

Lecture : Maps Visualization- I

Map Projections

DATA ANALYSIS & VISUALIZATION
FALL 2021

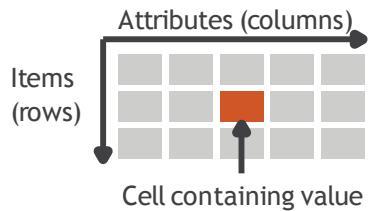
Dr. Muhammad Faisal Cheema
FAST-NU

GOALS FOR TODAY

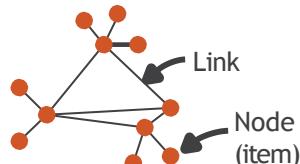
- What is Geo-Spatial data (have positions)
- Learn about different projections, and understand the (dis)advantages of each.

→ Dataset Types

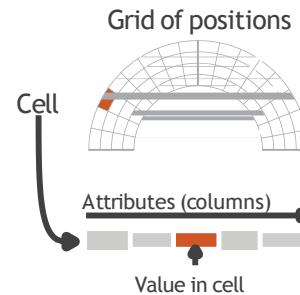
→ Tables



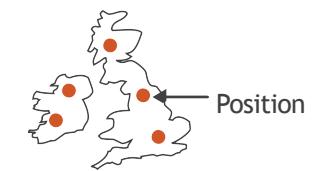
→ Networks



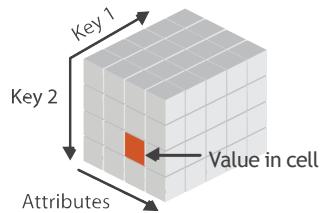
→ Fields (Continuous)



→ Geometry (Spatial)

