Data Visualization W11-1

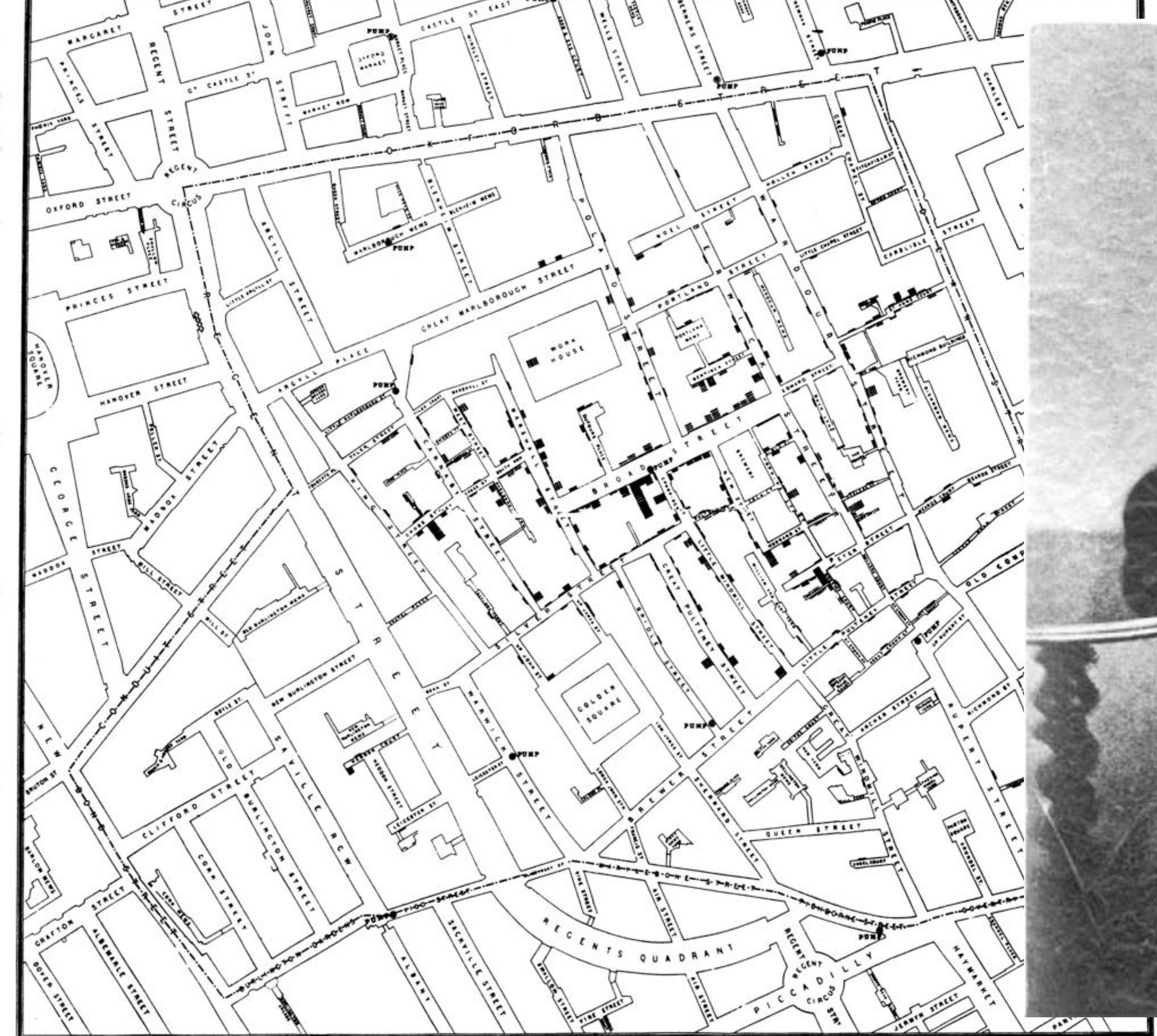
Quiz

- What do you find interesting in today's VotW?
- Explain MDS. What's the key idea? When do you want to use/not use it?
- Explain Isomap. What's the key idea? When do you want to use/not use it?

Maps

Why do we want to learn about visualizing maps and geographic information?

Any examples?


OXFORD STREET
REGENT STREET
REGENT CIRCUS
HANOVER SQUARE
HANOVER STREET
PRINCES STREET
GREAT MARLBOROUGH STREET
POLAND STREET
BROAD STREET
WORK HOUSE
GOLDEN SQUARE
PUMP
MARLBOROUGH MEWS
NOEL STREET
PORTLAND STREET
ARGYLL PLACE
GEORGE STREET
MADDOX STREET
CONDUIT STREET
NEW BOND STREET
SAVILLE ROW
CLIFFORD STREET
OLD BURLINGTON STREET
NEW BURLINGTON STREET
GREAT PULTENEY STREET
WARWICK STREET
BREWER STREET
QUEEN STREET
RUPERT STREET
HAYMARKET
REGENTS QUADRANT
PICCADILLY
REGENT CIRCUS
ALBANY
SACKVILLE STREET
DOVER STREET
ALBEMARLE STREET
GRAFTON STREET
JERMYN STREET
OLD COMPTON

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 zônes colorées à raison d'un millimètre pour dix mille hommes; ils sont de plus écrits en travers des zônes. 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. Thiers, 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 Davoust qui avaient été détachés sur Minsk et Mobilow et ont rejoint vers Orscha et Witebsk, avaient toujours marché avec l'armée.

