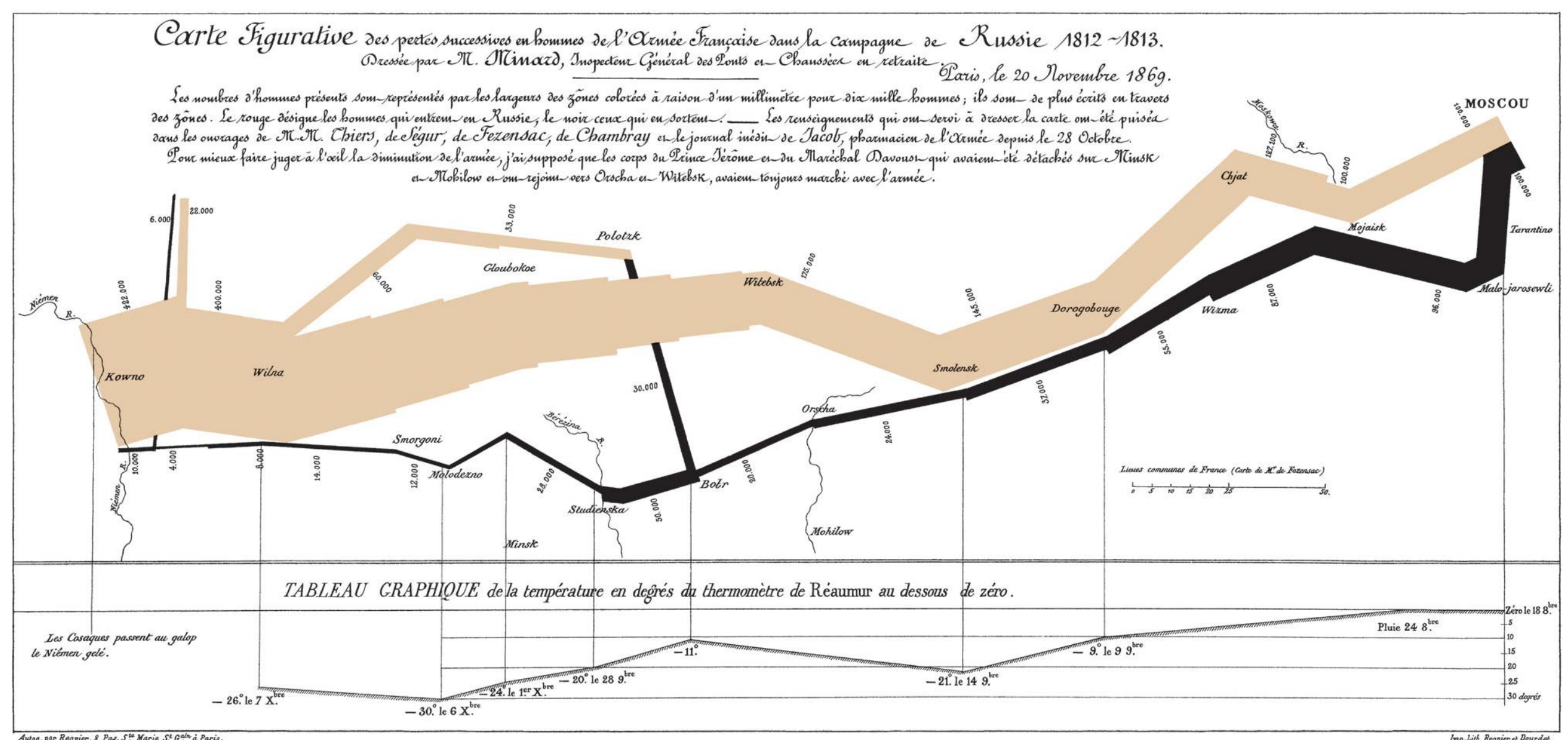


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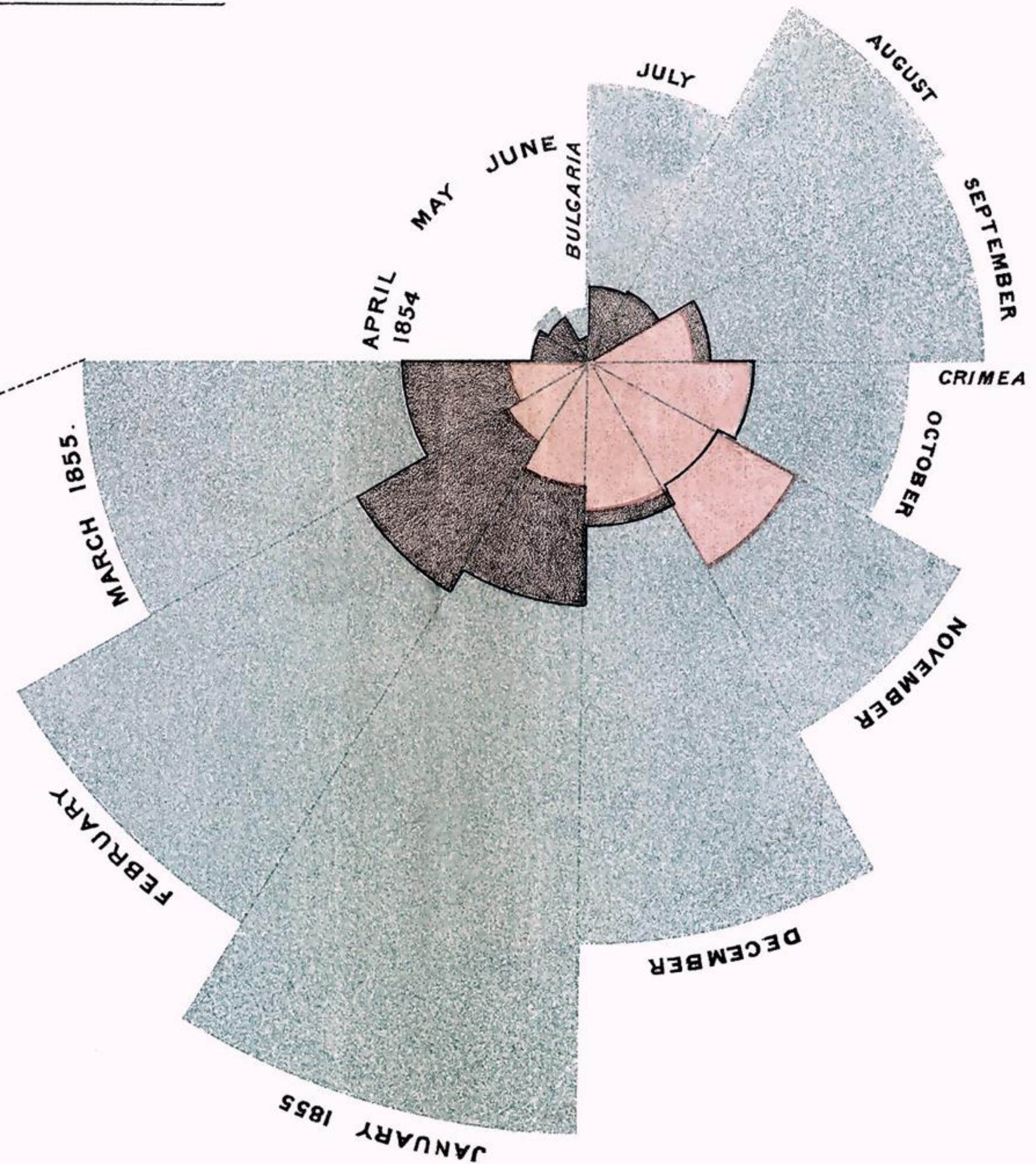
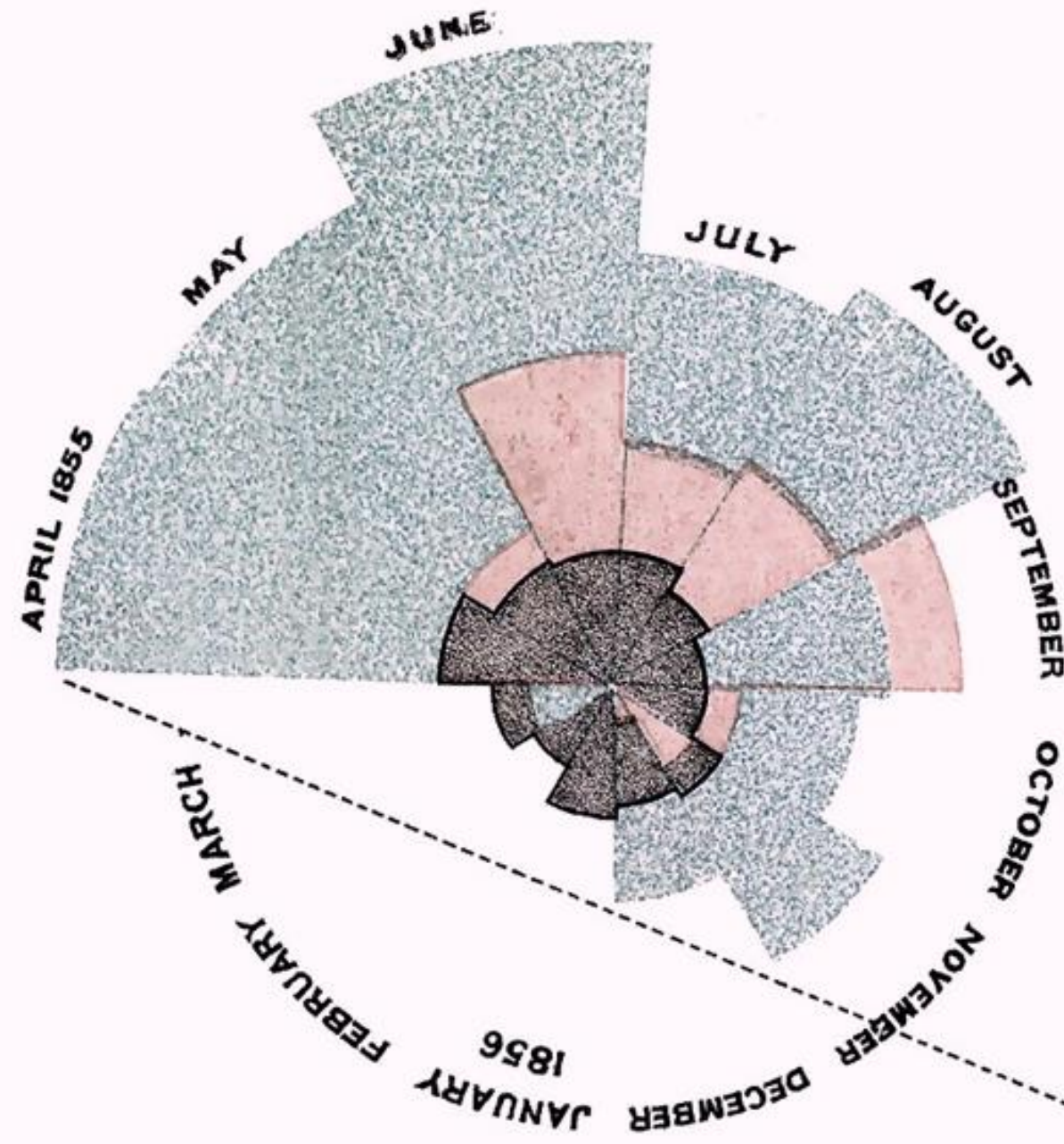


CHARLES MINARD (c. 1869)

DIAGRAM OF THE CAUSES OF MORTALITY IN THE ARMY IN THE EAST.

1.
APRIL 1854 TO MARCH 1855.

2.
APRIL 1855 TO MARCH 1856.



The Areas of the blue, red, & black wedges are each measured from the centre as the common vertex.

The blue wedges measured from the centre of the circle represent area for area the deaths from Preventible or Mitigable Zymotic diseases; the red wedges measured from the centre the deaths from wounds; & the black wedges measured from the centre the deaths from all other causes.

The black line across the red triangle in Nov^r 1854 marks the boundary of the deaths from all other causes during the month.

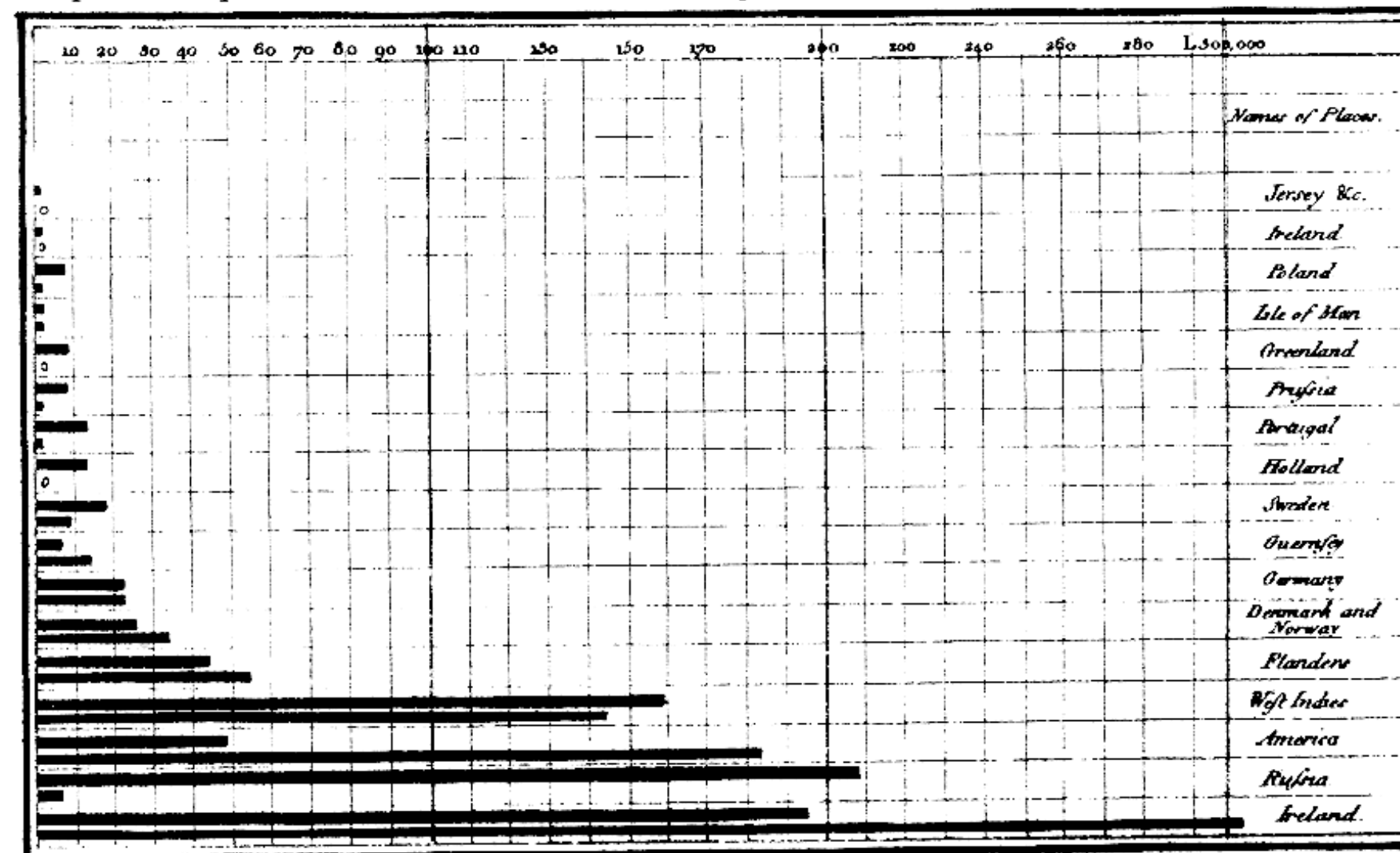
In October 1854, & April 1855, the black area coincides with the red; in January & February 1856, the blue coincides with the black.

The entire areas may be compared by following the blue, the red & the black lines enclosing them.