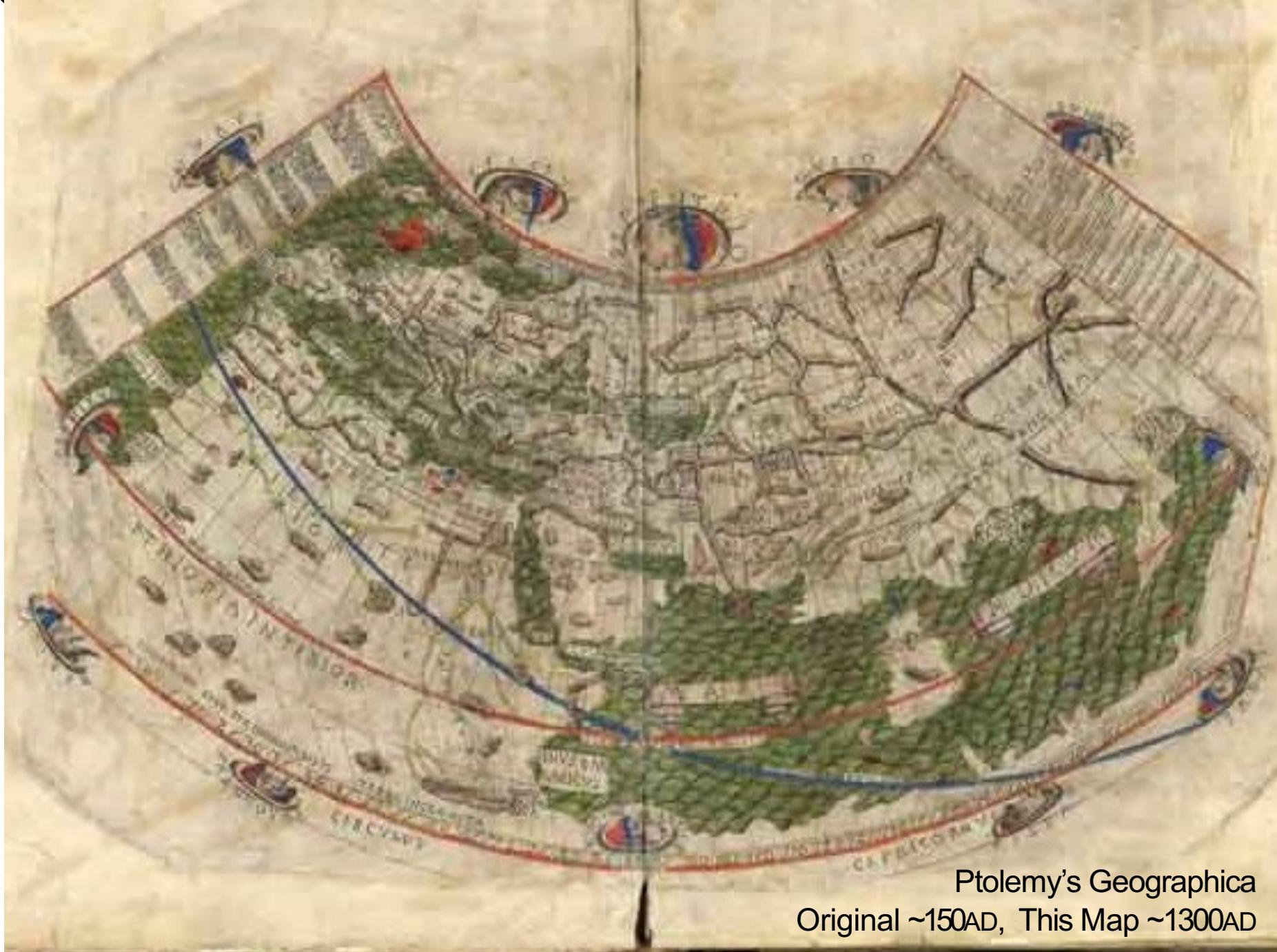


→ Multidimensional Table

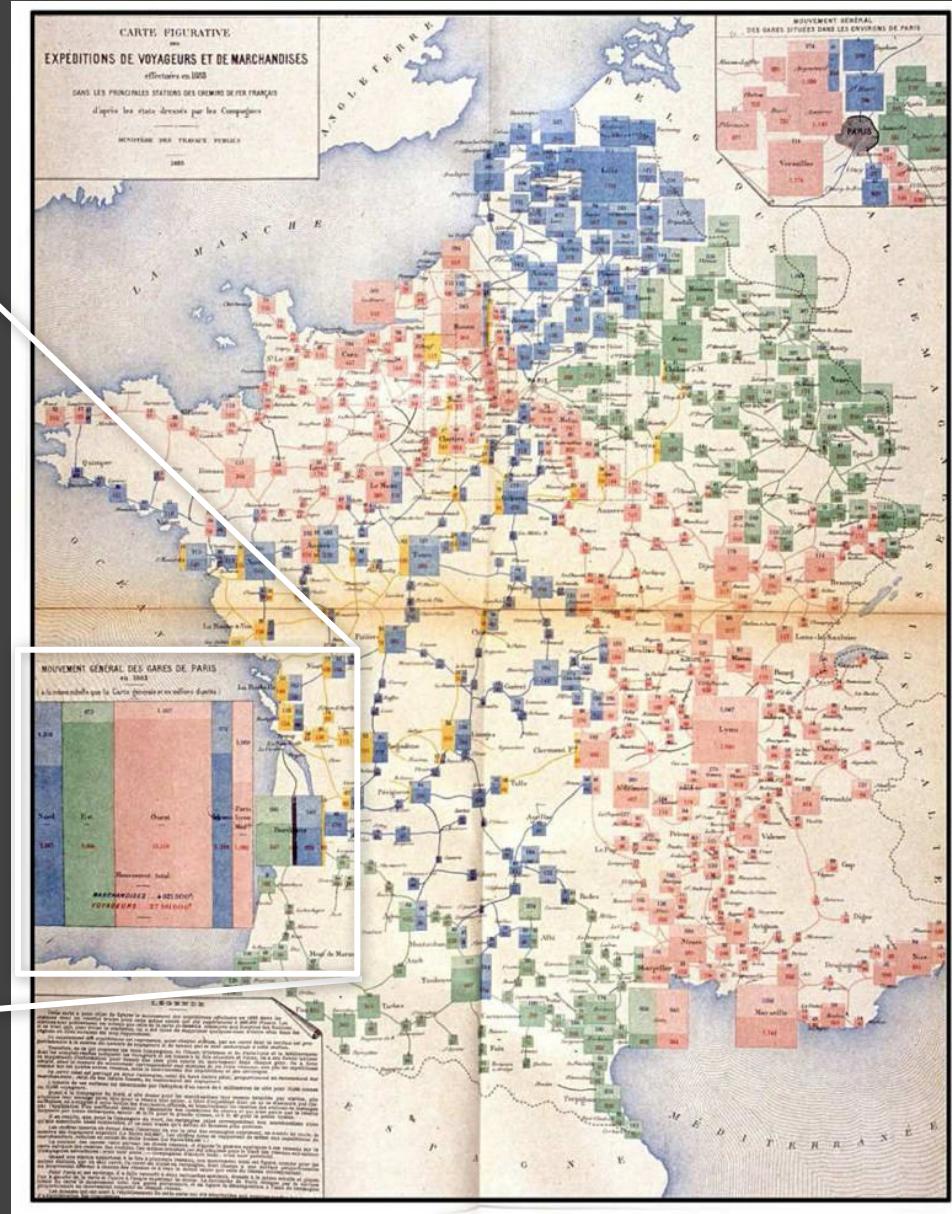
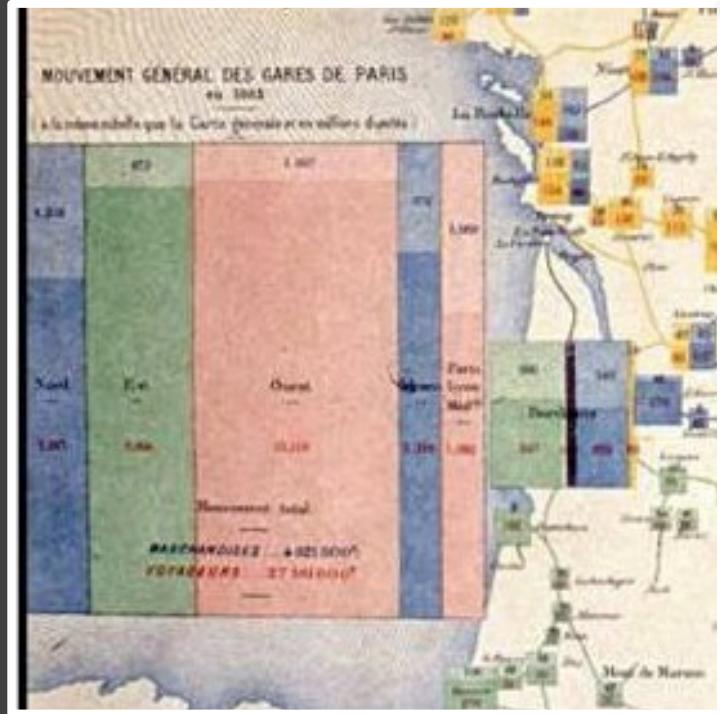