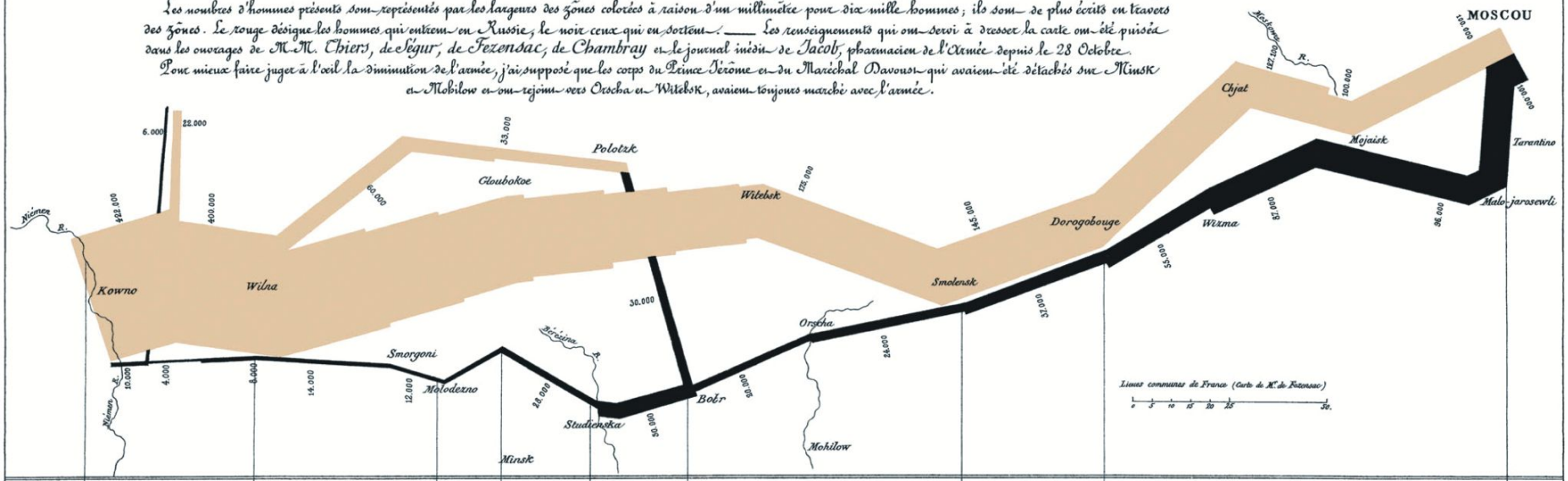
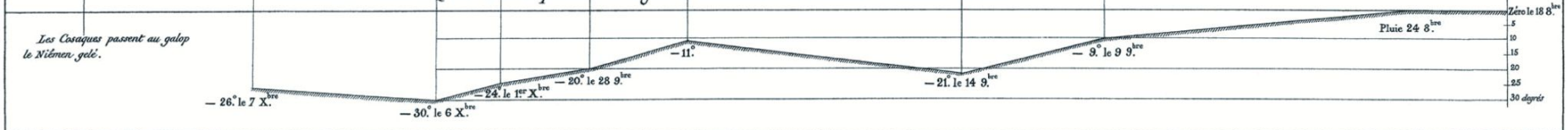
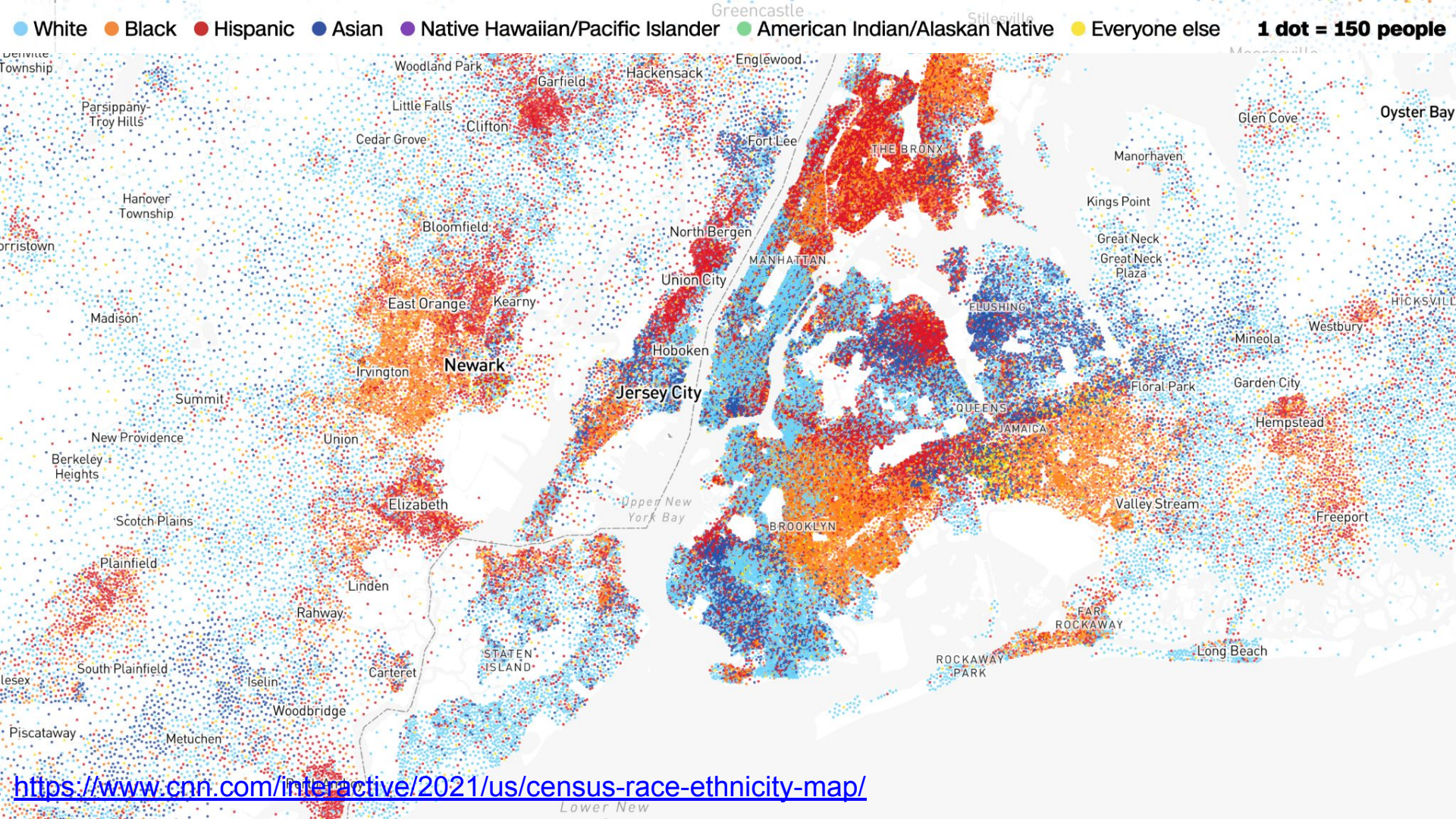


TABLEAU GRAPHIQUE de la température en degrés du thermomètre de Réaumur au dessous de zéro.



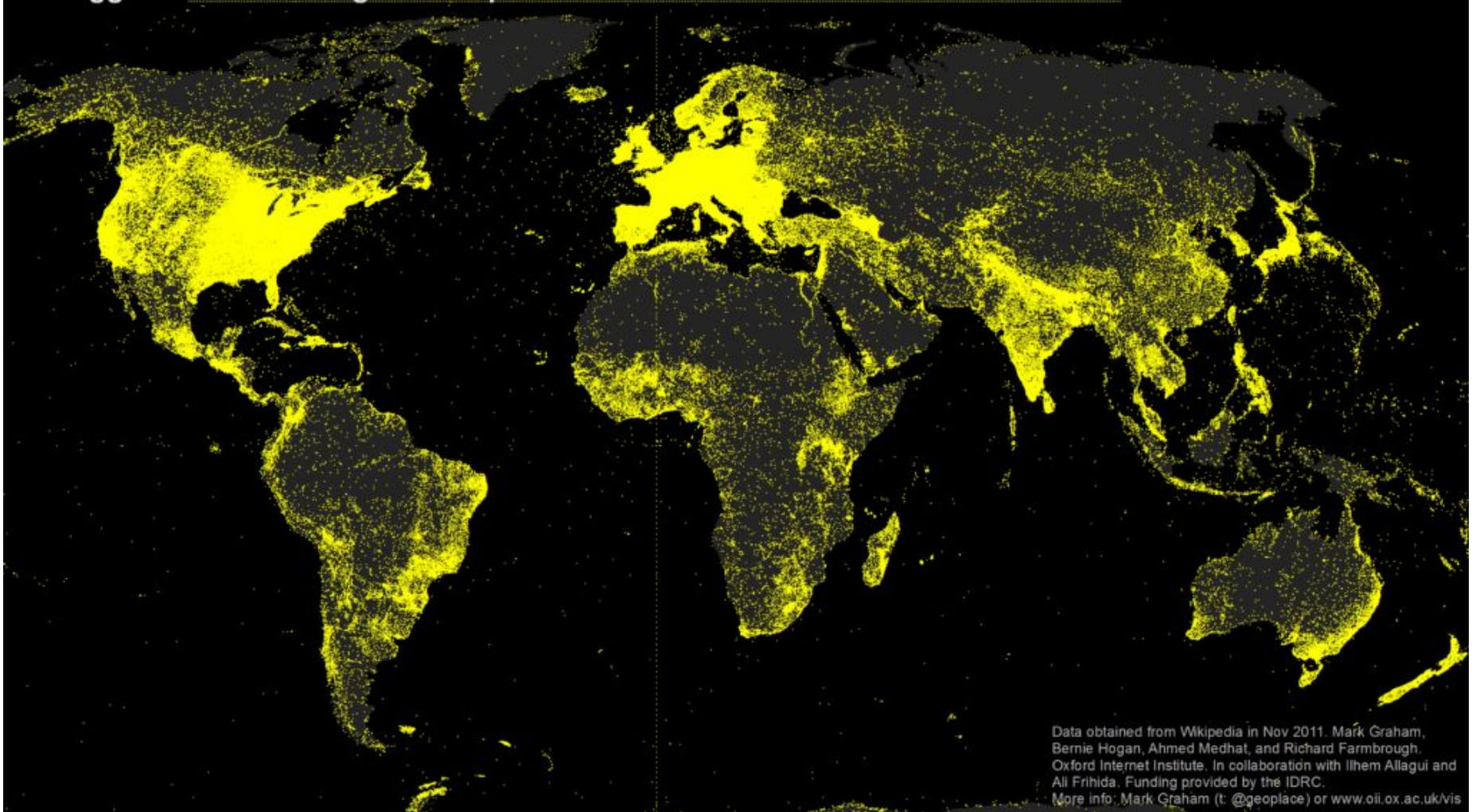
Autog. par Regnier, 3. Pas. Ste Marie St Gain à Paris.