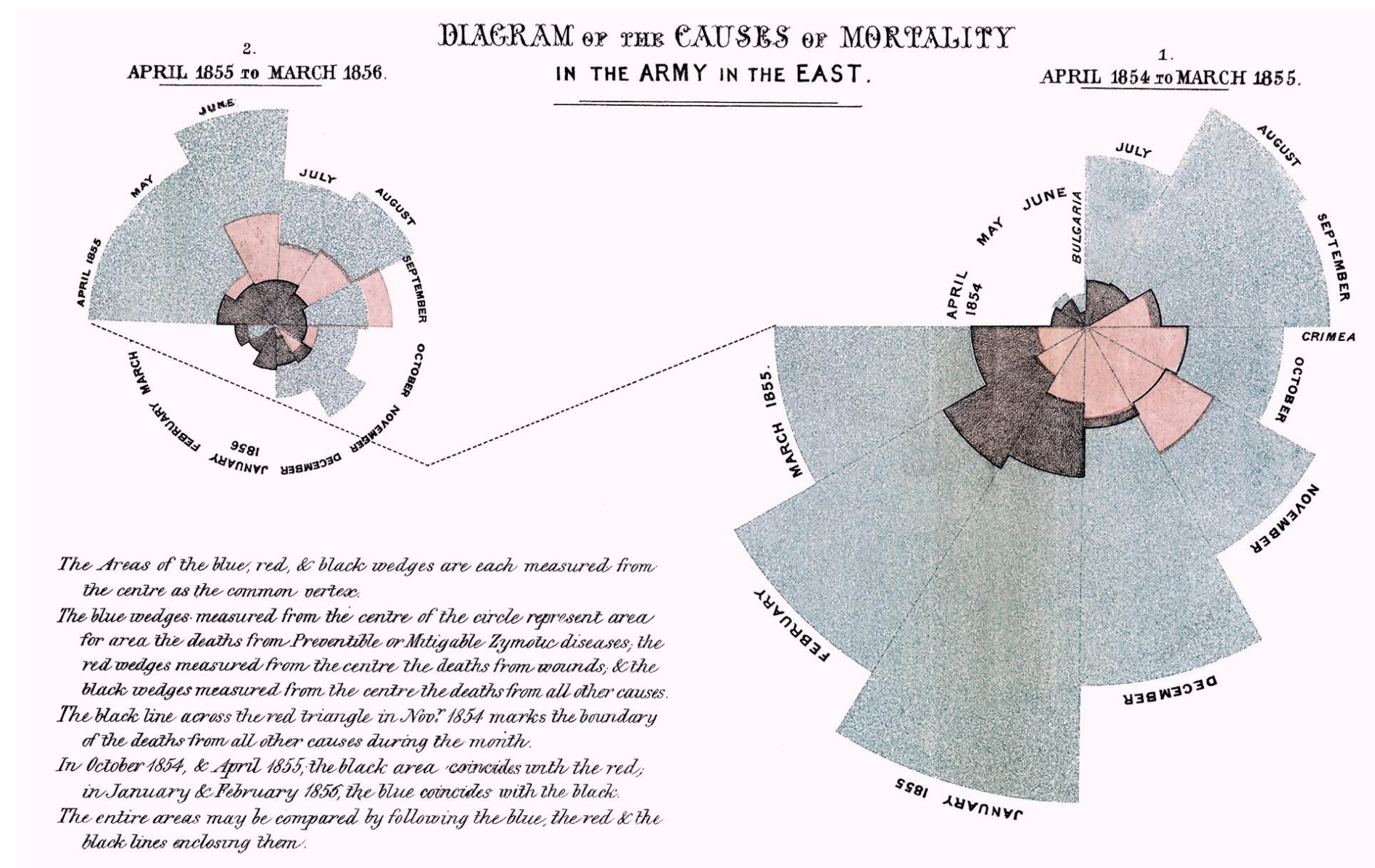
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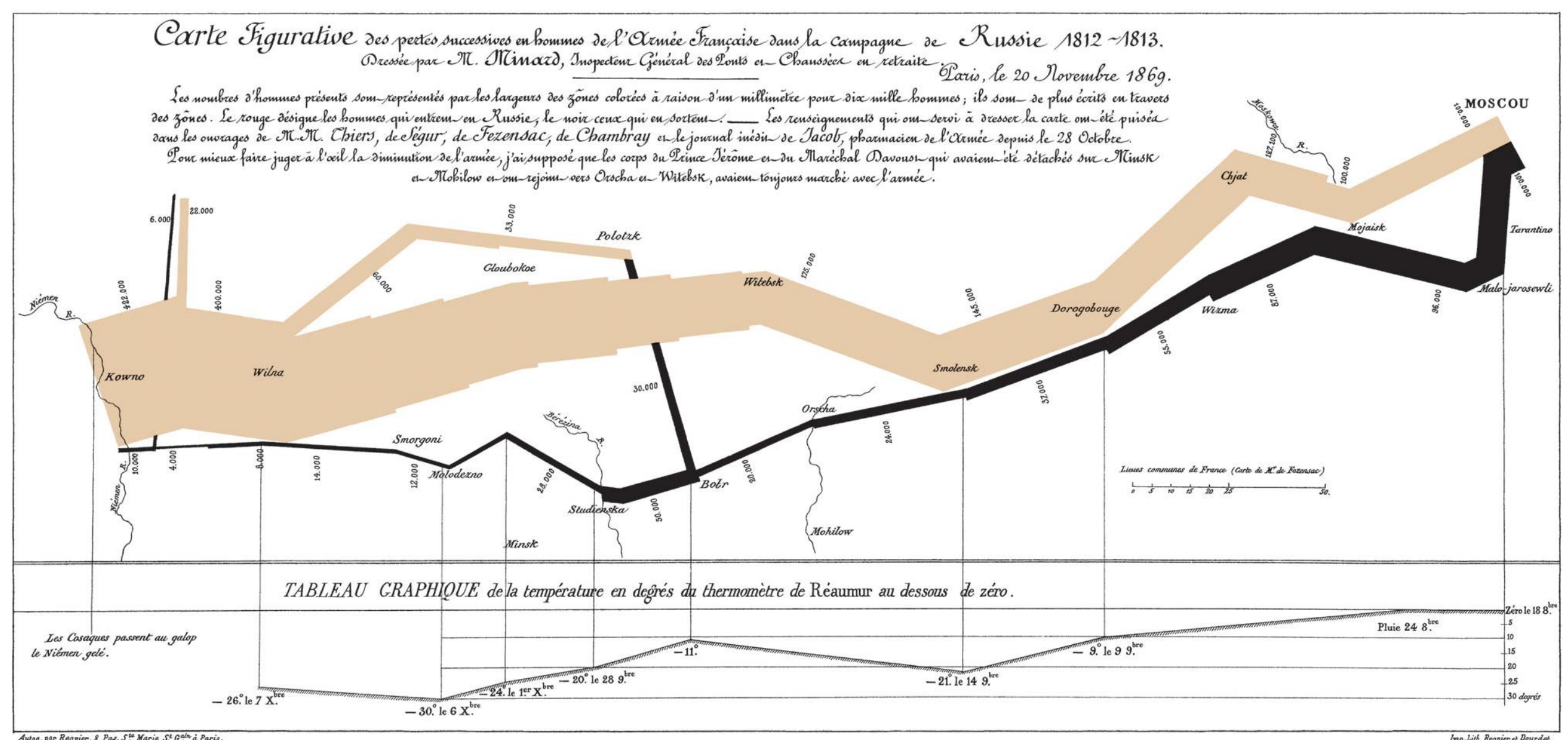


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Carte Figurative des pertes successives en hommes de l'Armée Française dans la campagne de Russie 1812-1813.

Dressée par M. Minard, Inspecteur Général des Ponts et Chaussées en retraite Paris, le 20 Novembre 1869.

Les nombres d'hommes présents sont représentés par les largeurs des zones colorées à raison d'un millimètre pour dix mille hommes; ils sont de plus écrits en travers des zones. Le rouge désigne les hommes qui entrent en Russie, le noir ceux qui en sortent. — Les renseignements qui ont servi à dresser la carte ont été puisés dans les ouvrages de M. M. Chiers, de Ségur, de Fezensac, de Chambray et le journal inédit de Jacob, pharmacien de l'Armée depuis le 28 Octobre. Pour mieux faire juger à l'œil la diminution de l'armée, j'ai supposé que les corps du Prince Jérôme et du Maréchal Davout qui avaient été détachés sur Minsk et Mohilow et ont rejoint vers Orscha et Witebsk, avaient toujours marché avec l'armée.

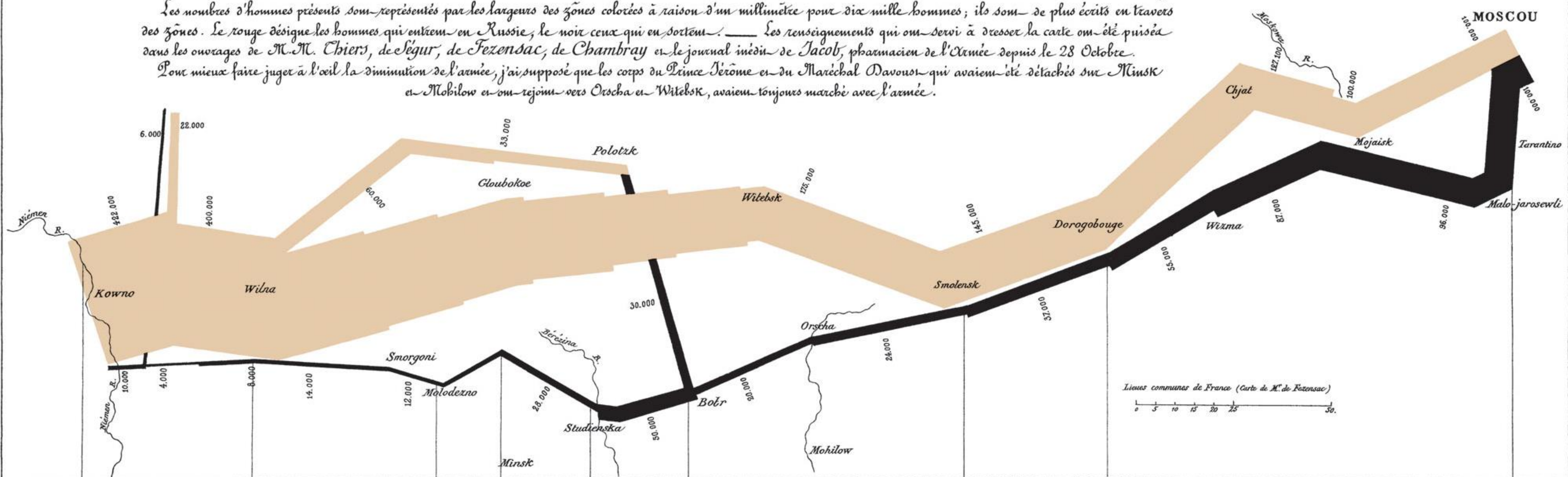
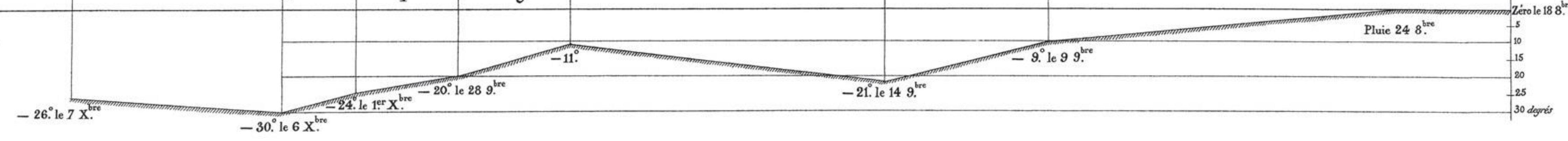


TABLEAU GRAPHIQUE de la température en degrés du thermomètre de Réaumur au dessous de zéro.

Les Cosaques passent au galop le Niémen gelé.



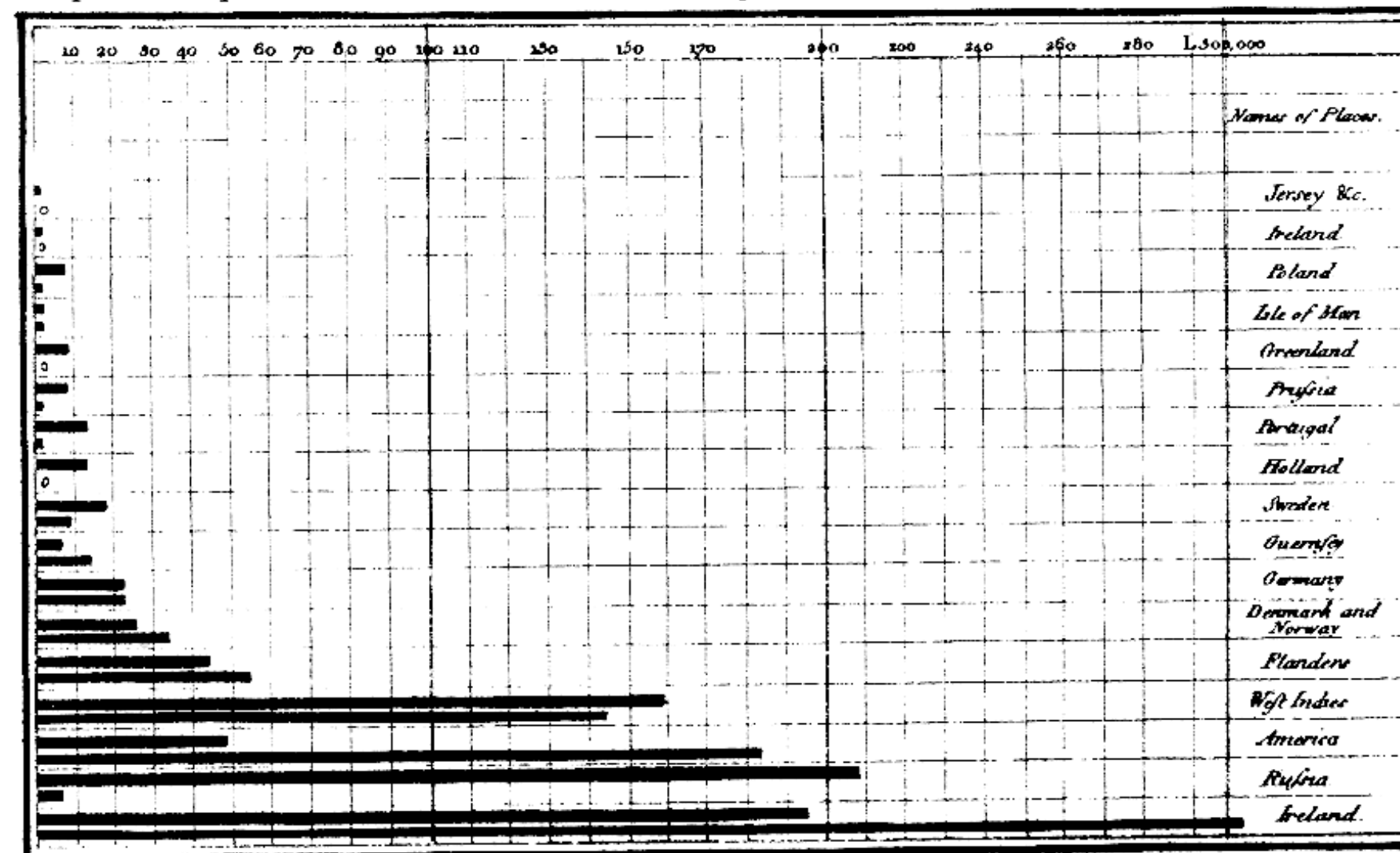
Autog. par Regnier, 8. Pas. 5^{me} Marie St G^{de} à Paris.

Imp. Lith. Regnier et Dourdet.



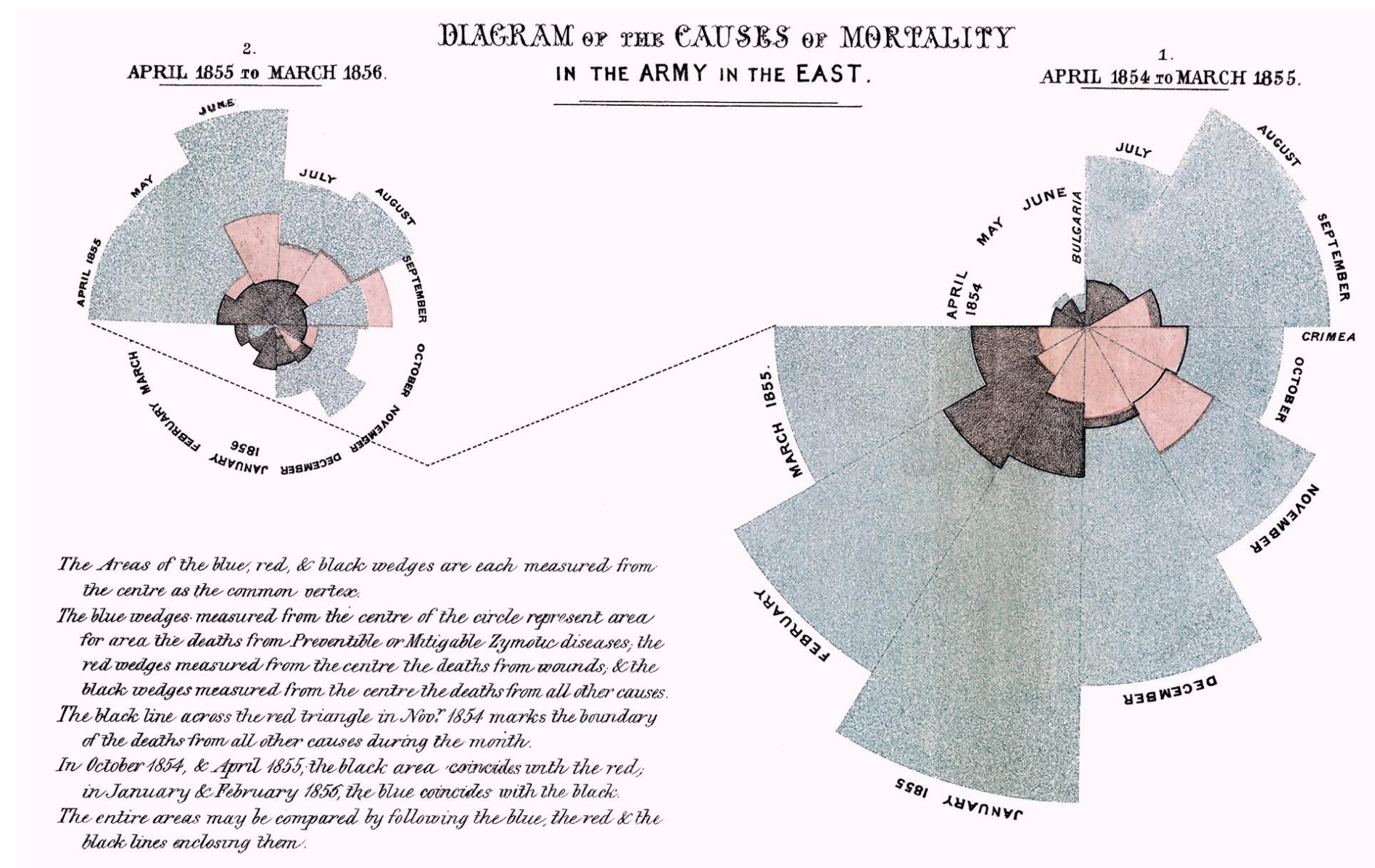
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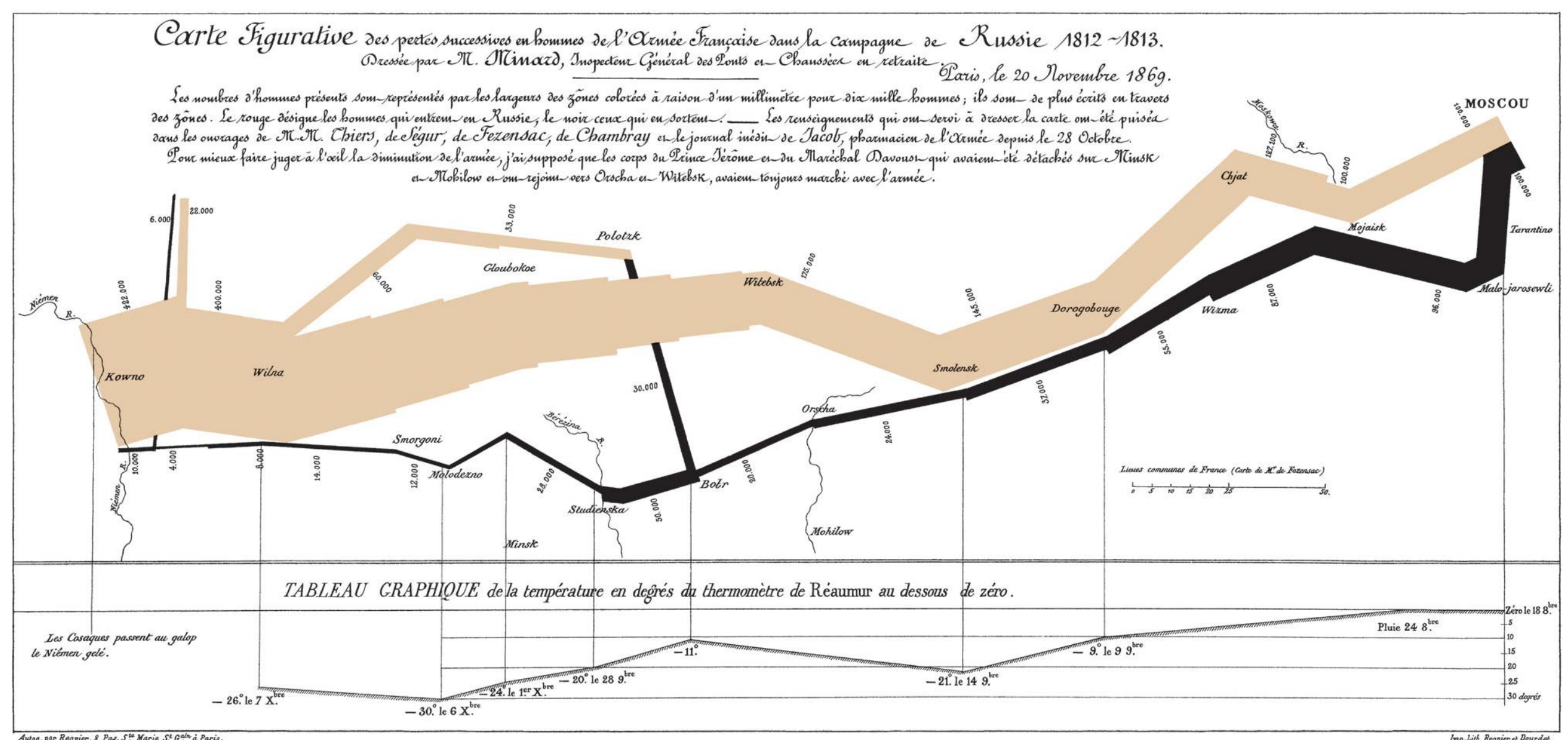