→ Trees





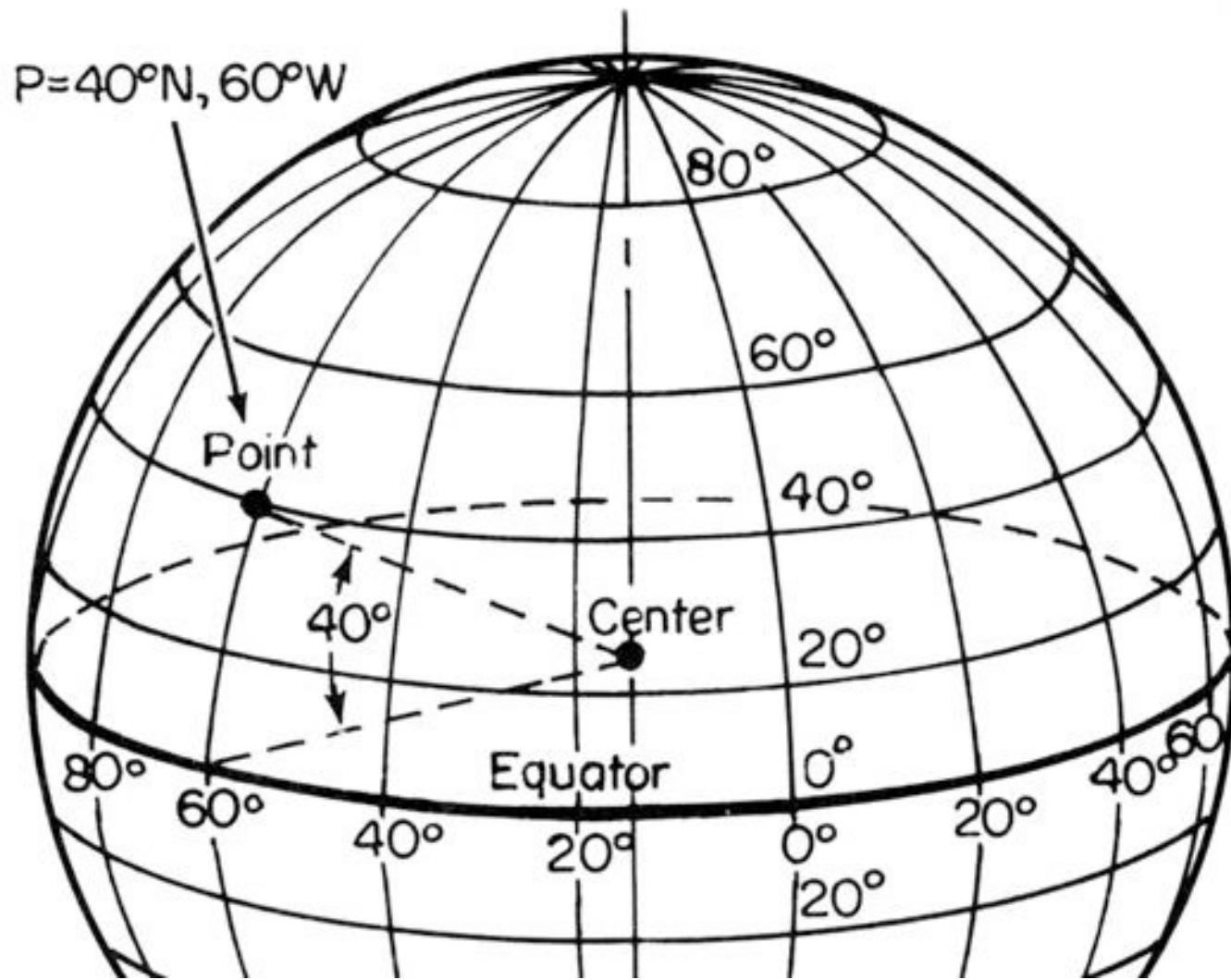
Ptolemy's Geographica
Original ~150AD, This Map ~1300AD