Imp. Lith. Regnier et Bourdet.

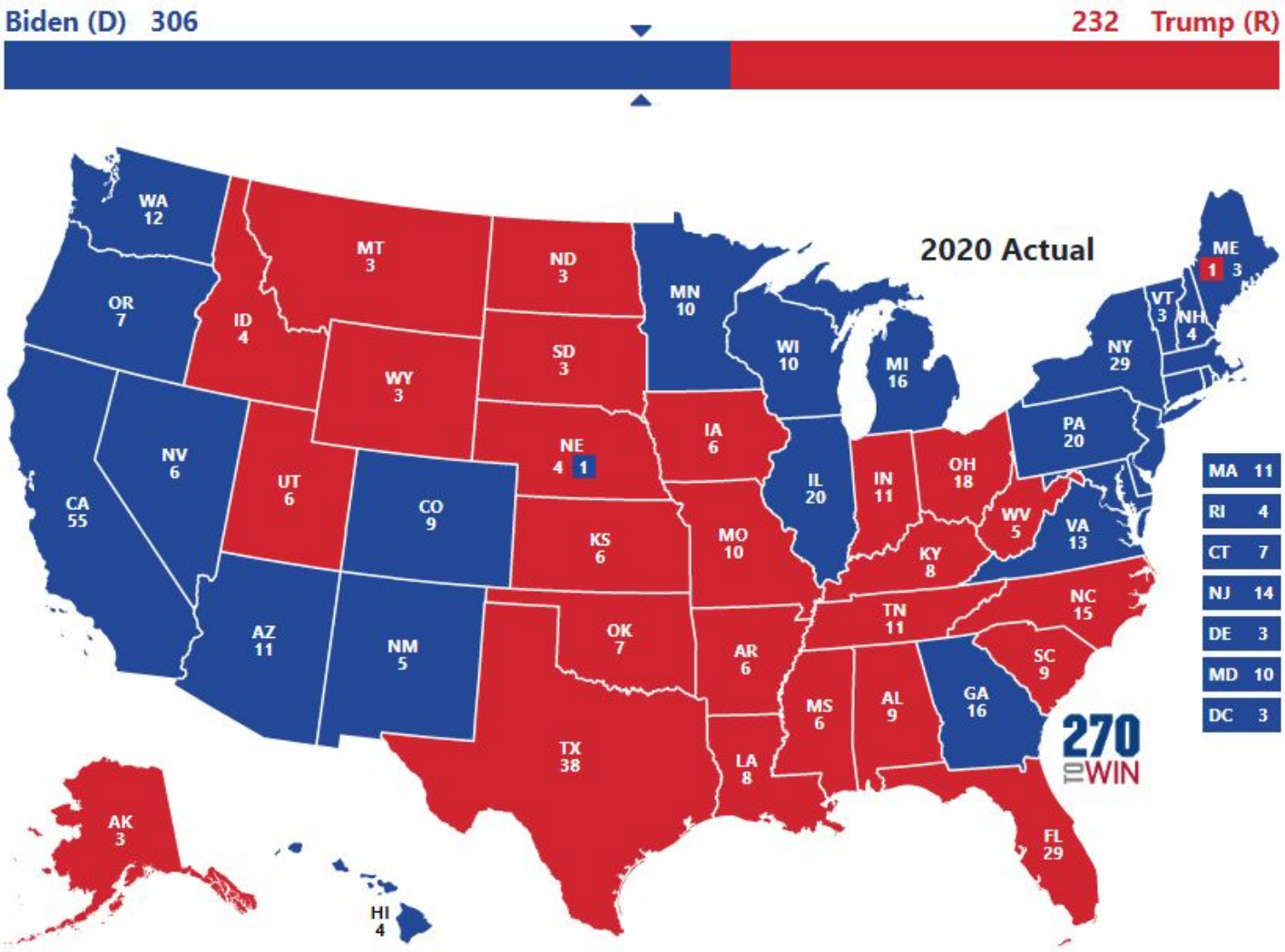


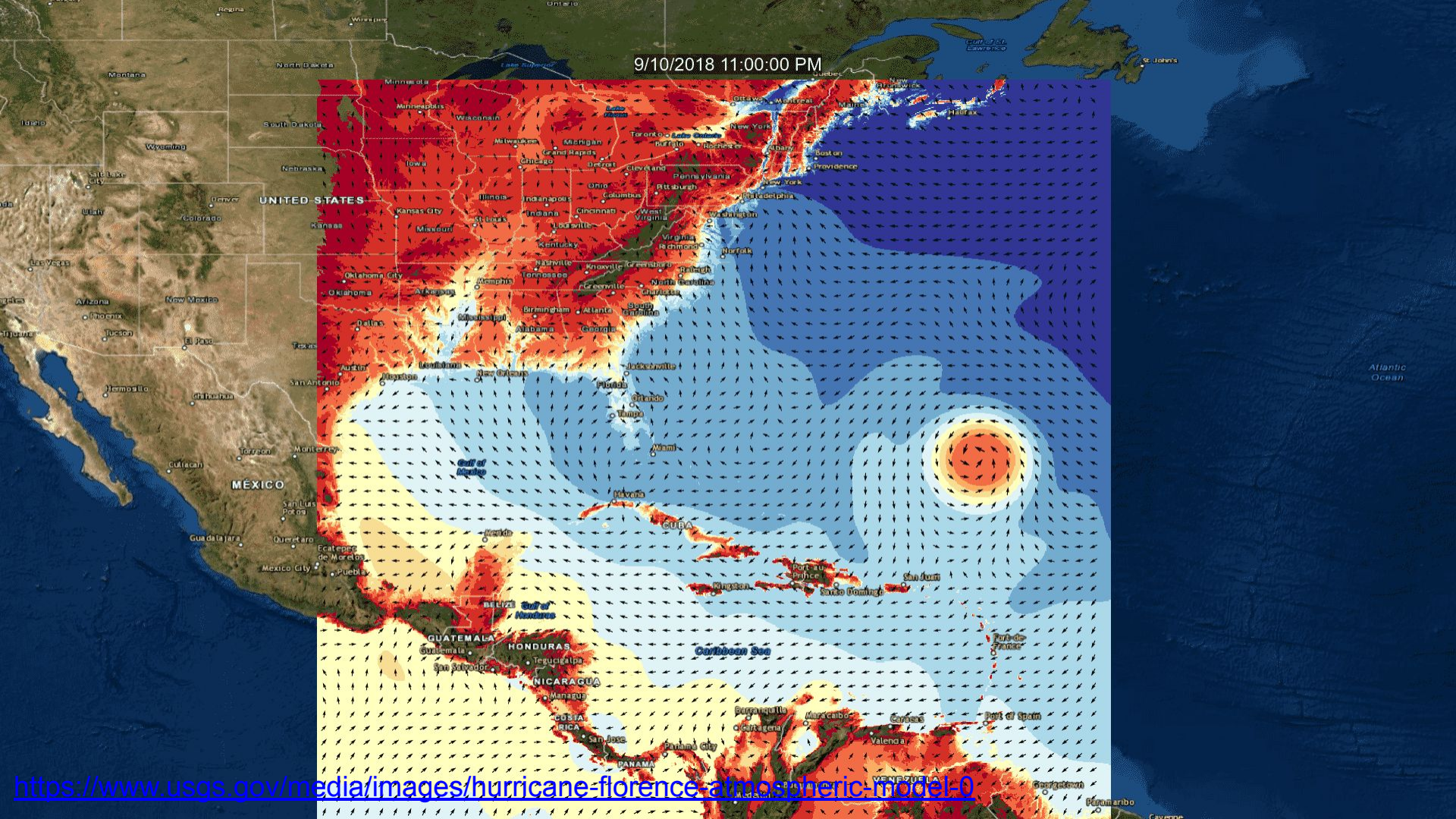
https://www.cnn.com/interactive/2021/us/census-race-ethnicity-map/