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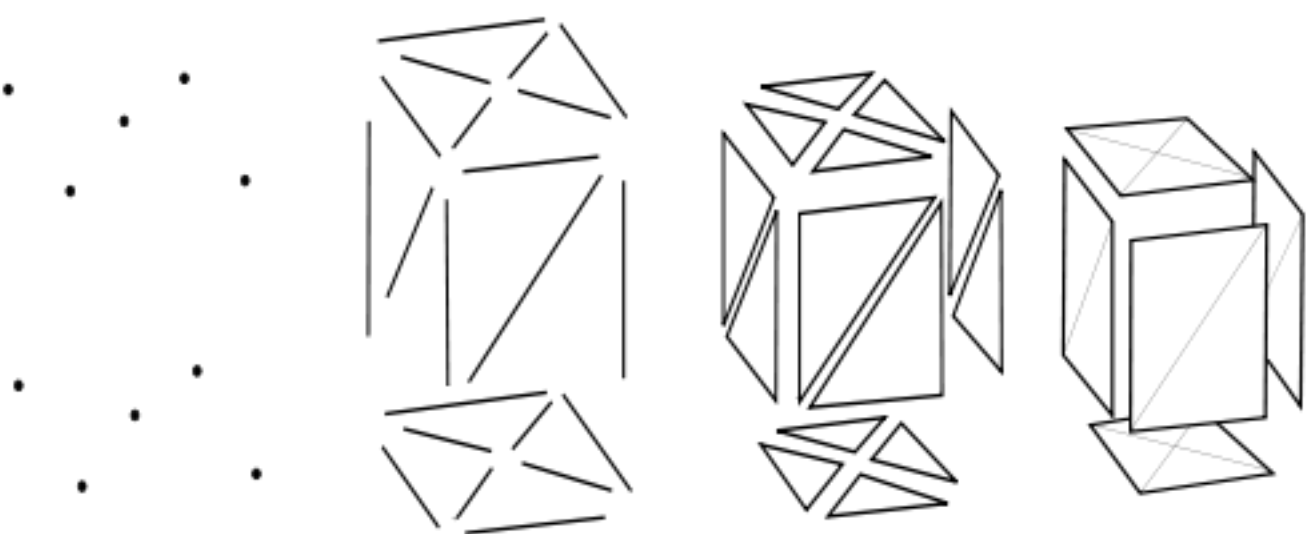
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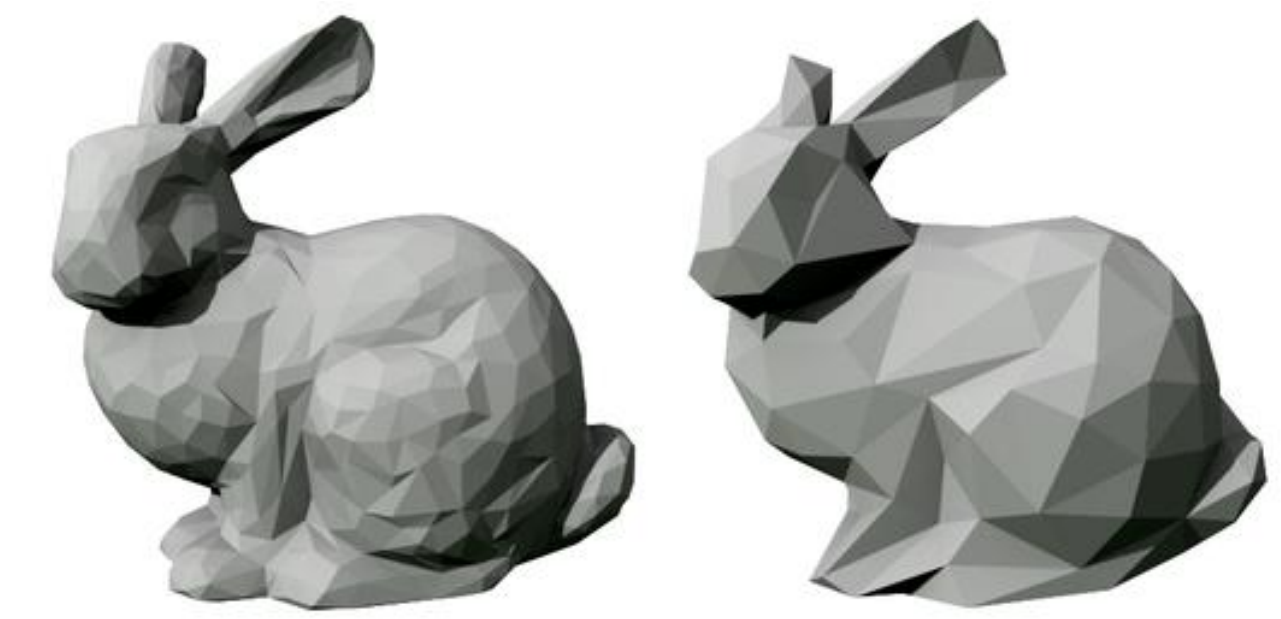
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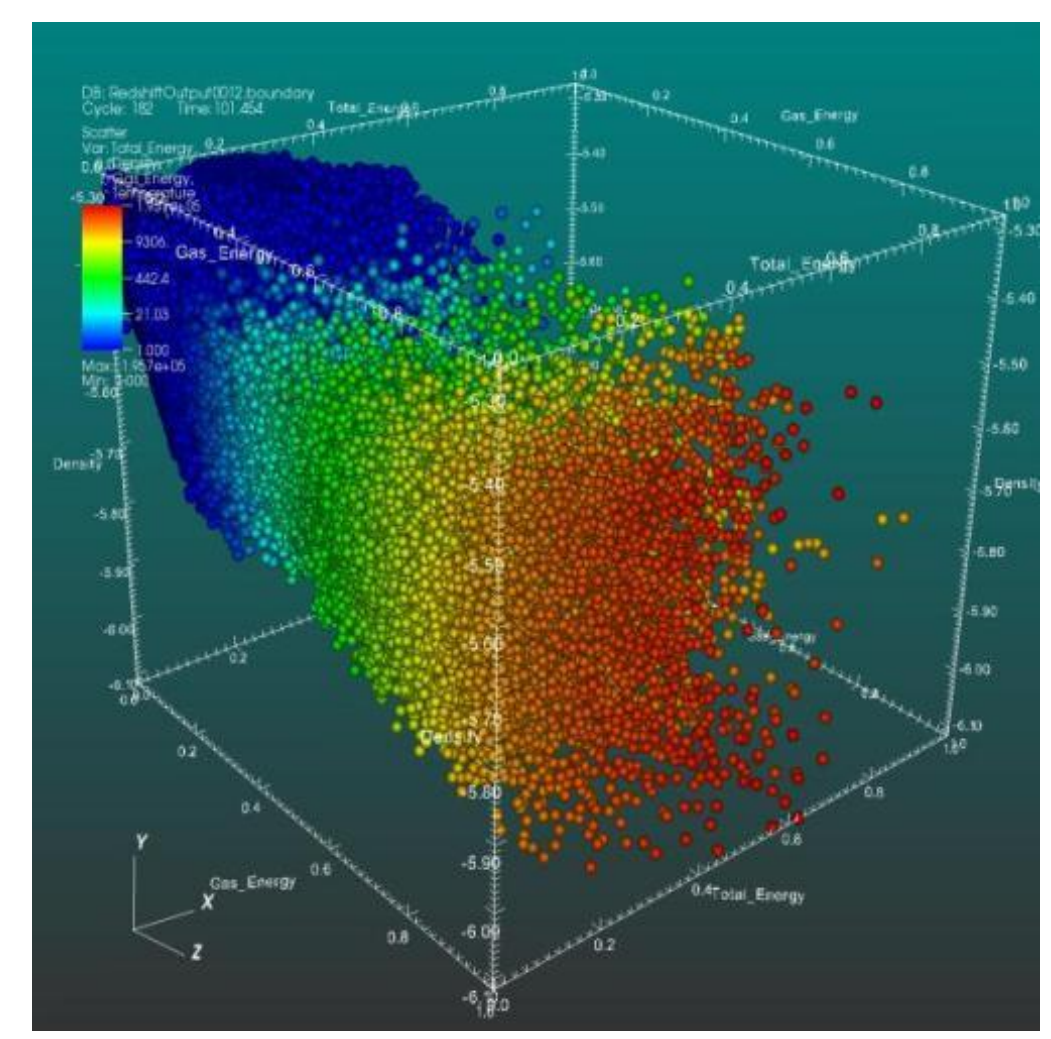
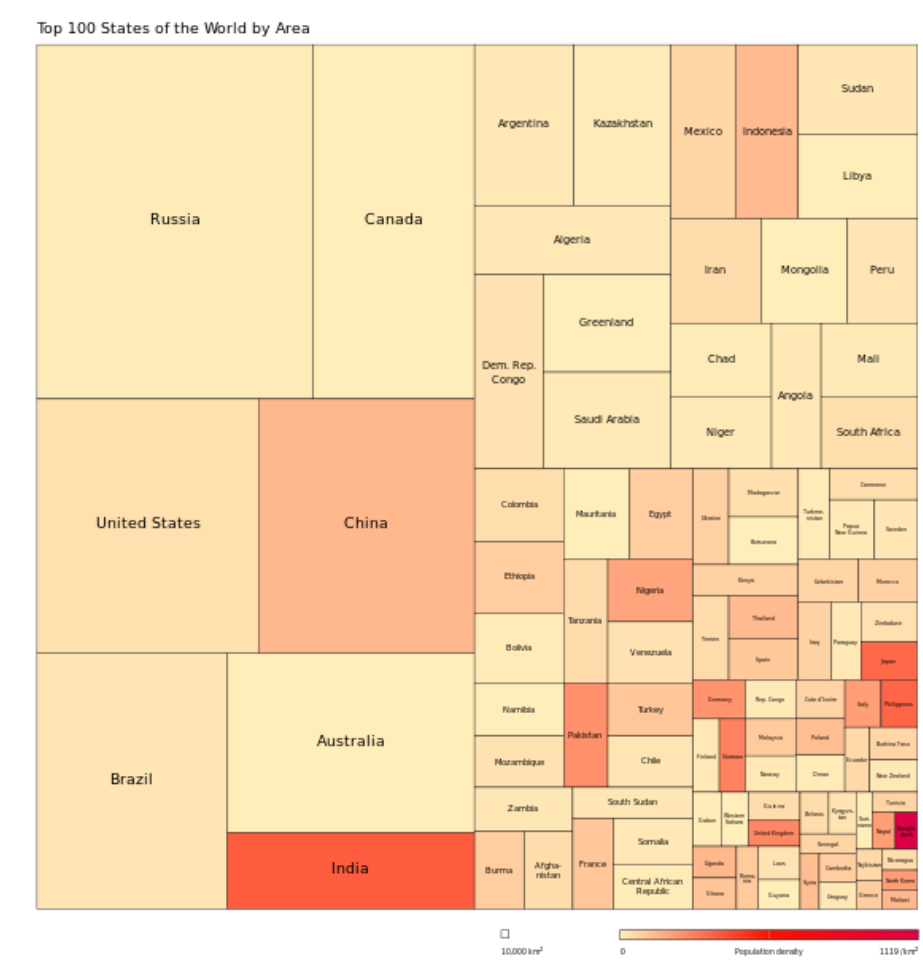
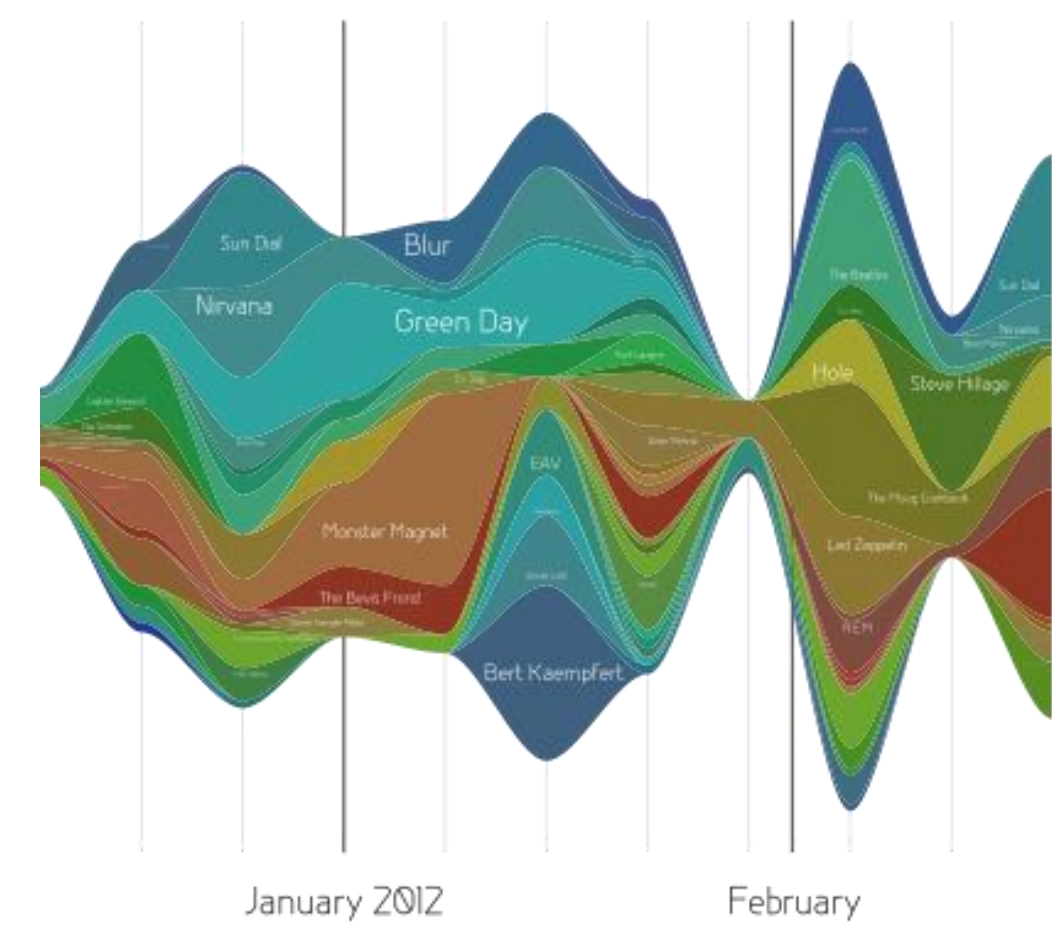
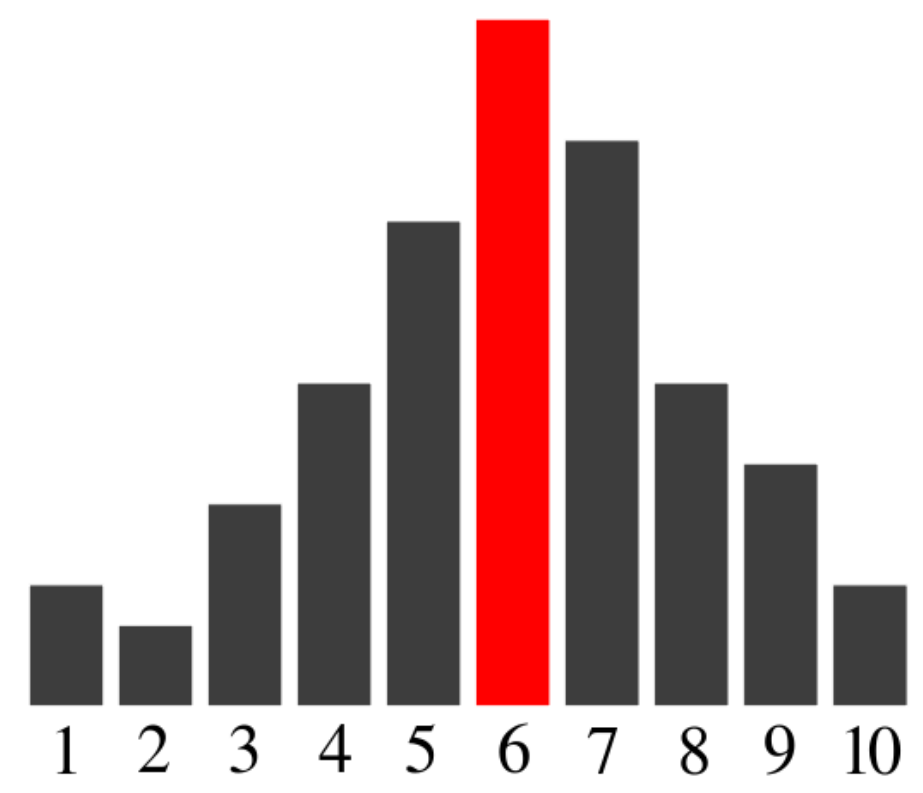
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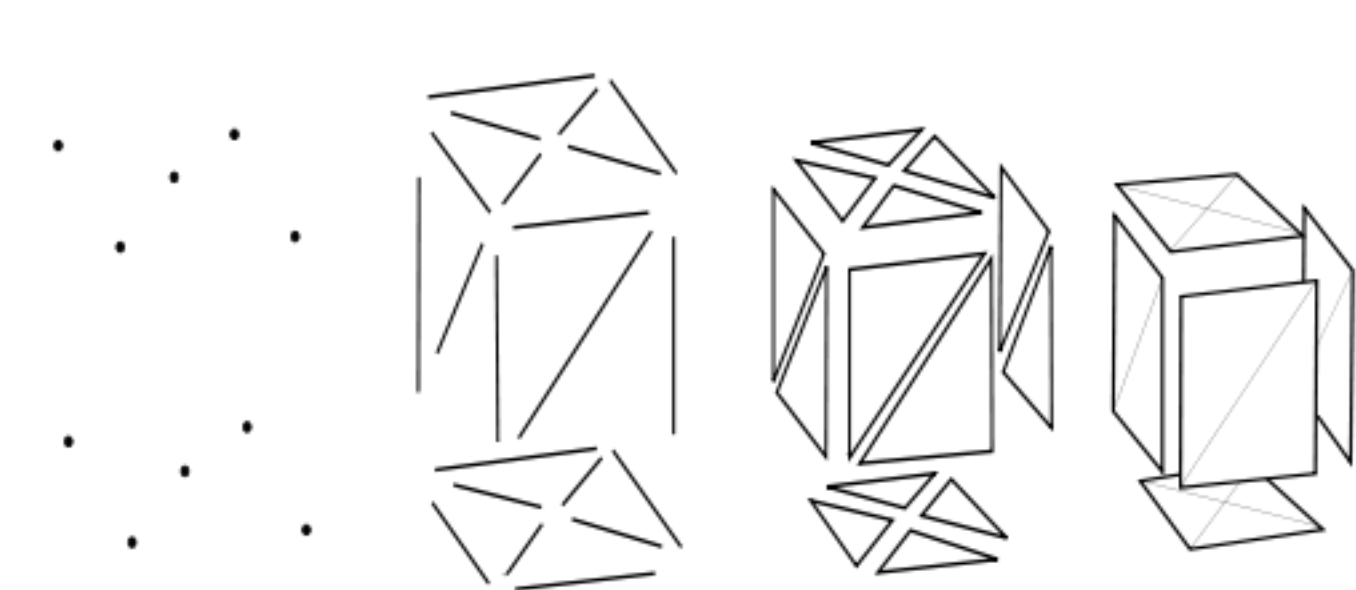