Geotagged Articles in English Wikipedia



Data obtained from Wikipedia in Nov 2011. Mark Graham, Bernie Hogan, Ahmed Medhat, and Richard Farmbrough. Oxford Internet Institute. In collaboration with Ilhem Allagui and Ali Frihida. Funding provided by the IDRC.
More info: Mark Graham (t: @geoplace) or www.oii.ox.ac.uk/vis


Biden (D) 306
232 Trump (R)
2020 Actual
WA 12
OR 7
CA 55
NV 6
ID 4
MT 3
WY 3
UT 6
AZ 11
CO 9
NM 5
ND 3
SD 3
NE 4 1
KS 6
OK 7
TX 38
MN 10
IA 6
MO 10
AR 6
LA 8
WI 10
IL 20
MS 6
MI 16
IN 11
KY 8
TN 11
AL 9
OH 18
WV 5
GA 16
SC 9
NC 15
VA 13
PA 20
NY 29
ME 1 3
VT 3
NH 4
MA 11
RI 4
CT 7
NJ 14
DE 3
MD 10
DC 3
FL 29
AK 3
HI 4
270 TO WIN



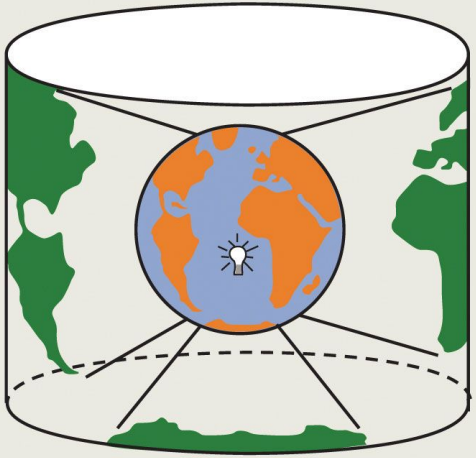
https://www.usgs.gov/media/images/hurricane-florence-atmospheric-model-0

What’s so hard about maps?

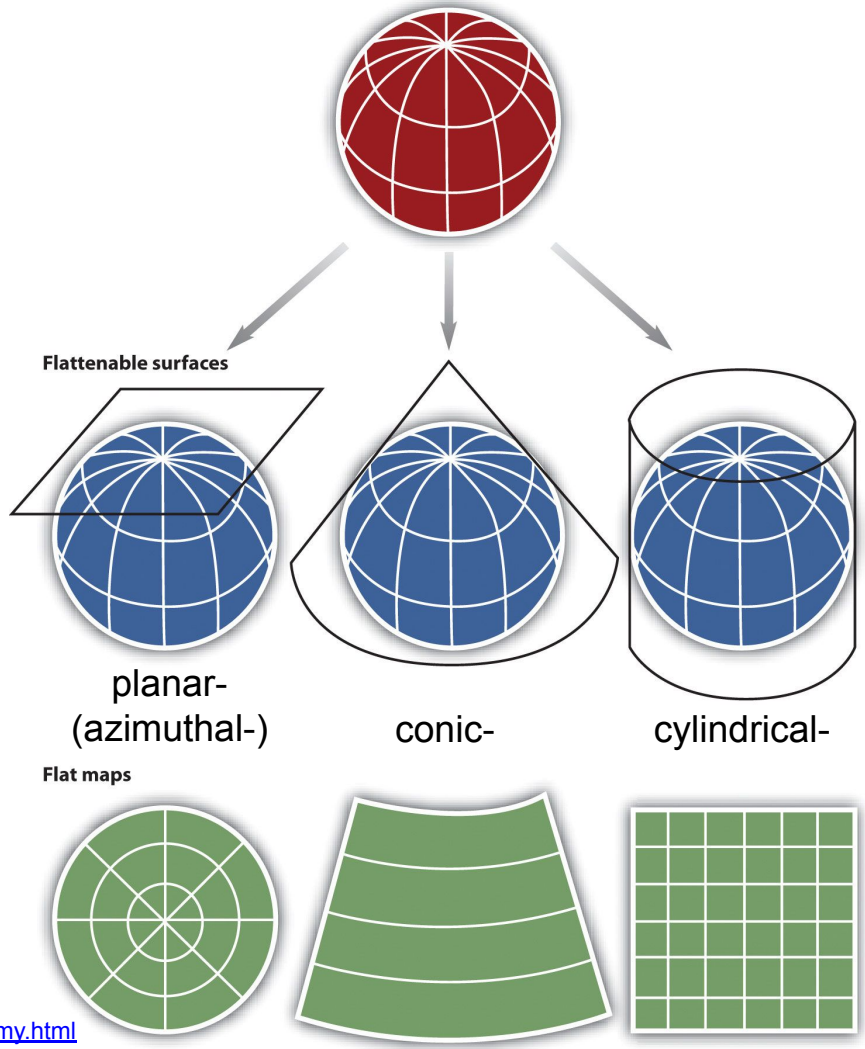

ATLANTIC
OCEAN
BRAZIL
SOUTH AMERICA
PERU
COLOMBIA
VENEZUELA
BOLIVIA
PARAGUAY
CHILE
ARGENTINA
ECUADOR
GUYANA
SURINAME
PANAMA
CUBA
BAHAMAS
MEXICO
NICARAGUA
CARIBBEAN SEA
LEGEND

Why all world maps are wrong

https://www.youtube.com/watch?v=kIID5FDi2JQ



Concept of
map “**projection**”

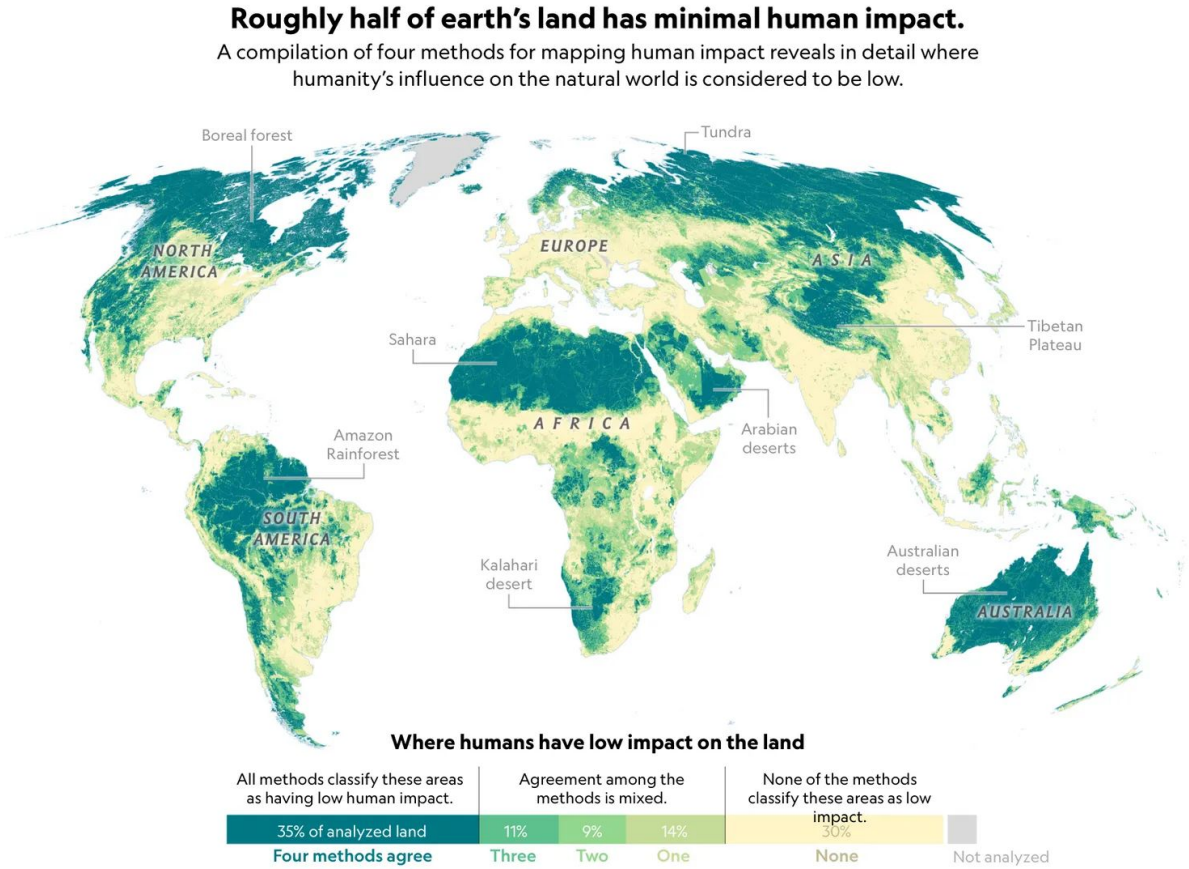


https://saylordotorg.github.io/text_essentials-of-geographic-information-systems/s06-map-anatomy.html

Every projection
preserves something
(area, angle, distance, etc.)

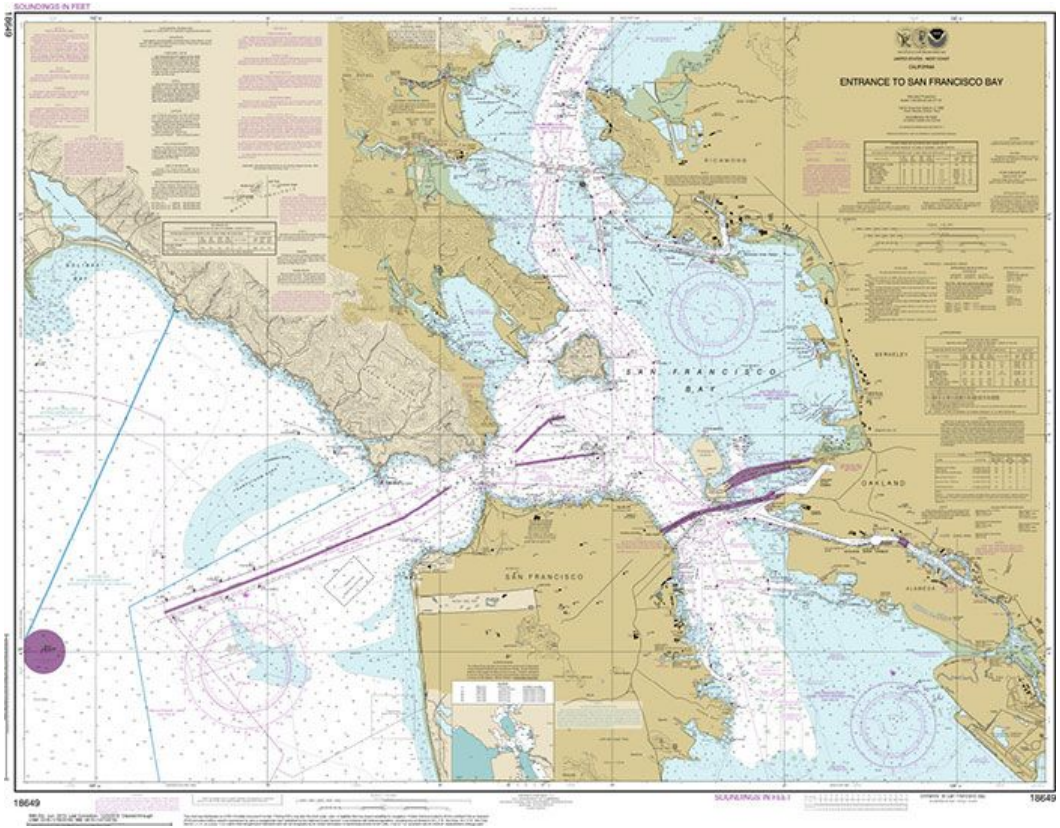
at the cost of others.

Equal-area (equivalent) projection



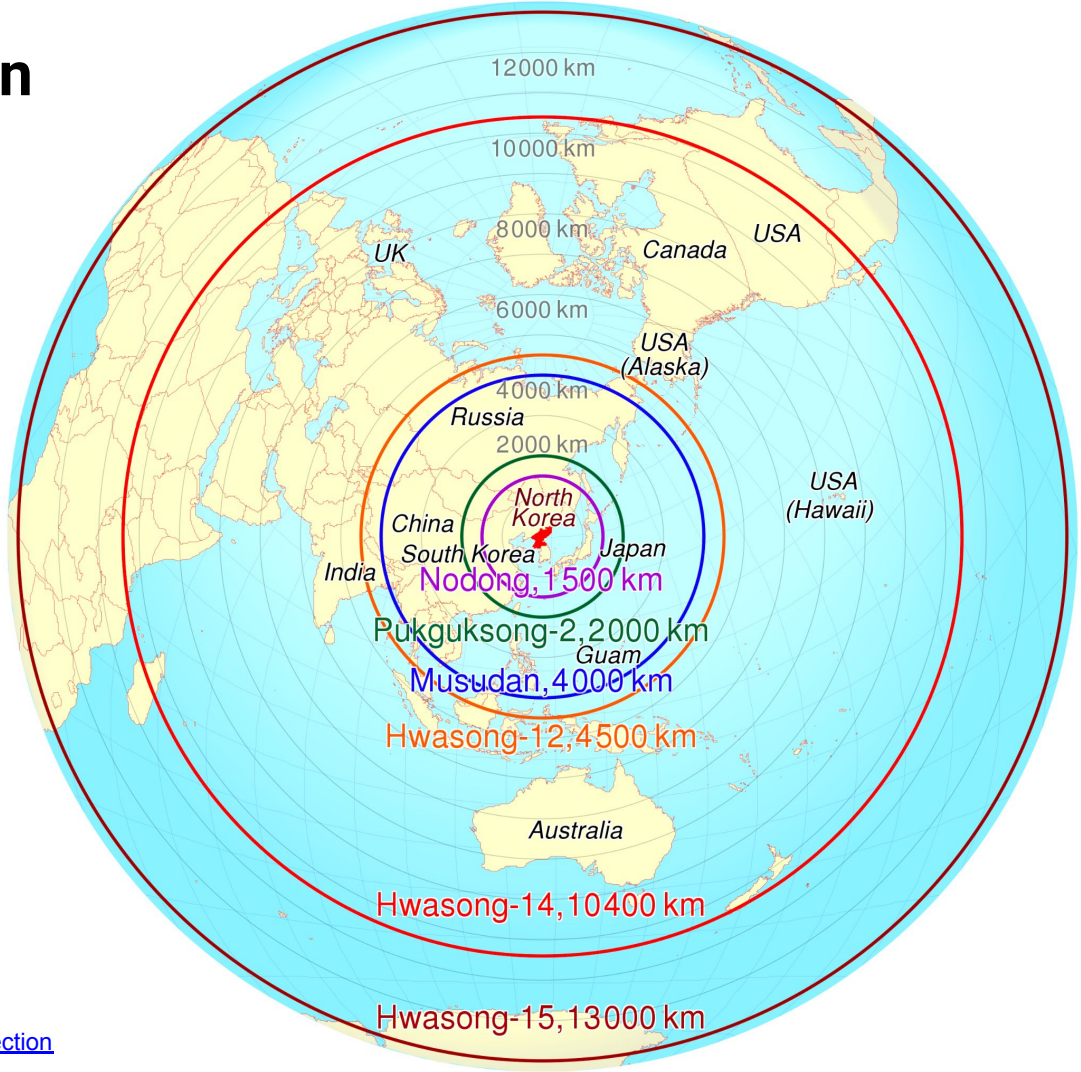
https://www.nationalgeographic.co.uk/environment-and-conservation/2020/06/this-map-shows-where-on-earth-humans-arent