computer graphics

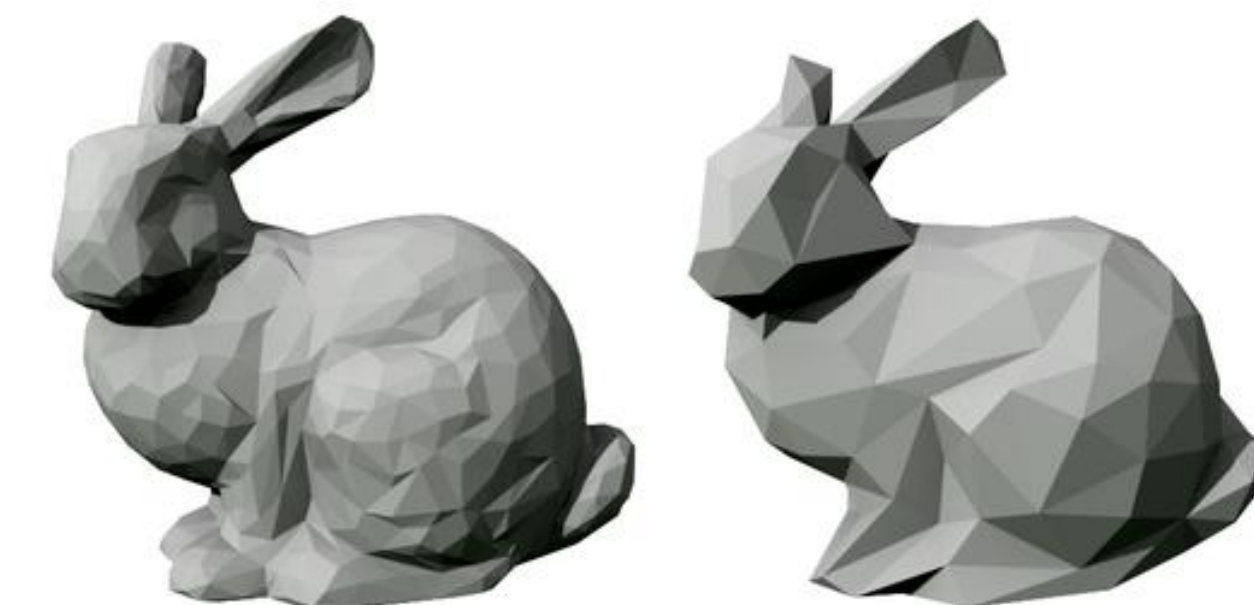


visualization

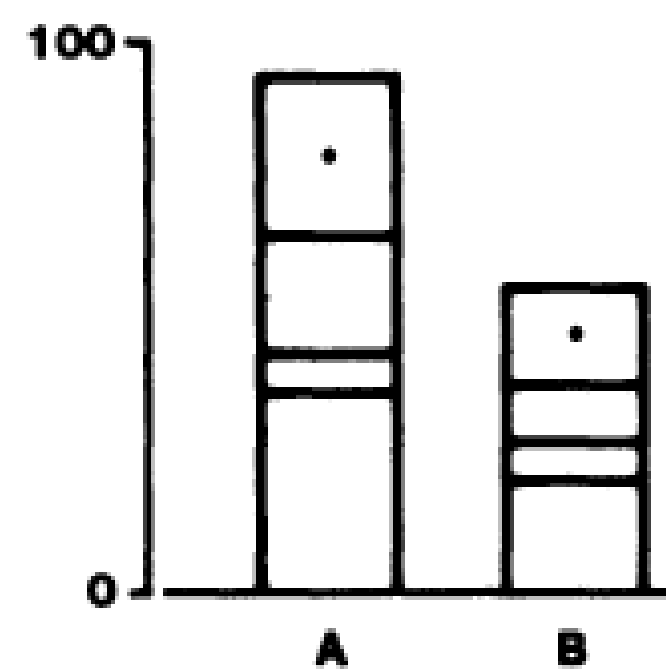
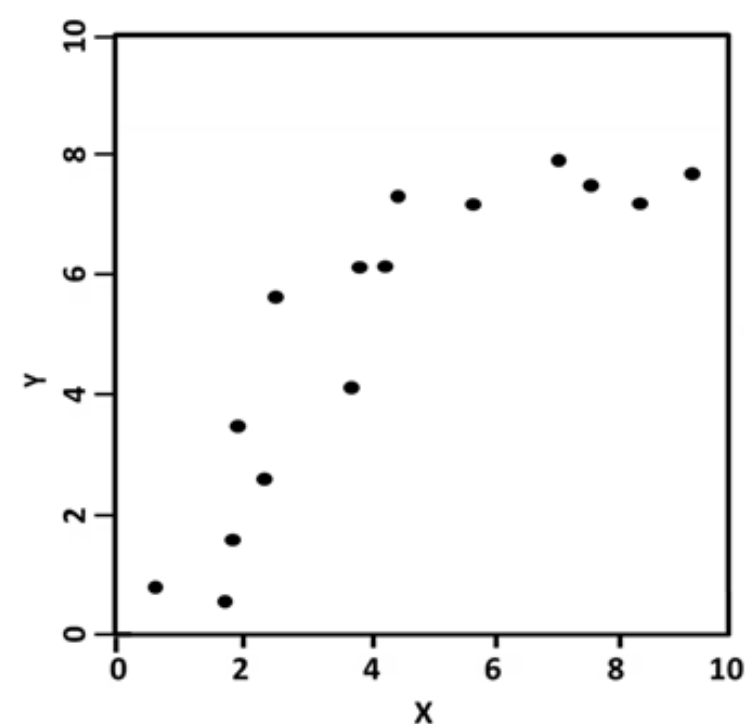




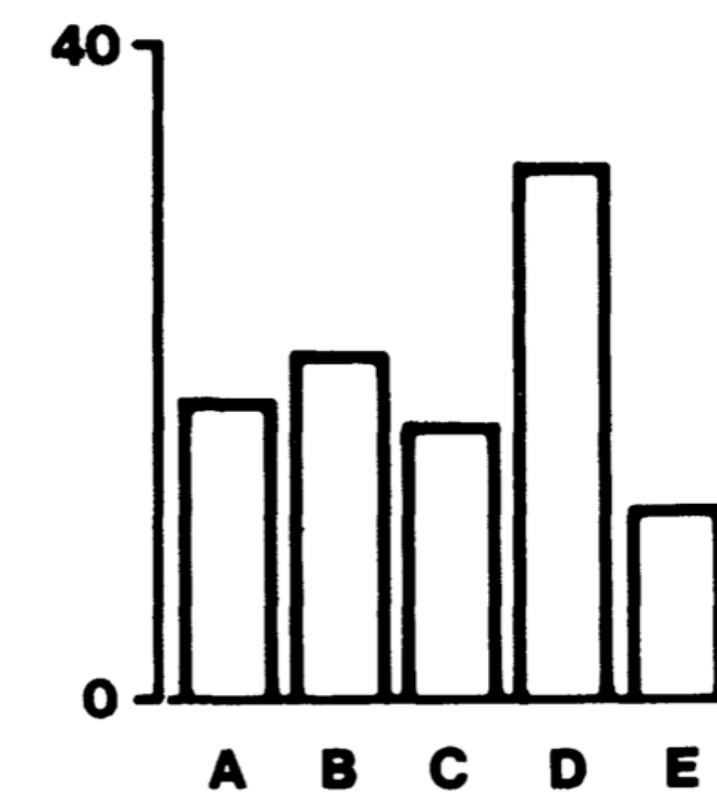
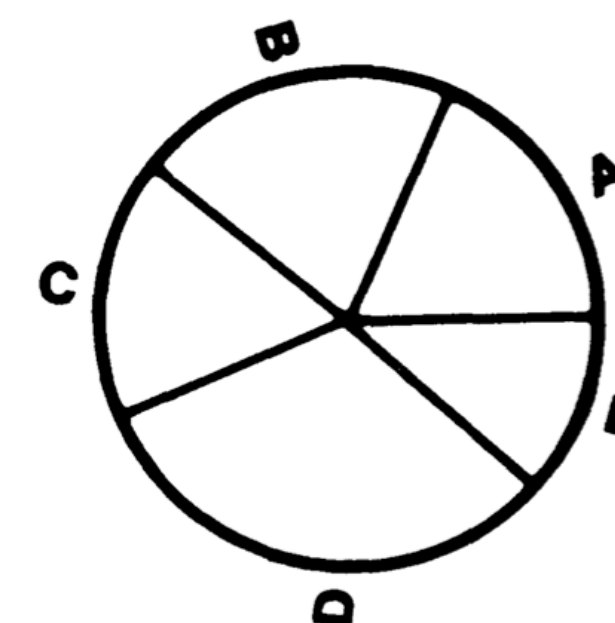
computer graphics