Conformal projection



https://www.nauticalcharts.noaa.gov/learn/nautical-cartography.html

Equidistant projection



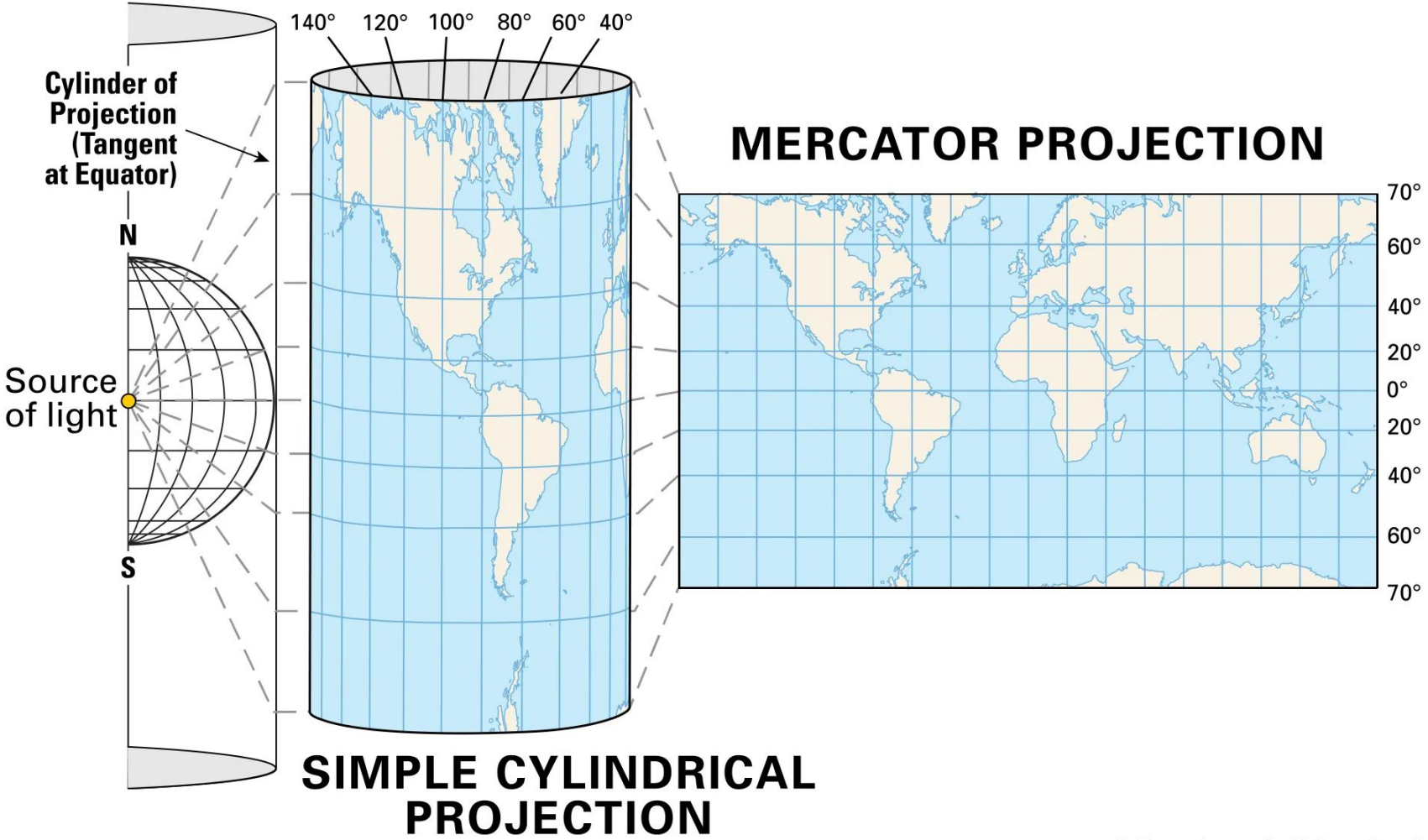
https://en.wikipedia.org/wiki/Azimuthal_equidistant_projection

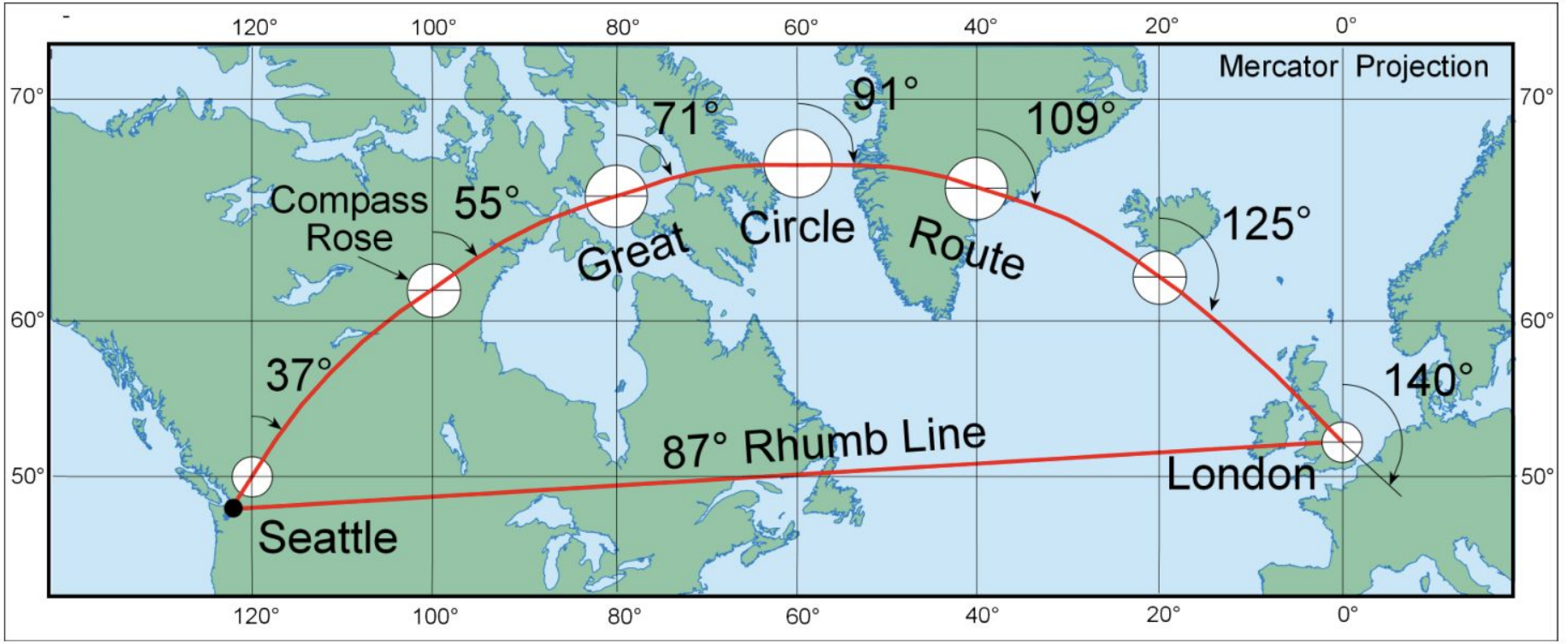
What is your favorite map projection?

Pick one and read about it.
Explain:
- What is the objective of the projection? What does it preserve?
- What does it ignore?
- Why is it cool?

https://github.com/d3/d3-geo-projection/#projections
www.jasondavies.com/maps/transition
https://storymaps.arcgis.com/stories/ea0519db9c184d7e84387924c84b703f

Gerardus Mercator
(1512-1594)




Mercator Projection
120°
100°
80°
60°
40°
20°
0°
70°
60°
50°
Compass Rose
55°
71°
91°
109°
125°
140°
37°
Great Circle Route
87° Rhumb Line
Seattle
London

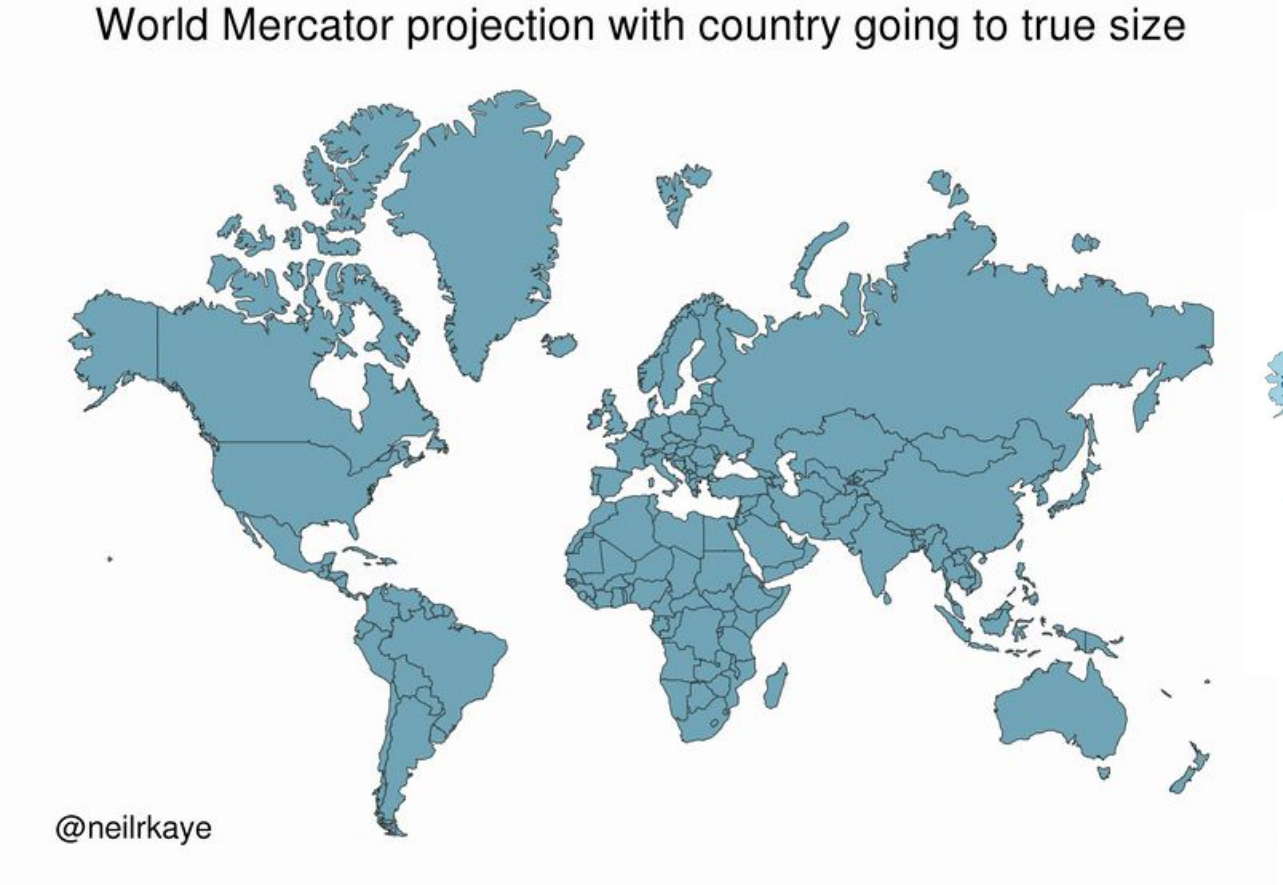
“The first launch of [Google] Maps actually did not use Mercator, and streets in high latitude places like Stockholm did not meet at right angles on the map the way they do in reality.”

https://www.theverge.com/2018/8/5/17653122/google-maps-update-mercator-projection-earth-isnt-flat

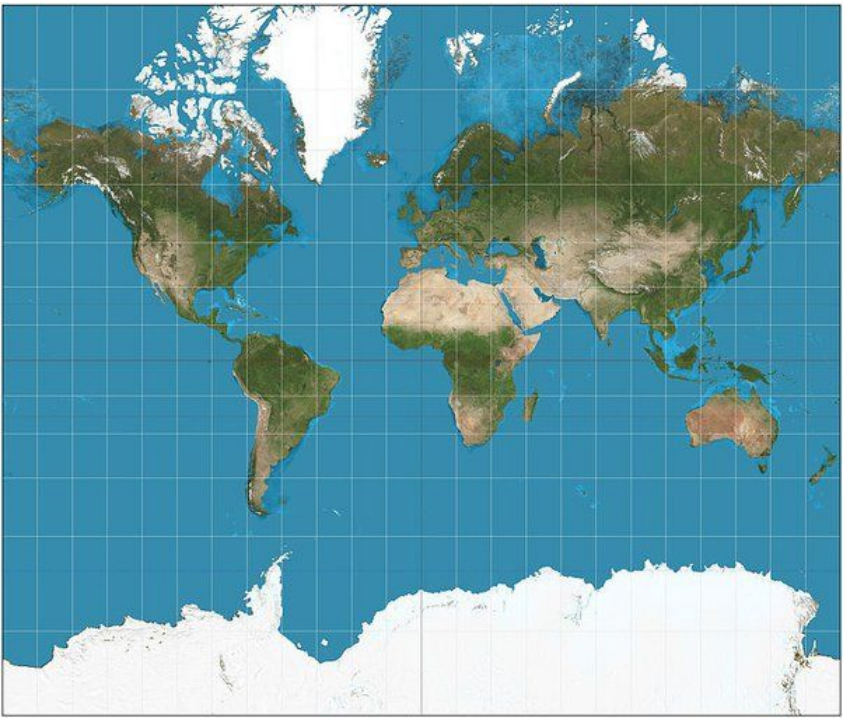
Mercator puzzle

https://bramus.github.io/mercator-puzzle-redux

or google
“Mercator puzzle redux”



https://www.nature.com/nature-index/news/data-visualisation-animated-map-mercater-projection-true-size-countries




GREENLAND
AUSTRALIA
0 250 500 750Km

The **True Size** of **Africa**

A small contribution in the fight against rampant *Immappancy*, by **Kai Krause**

Graphic layout for visualization only (some countries are cut and rotated)
But the conclusions are very accurate: refer to table below for exact data

COUNTRY	AREA x 1000 km²
China	9.597
USA	9.629
India	3.287
Mexico	1.964
Peru	1.285
France	633
Spain	506
Papua New Guinea	462
Sweden	441
Japan	378
Germany	357
Norway	324
Italy	301
New Zealand	270
United Kingdom	243
Nepal	147
Bangladesh	144
Greece	132
TOTAL	**30.102**
AFRICA	**30.221**

In addition to the well known social issues of *illiteracy* and *innumeracy*, there also should be such a concept as "*immappancy*", meaning *insufficient geographical knowledge*.

A survey with random American schoolkids let them guess the population and land area of their country. Not entirely unexpected, but still rather unsettling, the majority chose *"1-2 billion"* and *"largest in the world"*, respectively.

Even with Asian and European college students, geographical estimates were often off by factors of *2-3*. This is partly due to the highly distorted nature of the predominantly used mapping projections (such as *Mercator*).