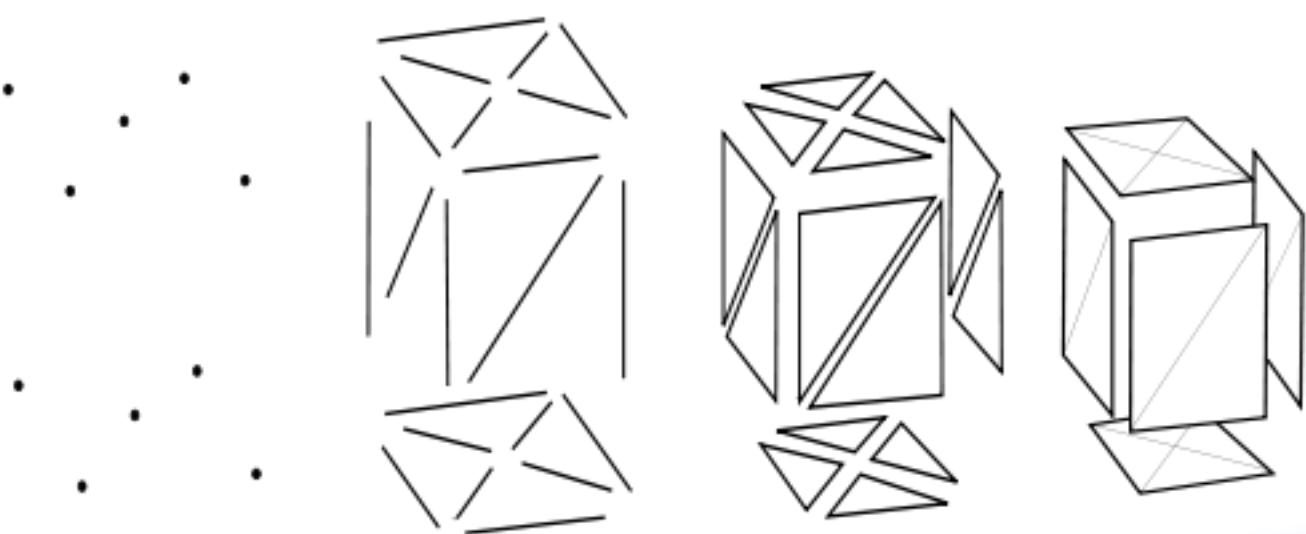


visualization

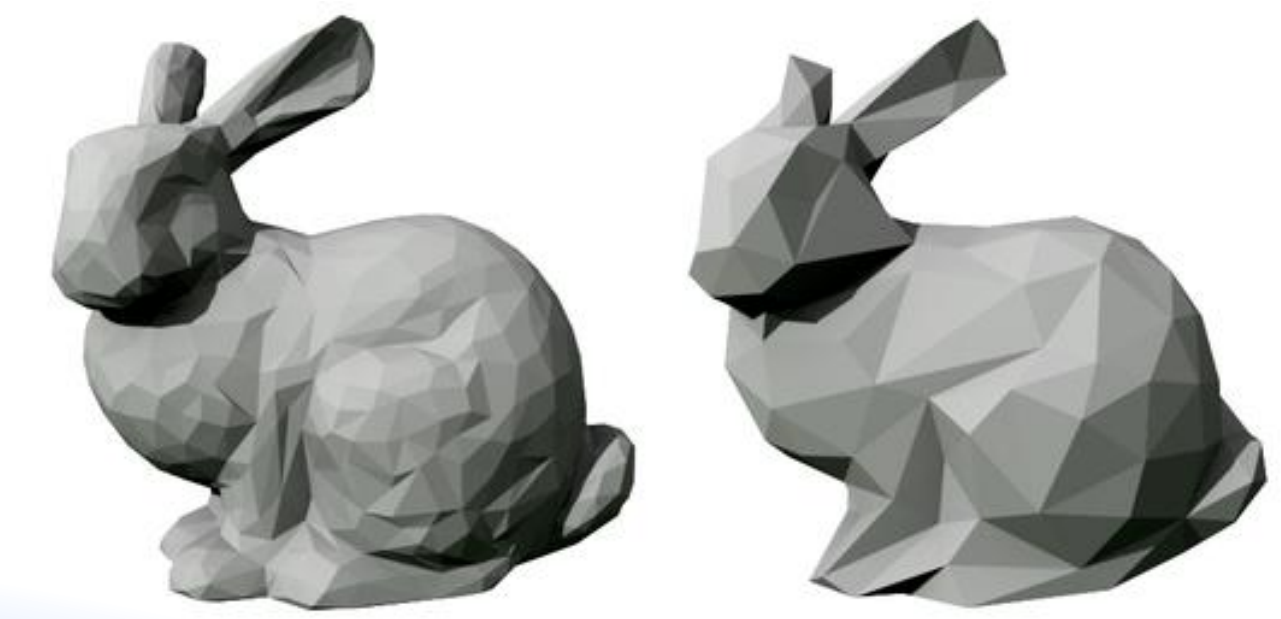


statistics





computer graphics



HCI

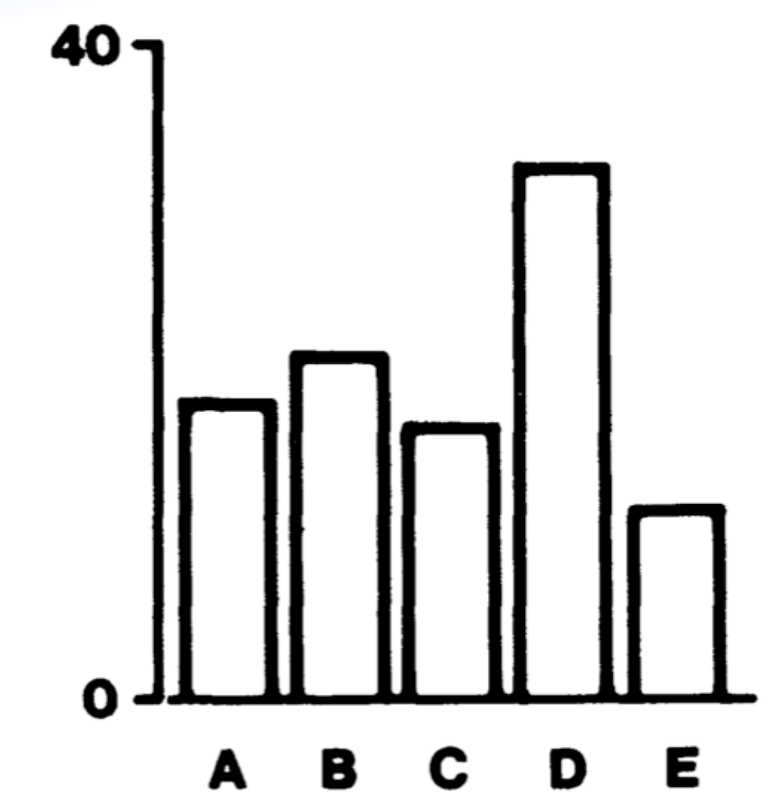
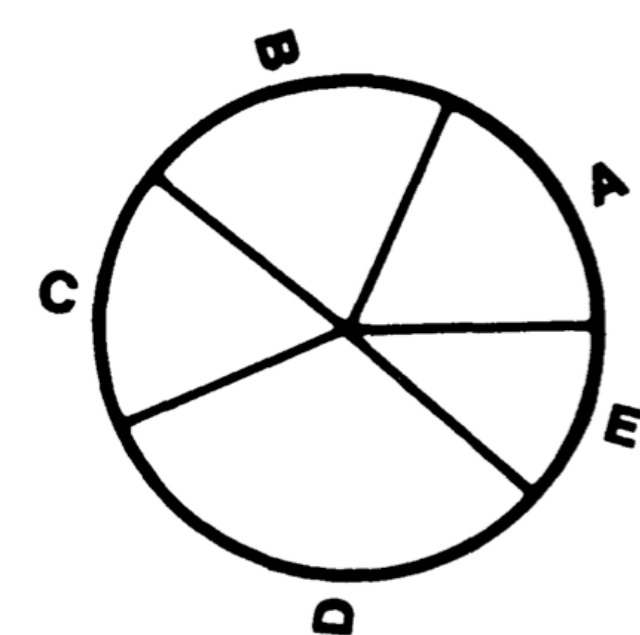
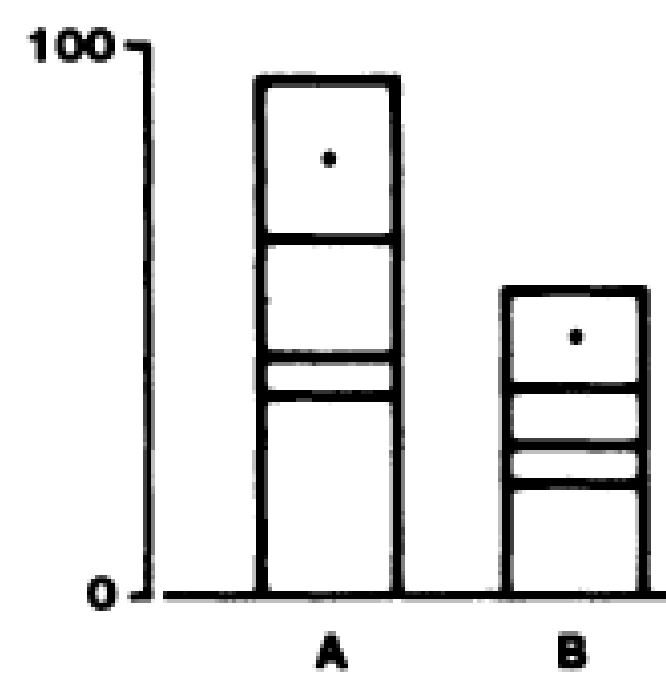
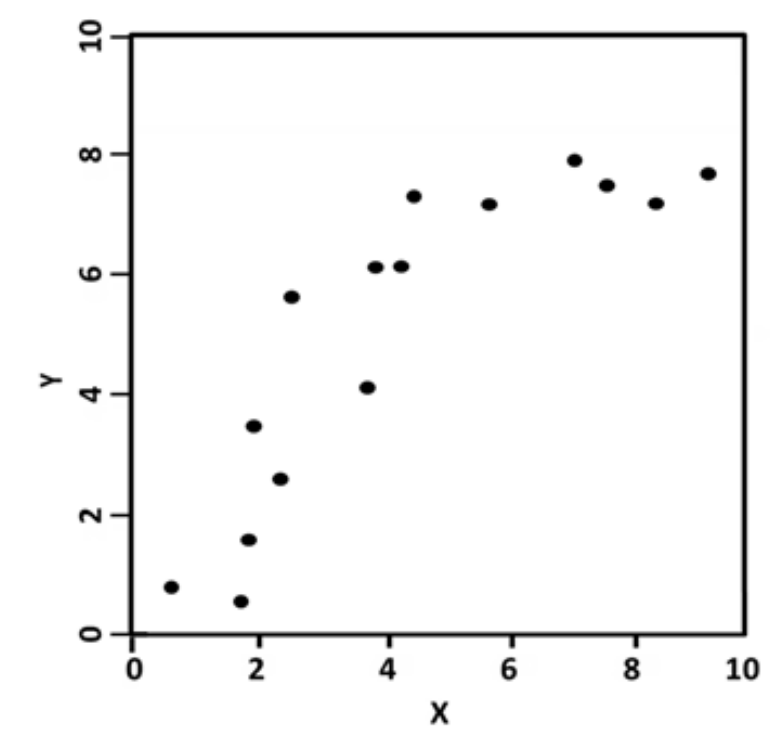
design

visualization

psychology

art

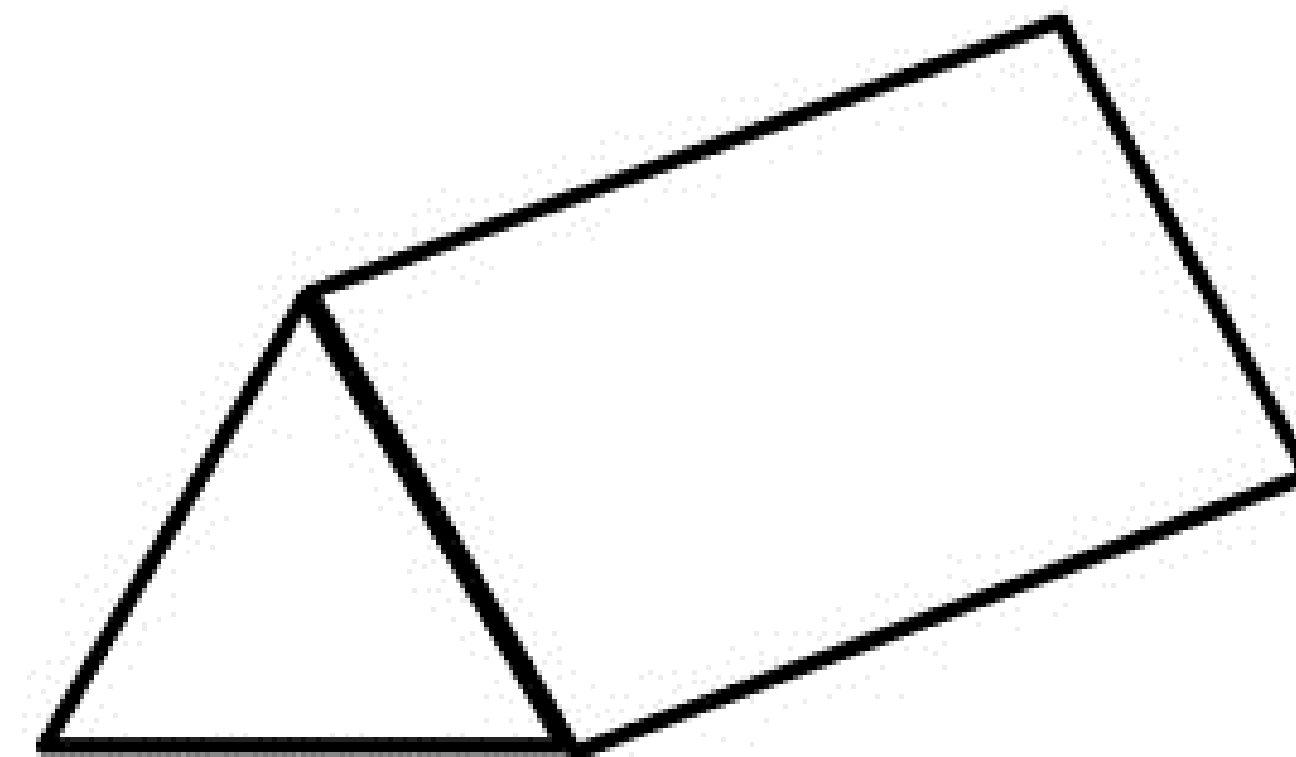
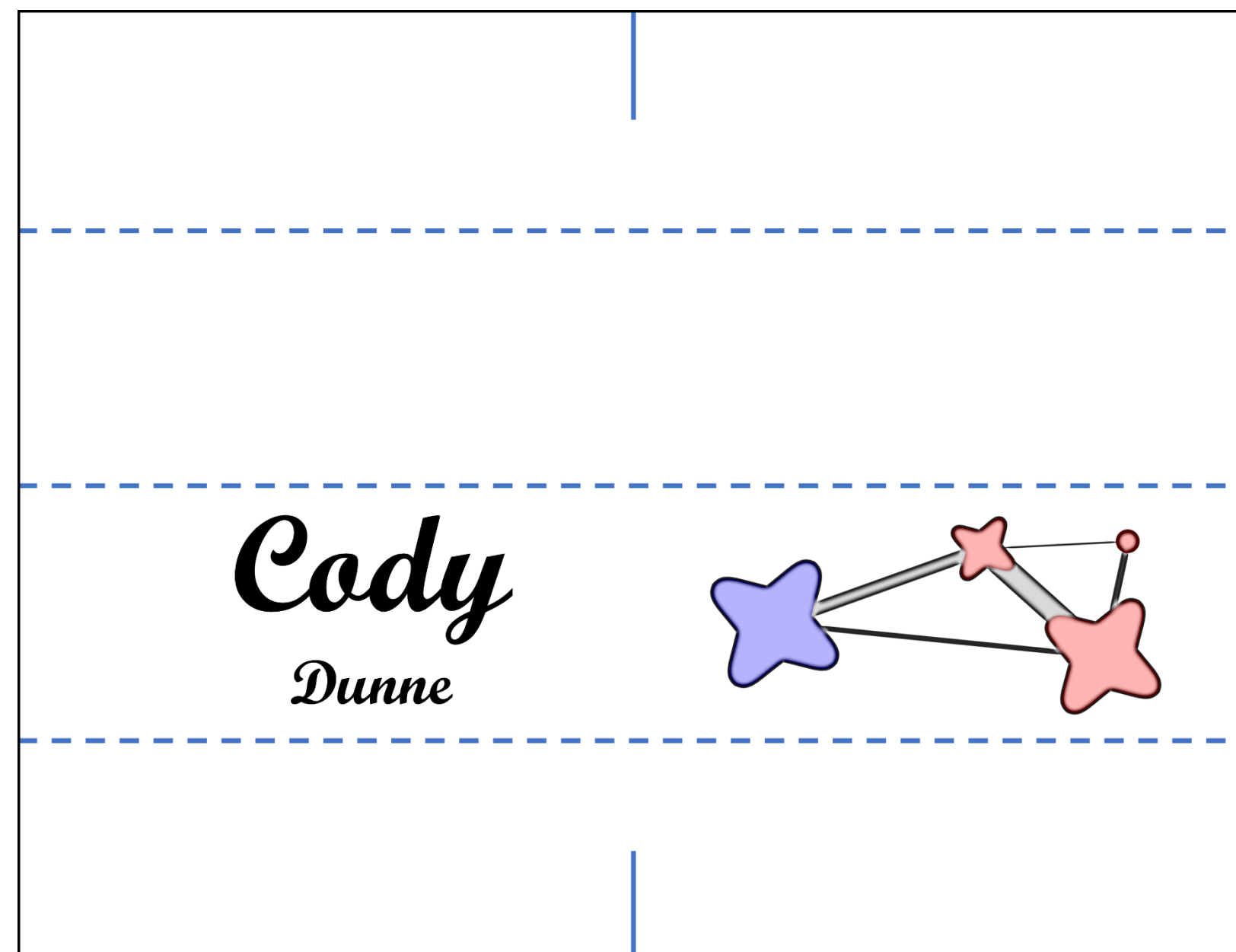
statistics



In-Class Sketching — Table Tents

15 min

1. Take a pre-made tent card and remove the strips along the long edge by folding one way then the other along the provided crease.
2. Then fold it in half along the center crease.
3. Once you're sure the table tent works, unfold the paper.
4. On one side of one of the two main faces, and with the proper orientation (see image above): Write your first name in large, legible text. Write your last name in smaller text.
5. Then, beside your name draw a simple visualization that holds some meaning for you.



In-Class Chat — Who Are you?

16 min

In under two minutes, tell the rest of us us:

- Who you are
- Your background in graphs, networks, visualization
- What you would like to get out of this course
- Any cool domains you want to work in for your course project

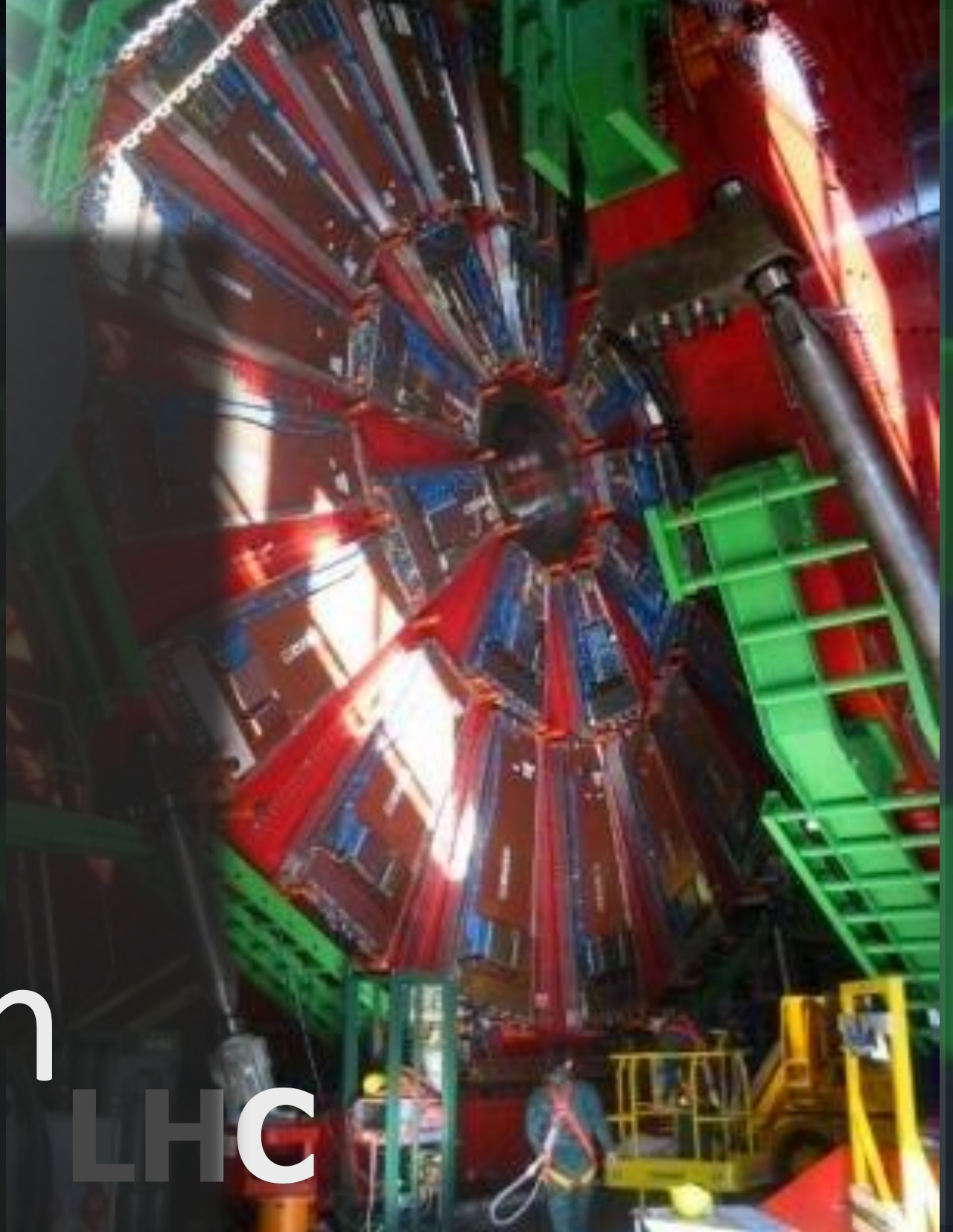
Ok, but why do we need
visualization?