A particularly extreme example is the worldwide misjudgement of the true size of *Africa*. This single image tries to embody the massive scale, which is larger than the *USA, China, India, Japan* and *all of Europe..... combined!*

Top 100 Countries

Area in square kilometers, Percentage of World Total
Sources: Britannica, Wikipedia, Almanac 2010

		AREA km²	%
1	Russia	17.098.242	11,50
2	Canada	9.984.670	6,70
3	China	9.596.961	6,40
4	United States	9.629.091	6,40
5	Brazil	8.514.877	5,70
6	Australia	7.692.024	5,20
7	India	3.287.263	2,30
8	Argentina	2.780.400	2,00
9	Kazakhstan	2.724.900	1,80
10	Sudan	2.505.813	1,70
11	Algeria	2.381.741	1,60
12	Congo	2.344.858	1,60
13	Greenland	2.166.086	1,50
14	Saudi Arabia	2.149.690	1,40
15	Mexico	1.964.375	1,30
16	Indonesia	1.860.360	1,30
17	Libya	1.759.540	1,20
18	Iran	1.628.750	1,10
19	Mongolia	1.564.100	1,10
20	Peru	1.285.216	0,86
21	Chad	1.284.000	0,86
22	Niger	1.267.000	0,85
23	Angola	1.246.700	0,85
24	Mali	1.240.192	0,83
25	South Africa	1.221.037	0,82
26	Colombia	1.141.748	0,76
27	Ethiopia	1.104.300	0,74
28	Bolivia	1.098.581	0,74
29	Mauritania	1.025.520	0,69
30	Egypt	1.002.000	0,67
31	Tanzania	945.087	0,63
32	Nigeria	923.768	0,62
33	Venezuela	912.050	0,61
34	Namibia	824.116	0,55
35	Mozambique	801.590	0,54
36	Pakistan	796.095	0,53
37	Turkey	783.562	0,53
38	Chile	756.102	0,51
39	Zambia	752.612	0,51
40	Myanmar	676.578	0,45
41	Afghanistan	652.090	0,44
42	Somalia	637.657	0,43
43	France	632.834	0,43
44	C. African Rep	622.984	0,42
45	Ukraine	603.500	0,41
46	Madagascar	587.041	0,39
47	Botswana	582.000	0,39
48	Kenya	580.367	0,39
49	Yemen	527.968	0,35
50	Thailand	513.120	0,34
51	Spain	505.992	0,34
52	Turkmenistan	488.100	0,33
53	Cameroon	475.442	0,32
54	Papua New Guinea	462.840	0,31
55	Uzbekistan	447.400	0,30
56	Morocco	446.550	0,30
57	Sweden	441.370	0,30
58	Iraq	438.317	0,29
59	Paraguay	406.752	0,27
60	Zimbabwe	390.757	0,26
61	Japan	377.930	0,25
62	Germany	357.114	0,24
63	Rep o.t. Congo	342.000	0,23
64	Finland	338.419	0,23
65	Vietnam	331.212	0,22
66	Malaysia	330.803	0,22
67	Norway	323.802	0,22
68	Côte d'Ivoire	322.463	0,22
69	Poland	312.685	0,21
70	Oman	309.500	0,21
71	Italy	301.336	0,20
72	Philippines	300.000	0,20
73	Burkina Faso	274.222	0,18
74	New Zealand	270.467	0,18
75	Gabon	267.668	0,18
76	Western Sahara	266.000	0,18
77	Ecuador	256.369	0,20
78	Guinea	245.857	0,17
79	United Kingdom	242.900	0,16
80	Uganda	241.038	0,16
81	Ghana	238.539	0,16
82	Romania	238.391	0,16
83	Laos	236.800	0,16
84	Guyana	214.969	0,14
85	Belarus	207.600	0,14
86	Kyrgyzstan	199.951	0,13
87	Senegal	196.722	0,13
88	Syria	185.180	0,12
89	Cambodia	181.035	0,12
90	Uruguay	176.215	0,12
91	Suriname	163.820	0,11
92	Tunisia	163.610	0,11
93	Nepal	147.181	0,10
94	Bangladesh	143.998	0,10
95	Tajikistan	143.100	0,10
96	Greece	131.957	0,09
97	Nicaragua	130.373	0,09
98	North Korea	120.538	0,08
99	Malawi	118.484	0,08
100	Eritrea	117.600	0,08
	TOP 100 TOTAL	132.632.524	89,34


United States


Europe


India


Japan

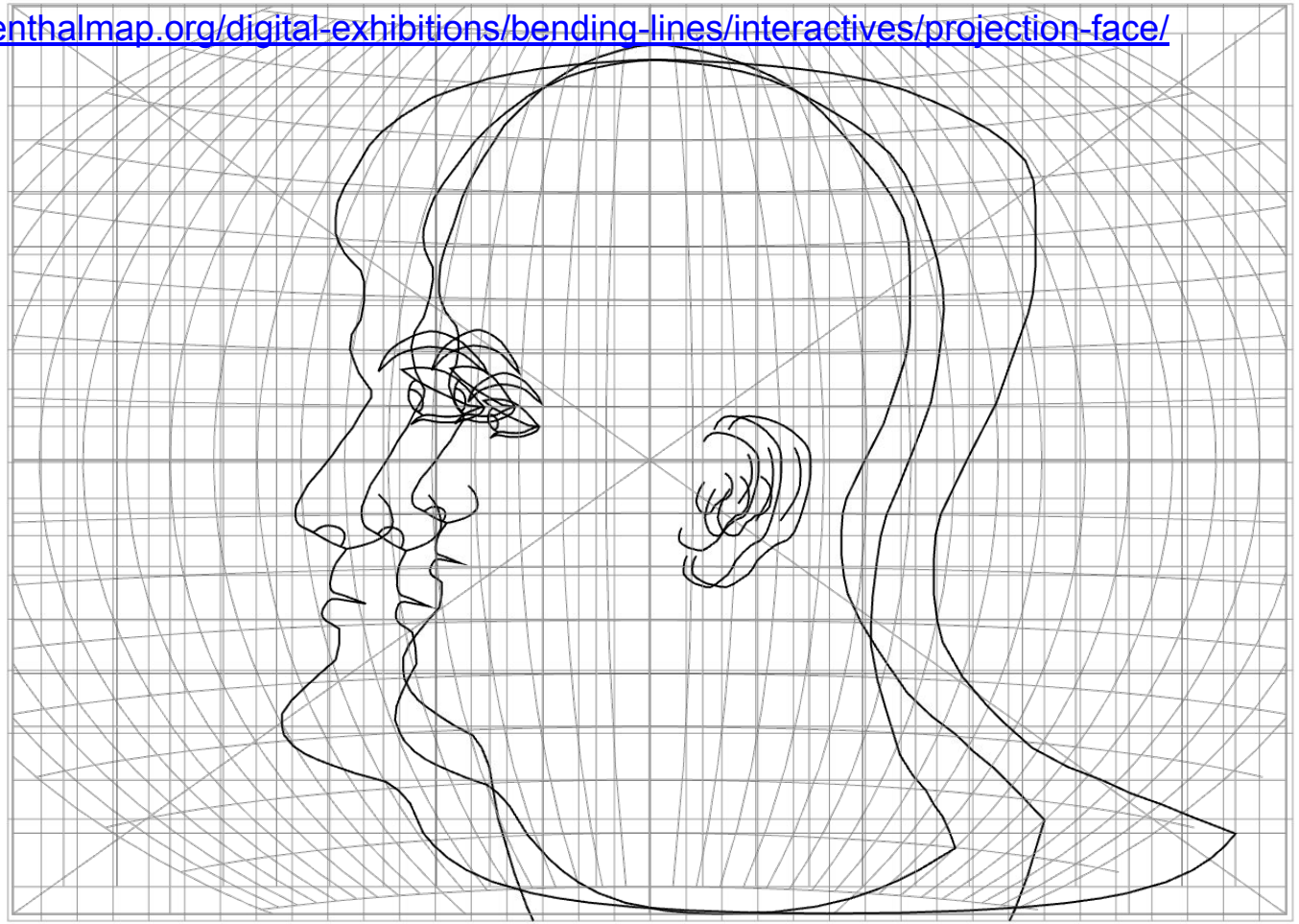

China

https://www.thetruesize.com

What is the most interesting example?
(you can check out individual states in US)

How can we visualize the distortion?

https://www.leventhalmap.org/digital-exhibitions/bending-lines/interactives/projection-face/



Choose a projection: Mercator

??

Tissot’s indicatrix (ellipse of distortion)

Nicolas Auguste Tissot (1824~1907)