LSST



Financial Markets



LHC



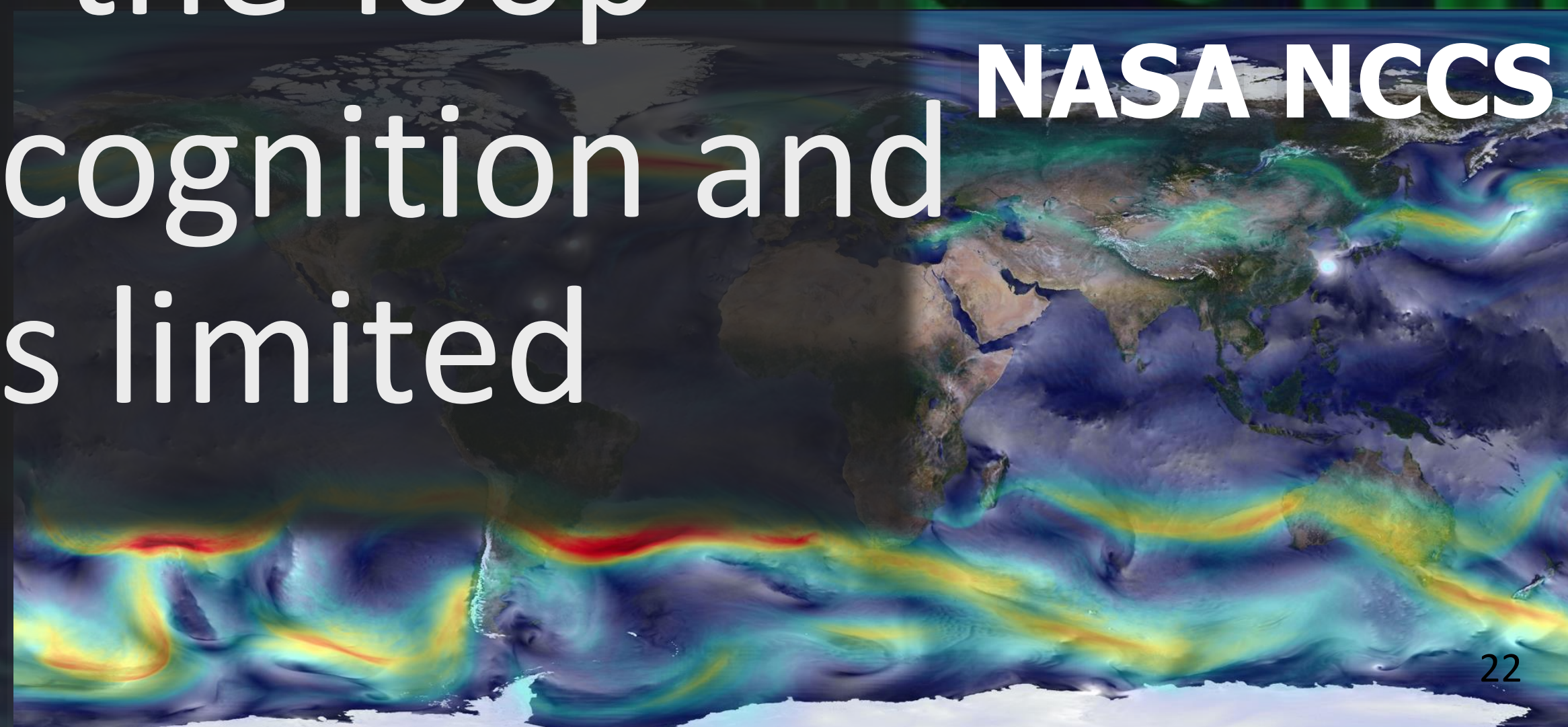
GenBank

CHALLENGES:

- Scalability
- Complexity reduction
- Humans in-the-loop
 - human cognition and memory is limited



ngrams



NASA NCCS

q t f j n i x i g j u n a s b b t g r
k c l b v t x j x z x m x r g k l x
q h m z y w t e y j w n o

q t f j n i x i g j u n a s b b t g r
k c l b v t x j x z x m x r g k l x
q h m z y w t e y j w n o

q t f j n i x i g j u n a s b b t g r
k c l b v t x j x z x m x r g k l x
q h m z y w t e y j w n o

q t f j n i x i g j u n a s b b t g r
k c l b v t x j x z x m x r g k l x
q h m z y w t e y j w n o

“change blindness”



<https://www.youtube.com/watch?v=FW5xSQsspiQ>

The "Door" Study

from Simons & Levin (1998)

“change blindness”



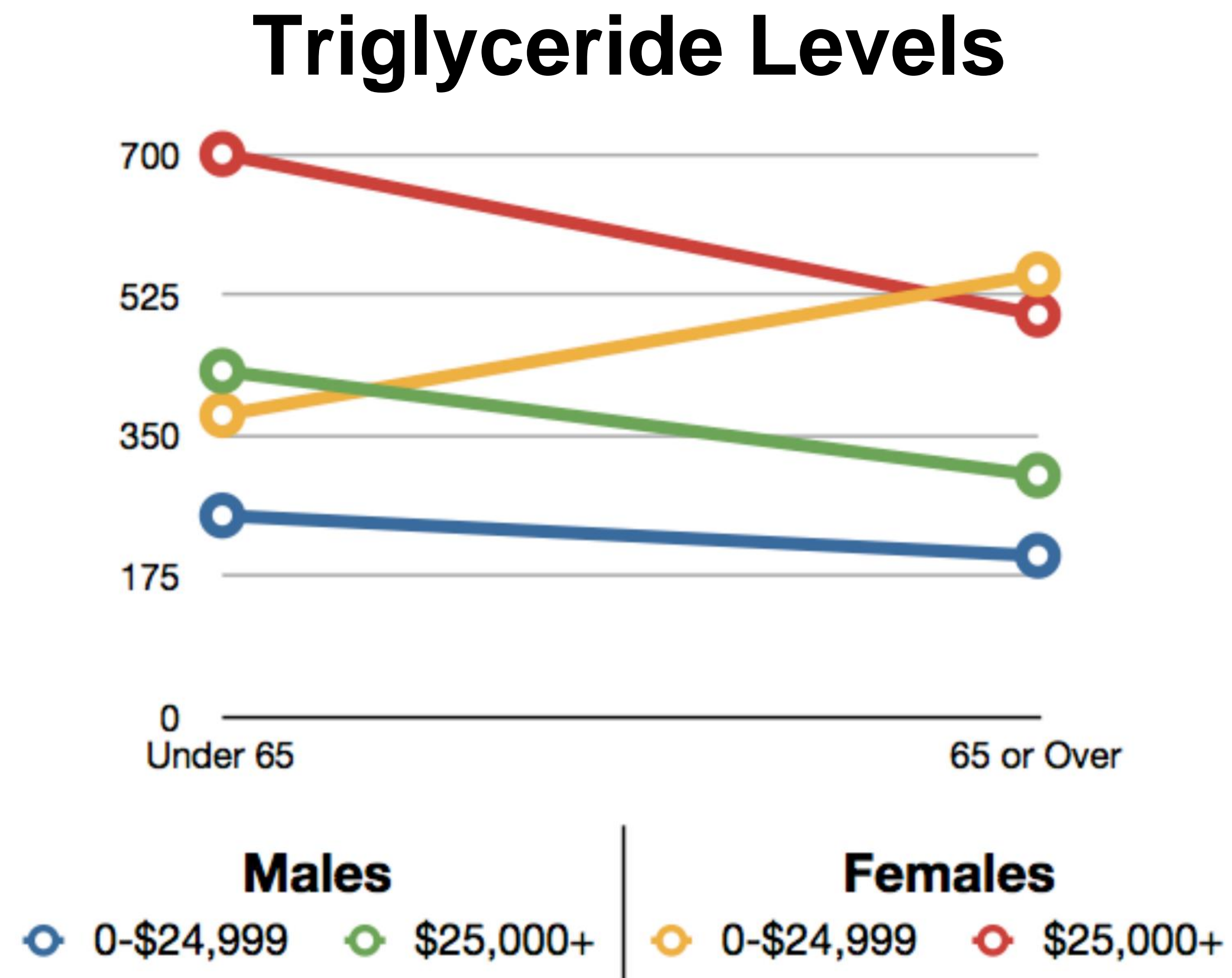
<https://www.youtube.com/watch?v=FW5xSQsspiQ>

Which gender and income level shows a different effect of age on triglyceride levels?

Triglyceride Levels

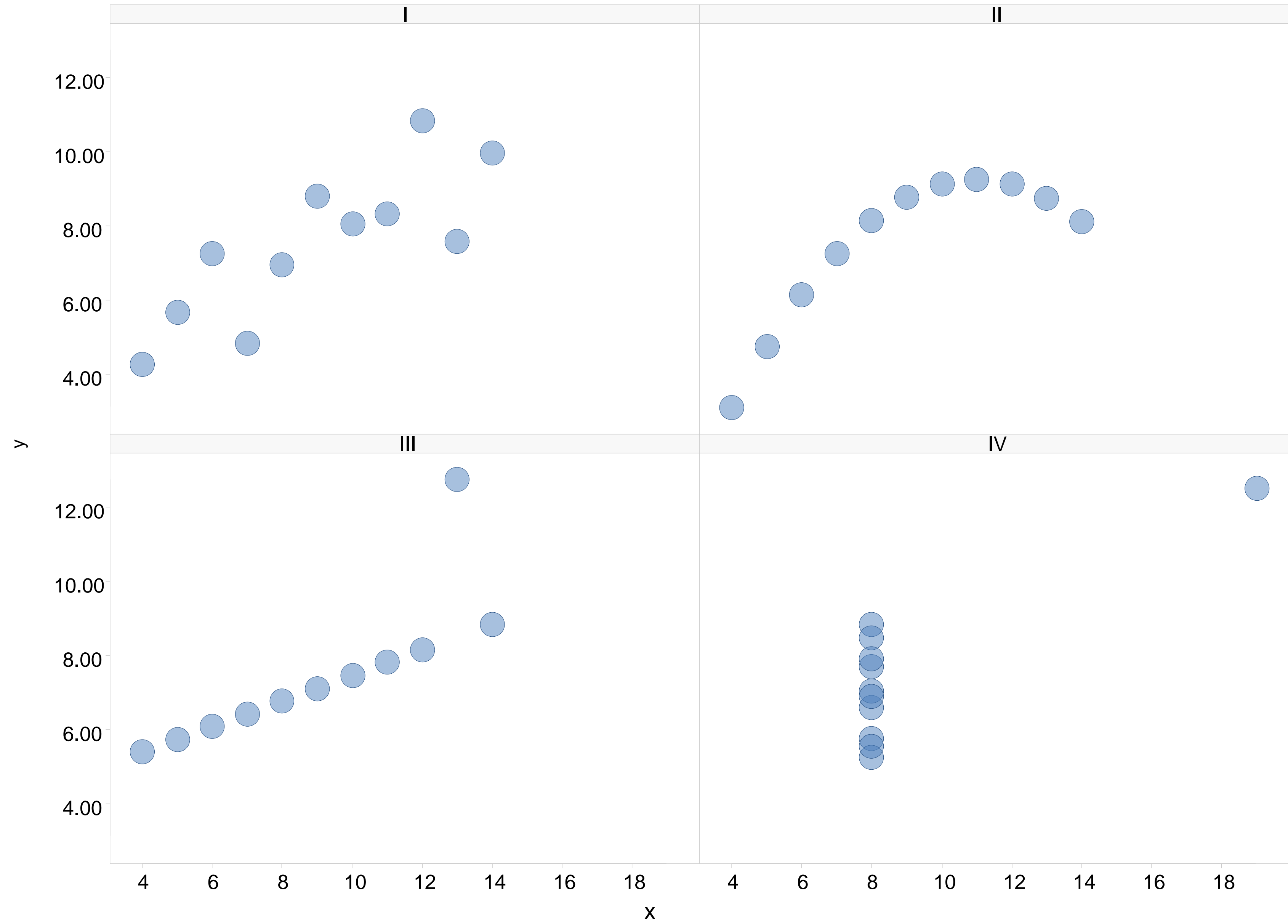
	Males		Females	
Income Group	Under 65	65 or Over	Under 65	65 or Over
0-\$24,999	250	200	375	550
\$25,000+	430	300	700	500

Which gender and income level shows a different effect of age on triglyceride levels?



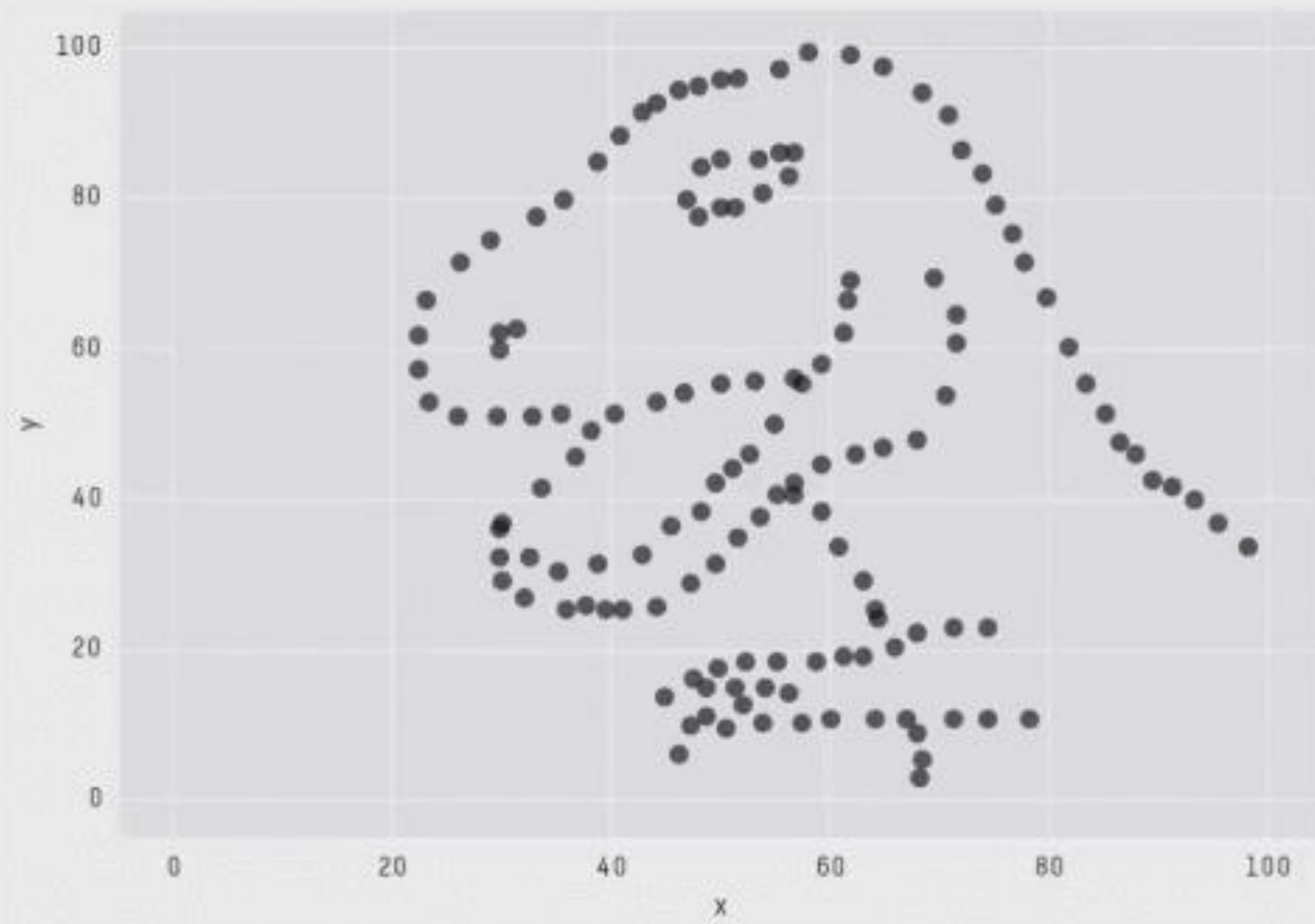
I		II		III		IV	
x	y	x	y	x	y	x	y
10.00	8.04	10.00	9.14	10.00	7.46	8.00	6.58
8.00	6.95	8.00	8.14	8.00	6.77	8.00	5.76
13.00	7.58	13.00	8.74	13.00	12.74	8.00	7.71
9.00	8.81	9.00	8.77	9.00	7.11	8.00	8.84
11.00	8.33	11.00	9.26	11.00	7.81	8.00	8.47
14.00	9.96	14.00	8.10	14.00	8.84	8.00	7.04
6.00	7.24	6.00	6.13	6.00	6.08	8.00	5.25
4.00	4.26	4.00	3.10	4.00	5.39	19.00	12.50
12.00	10.84	12.00	9.13	12.00	8.15	8.00	5.56
7.00	4.82	7.00	7.26	7.00	6.42	8.00	7.91
5.00	5.68	5.00	4.74	5.00	5.73	8.00	6.89

	Value	Equality
X Mean	9	=
Y Mean	7.50	.00
X Variance	11	=
Y Variance	4.12	.00
Correlation	0.816	.000
Linear regression line	$y = 3.00 + 0.500x$.00 and .000



There are three types of lies: lies,
damned lies, and statistics

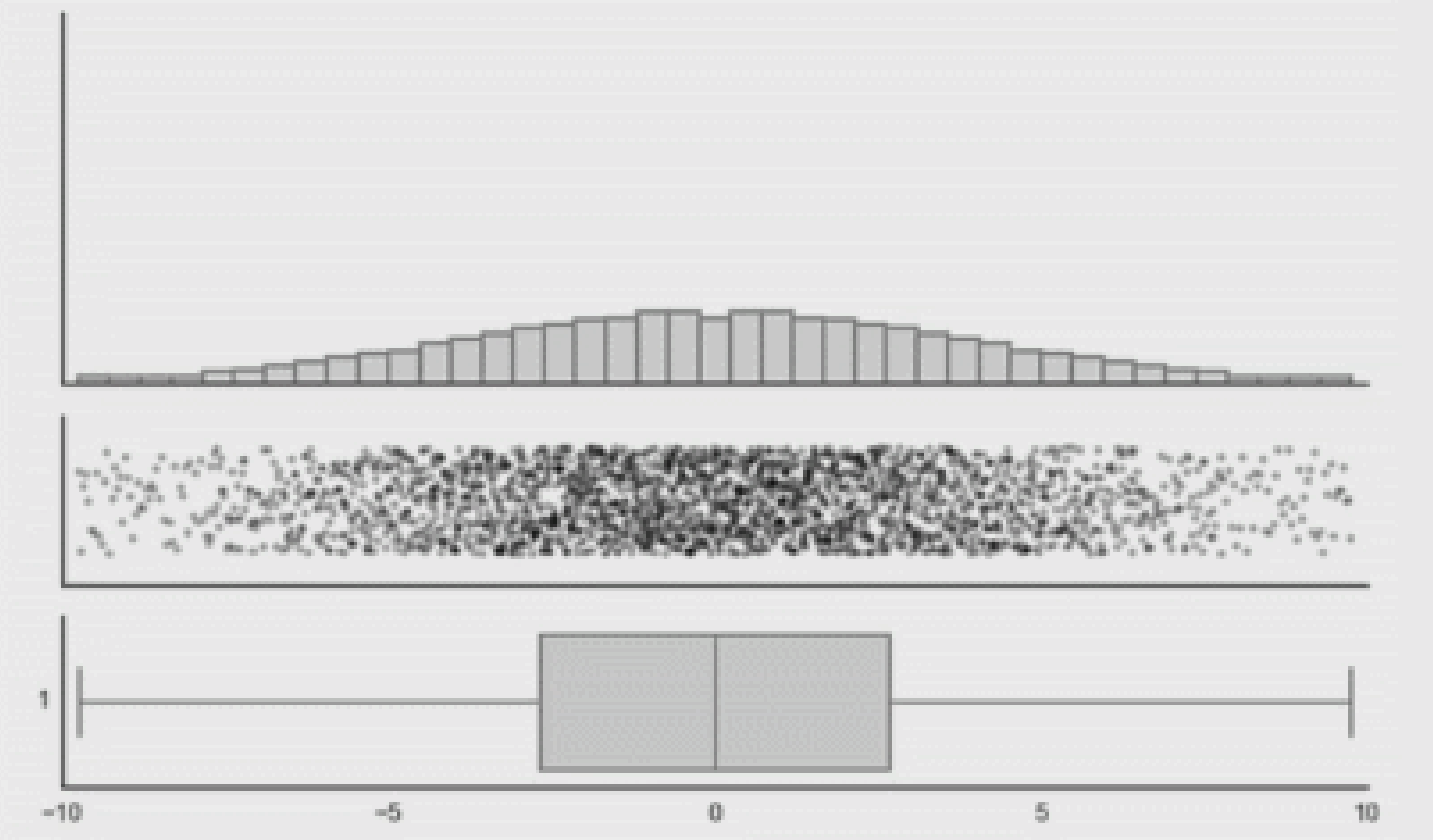
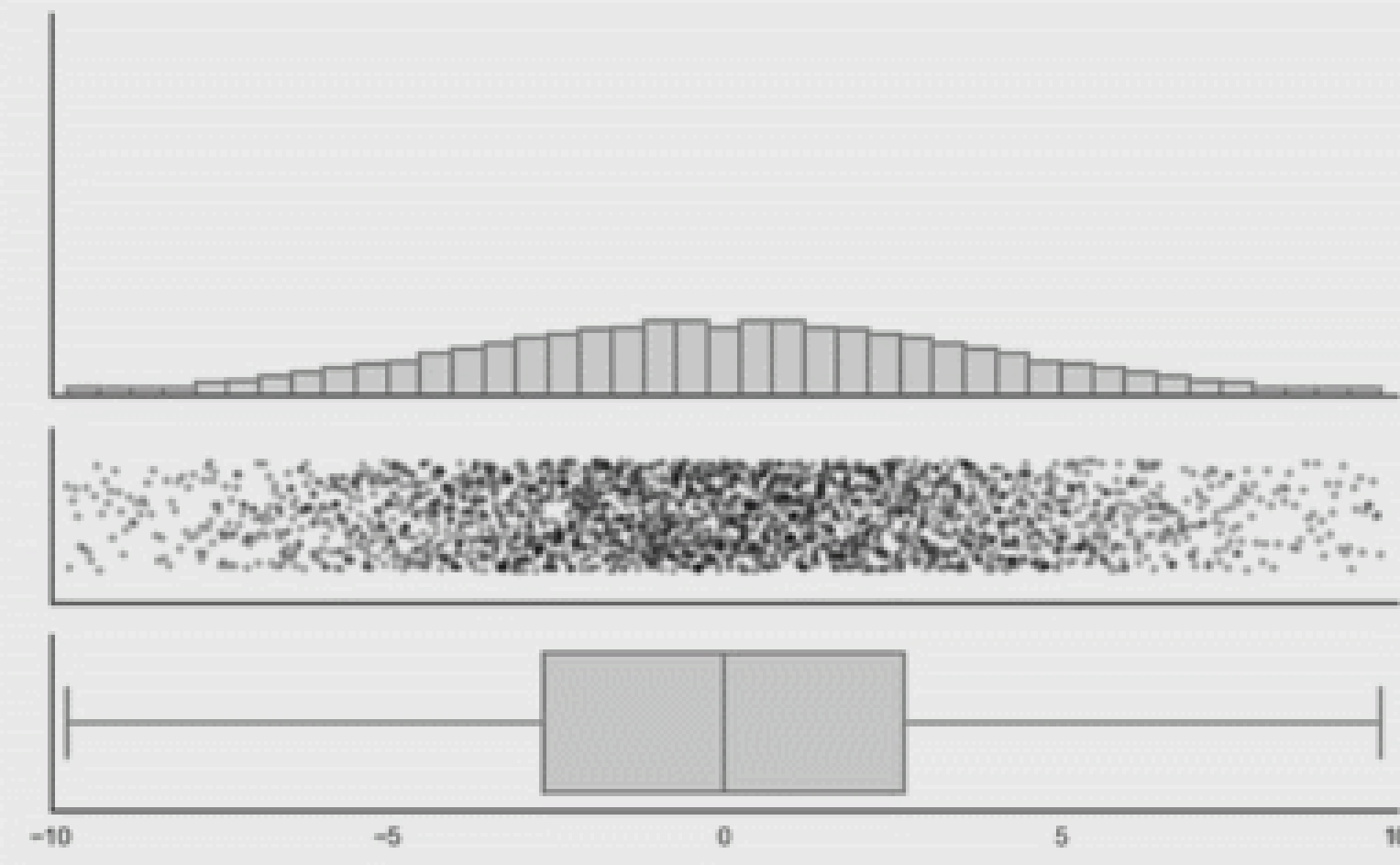
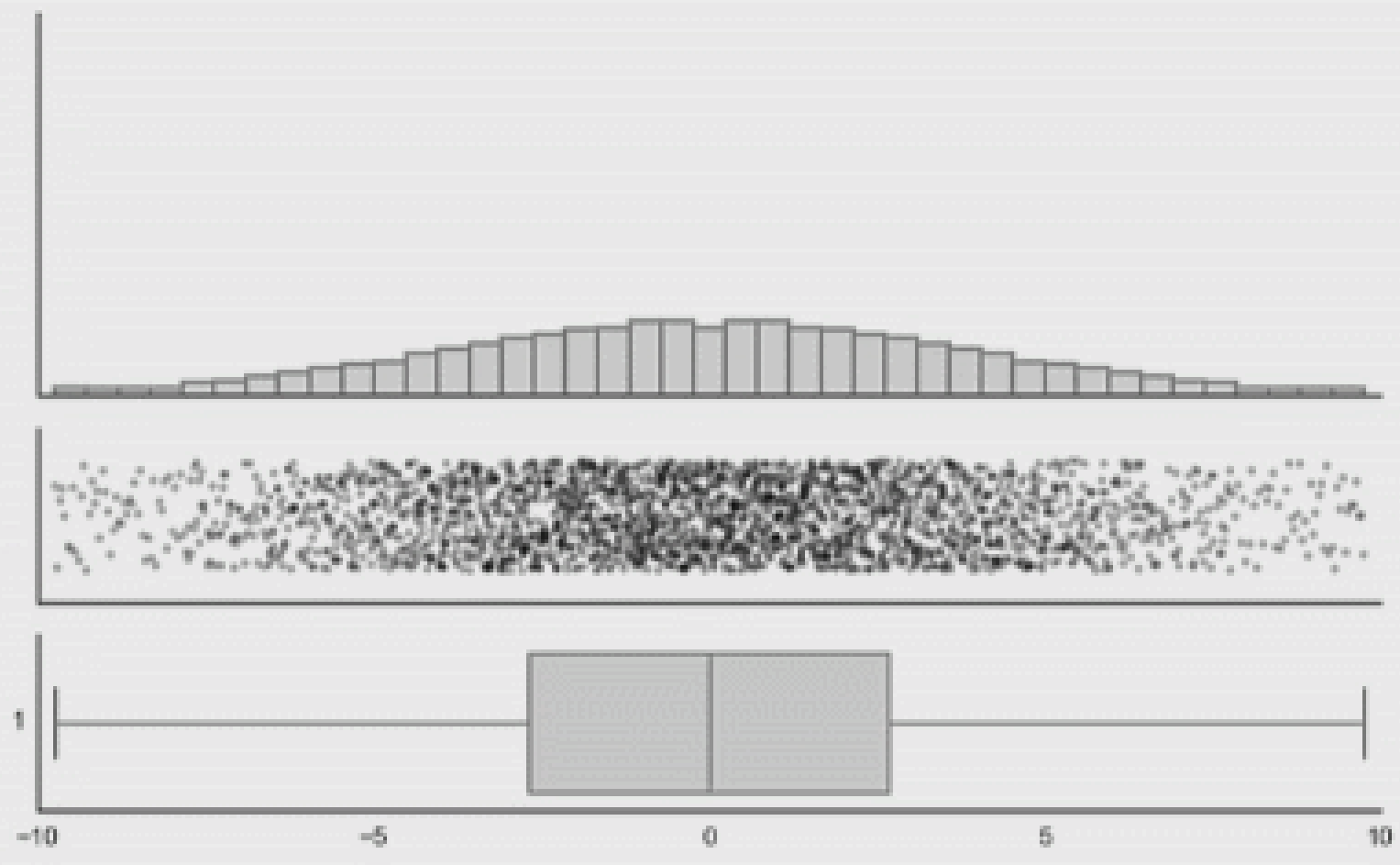
Unknown author, popularized by Mark Twain

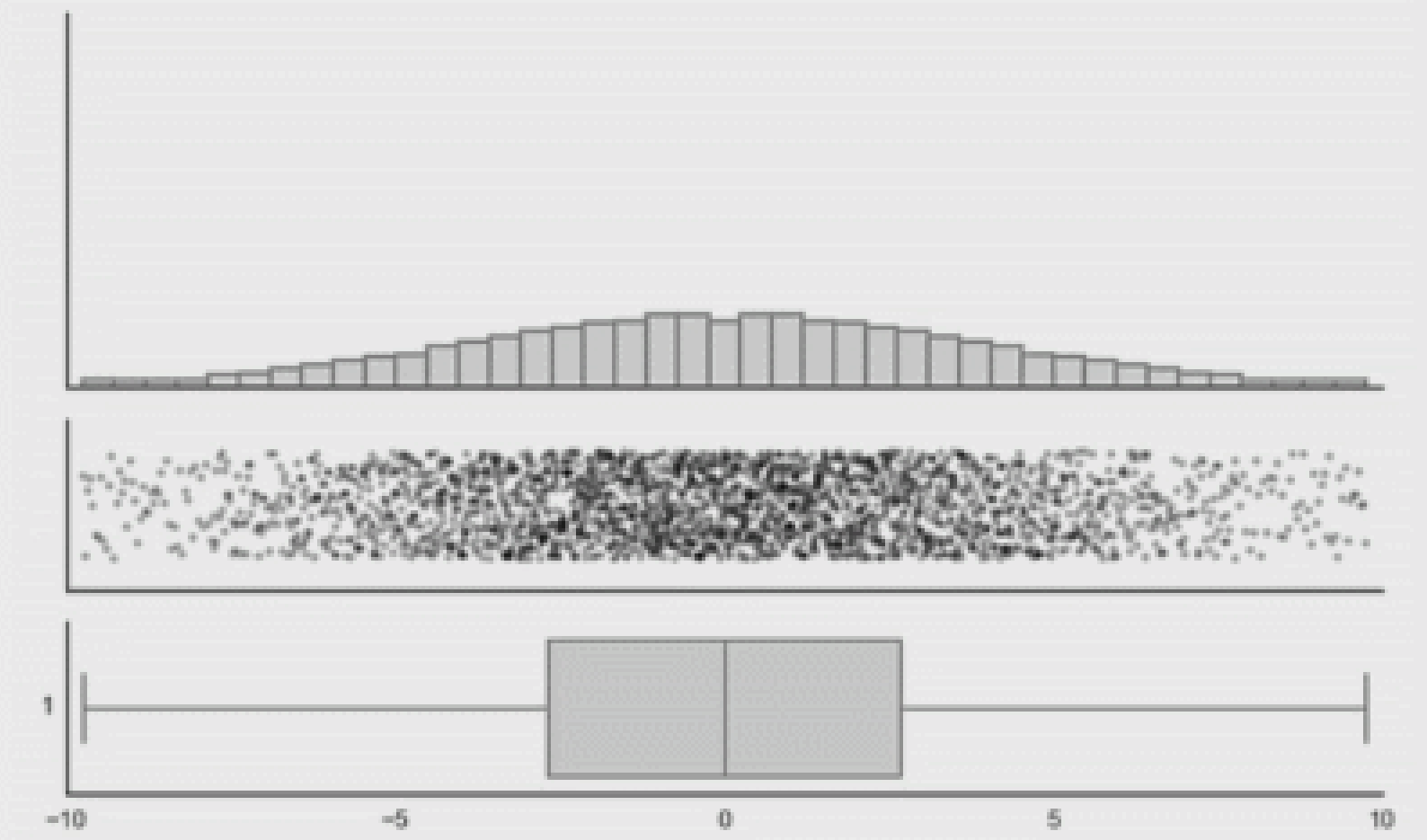
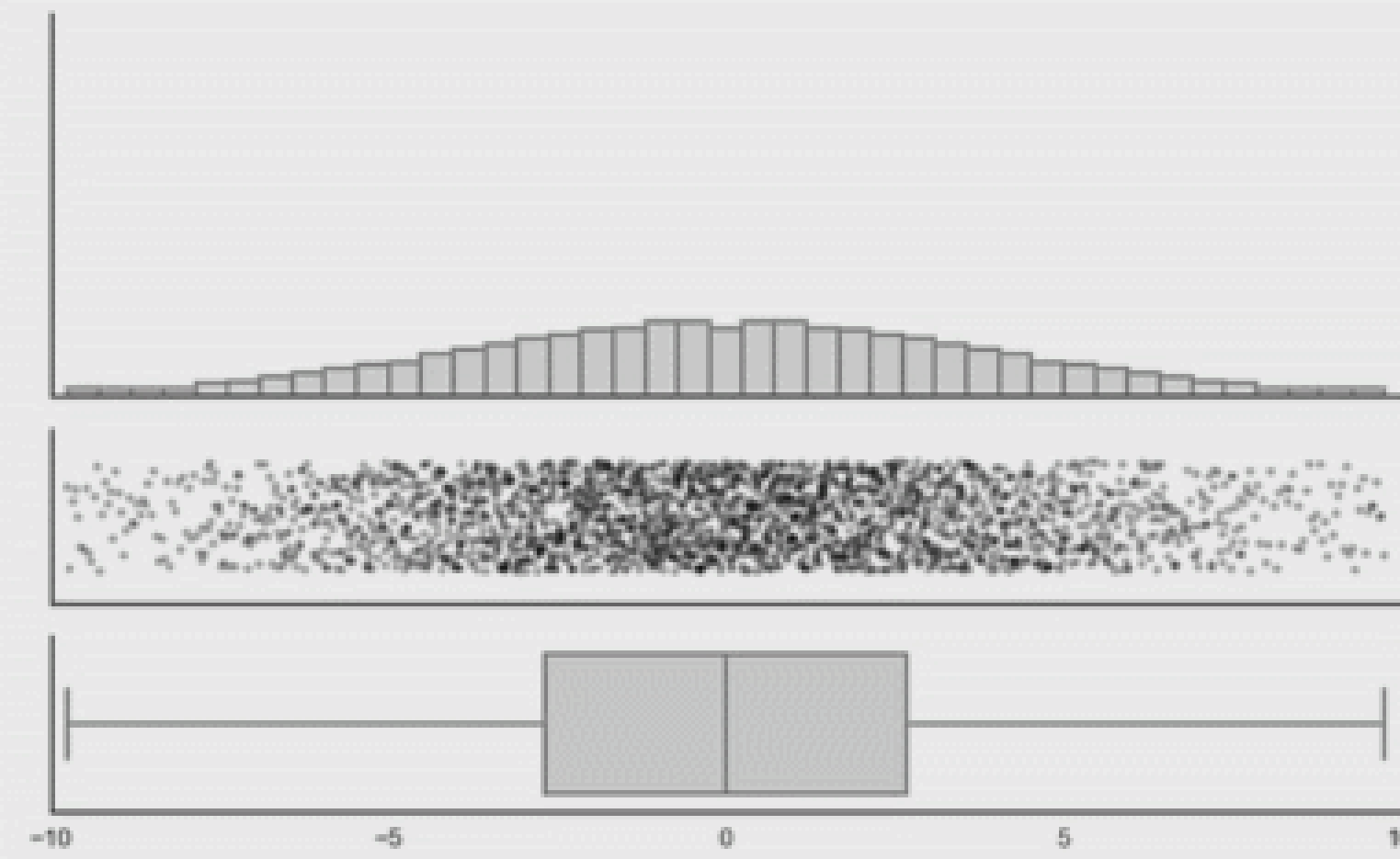
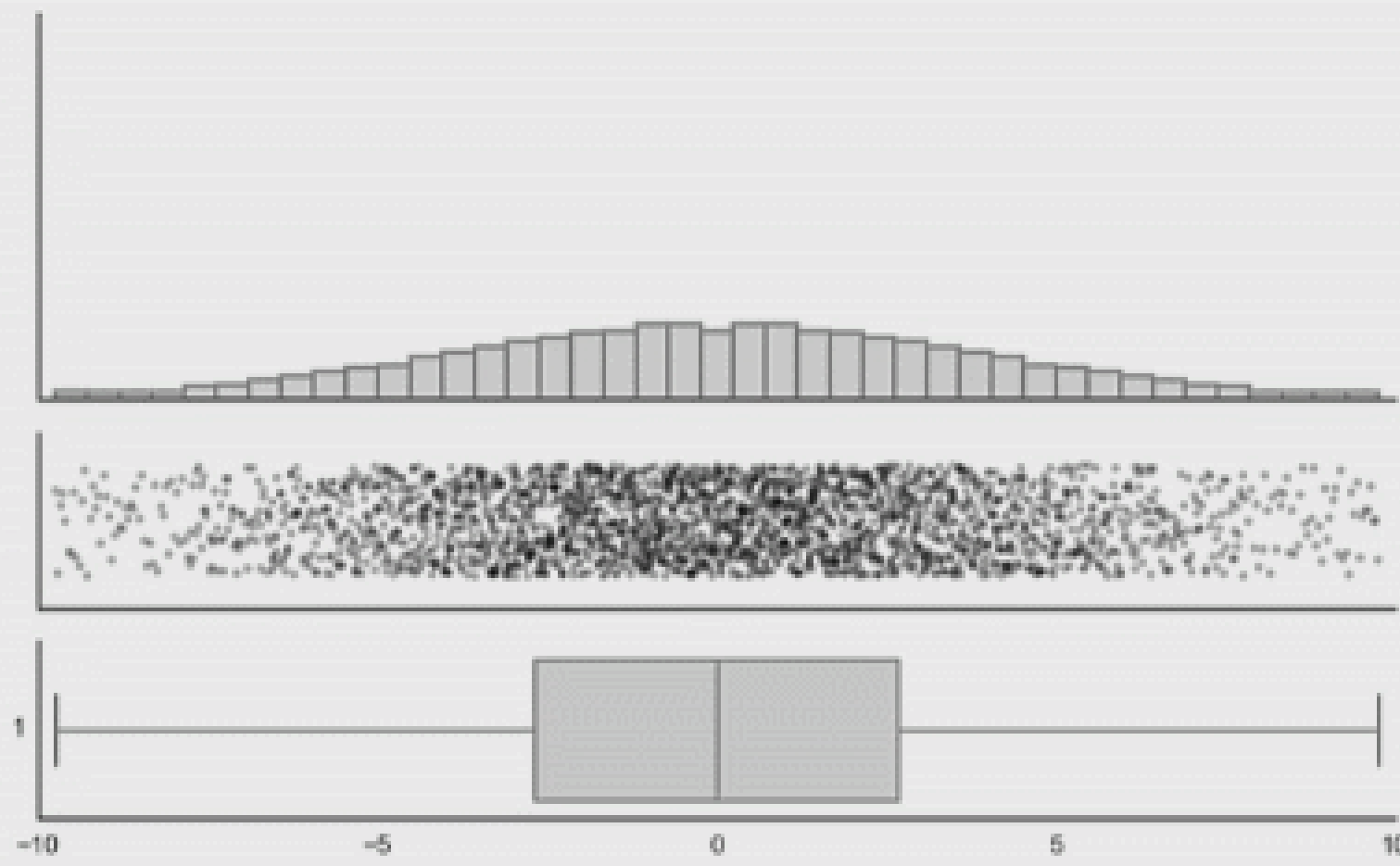


X Mean: 54.2659224
Y Mean: 47.8313999
X SD : 16.7649829
Y SD : 26.9342120
Corr. : -0.0642526

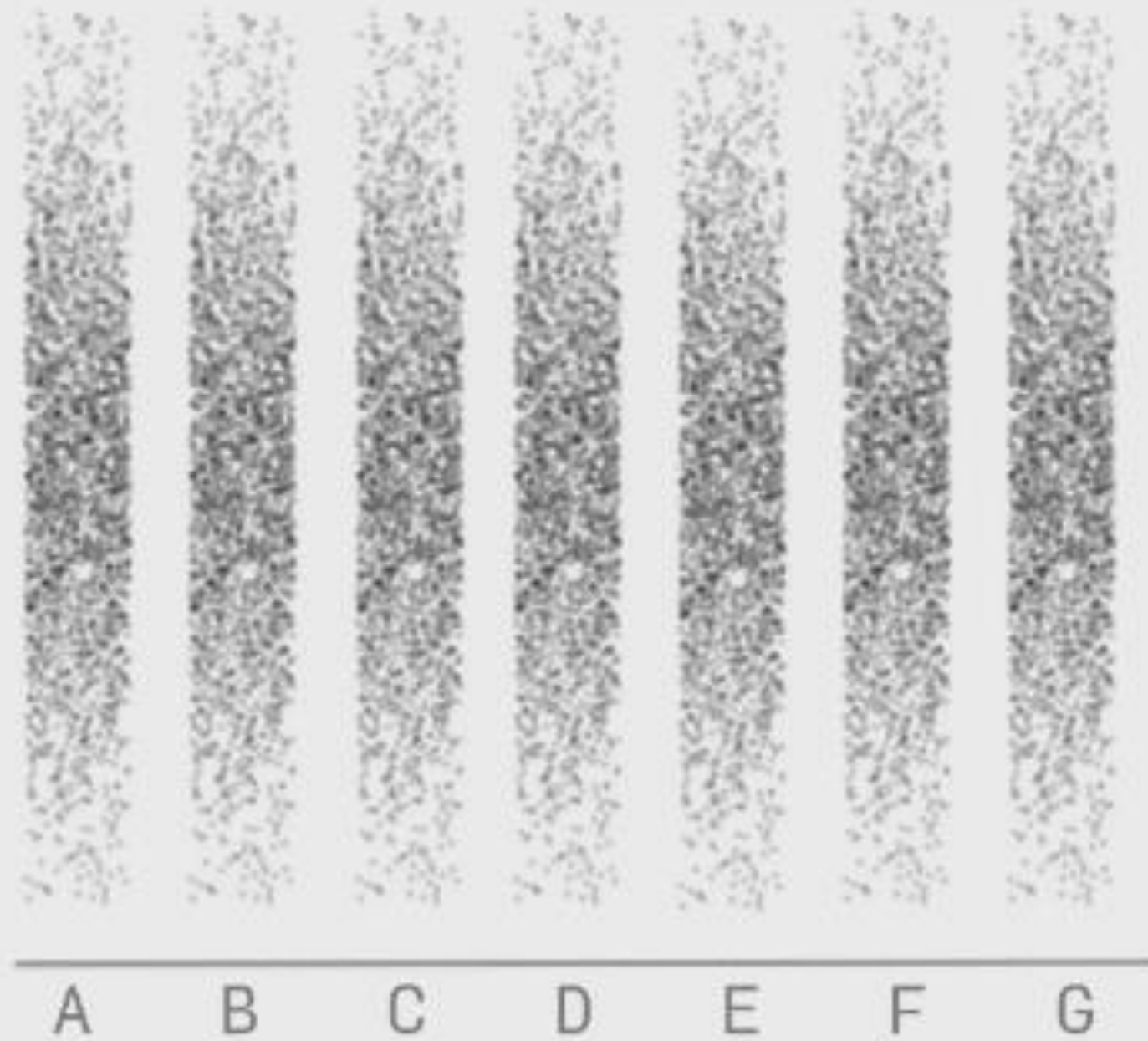
No catalogue of techniques can convey a willingness to look for what can be seen, whether or not anticipated. Yet this is at the heart of exploratory data analysis. ... the picture-examining eye is the best finder we have of the wholly unanticipated.

– Tukey, 1980

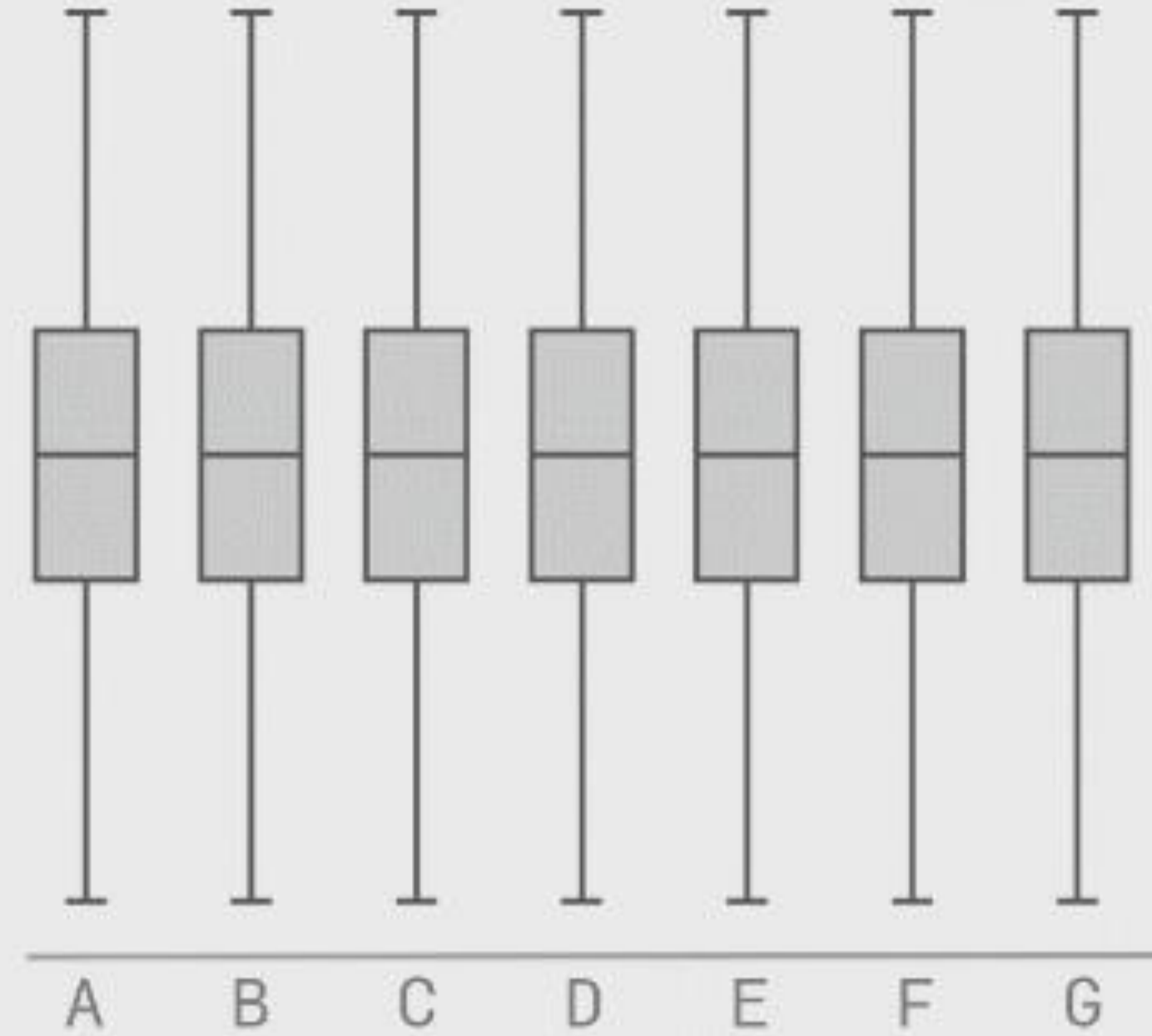




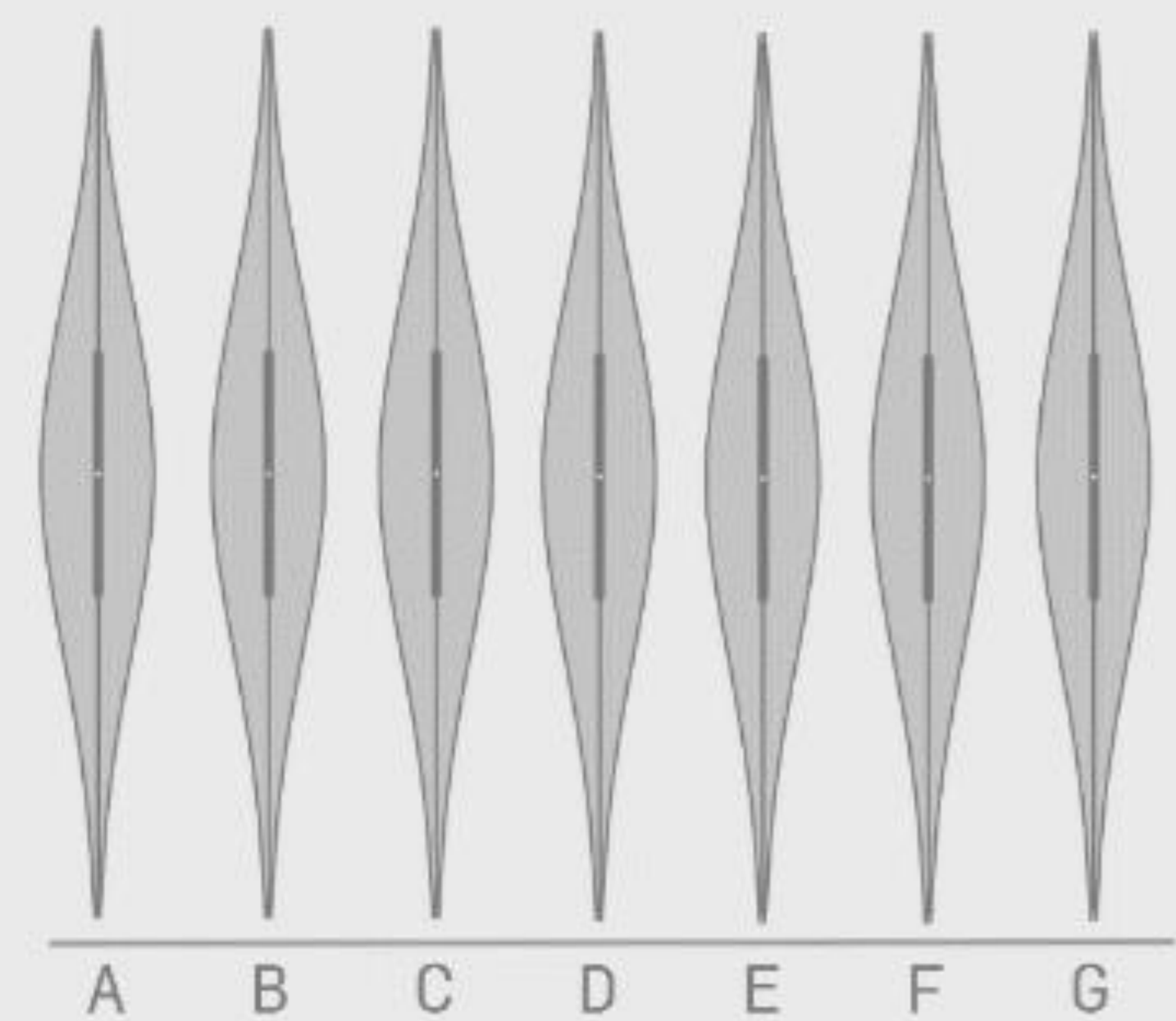
Raw Data



Box-plot of the Data



Violin-plot of the Data



Ok, but why do we need
visualization?

Why visualize your data?

- Help cognition
- Expand memory
- Generate hypotheses
- Answer questions
- Make decisions
- Find patterns
- Record
- Clarify
- Communicate
- Inspire

For Next Time & Communication

Canvas course + syllabus incoming soon!

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doi: [10.1007/3-540-44969-8_5](https://doi.org/10.1007/3-540-44969-8_5) (EZproxy [metadata](#), [PDF](#))
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doi: [10.1007/3-540-44969-8_1](https://doi.org/10.1007/3-540-44969-8_1) (EZproxy [metadata](#), [PDF](#))

Everyday Required Supplies:

- 5+ colors of pen/pencil
- White paper
- Laptop and charger

Use Canvas Discussions for general questions, email the instructor for questions specific to you.