Rail Passengers and Freight from Paris 1884

Map Projections

Latitude, Longitude





A sphere tears
when you flatten it

Map Projections

Dimensionality reduction

3D



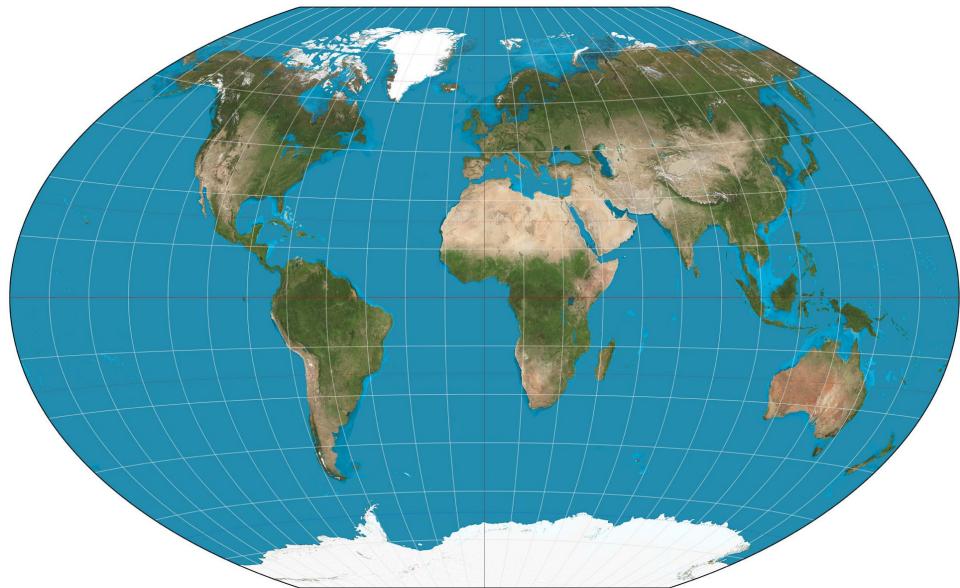
Map Projections

Dimensionality reduction

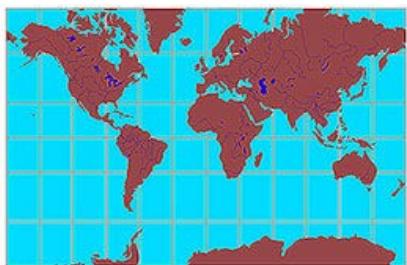
3D



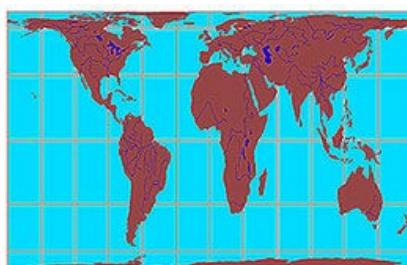
2D



(Many) types of Map Projections



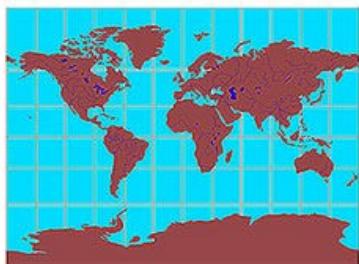
Mercator Projection



Gall-Peters Projection



Goode's Homolosine Equal-area Projection



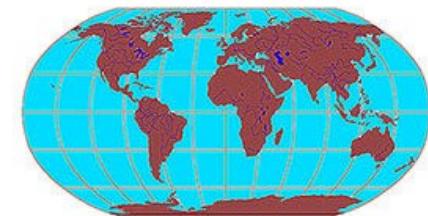
Miller Cylindrical Projection



Mollweide Projection



Sinusoidal Equal-Area Projection



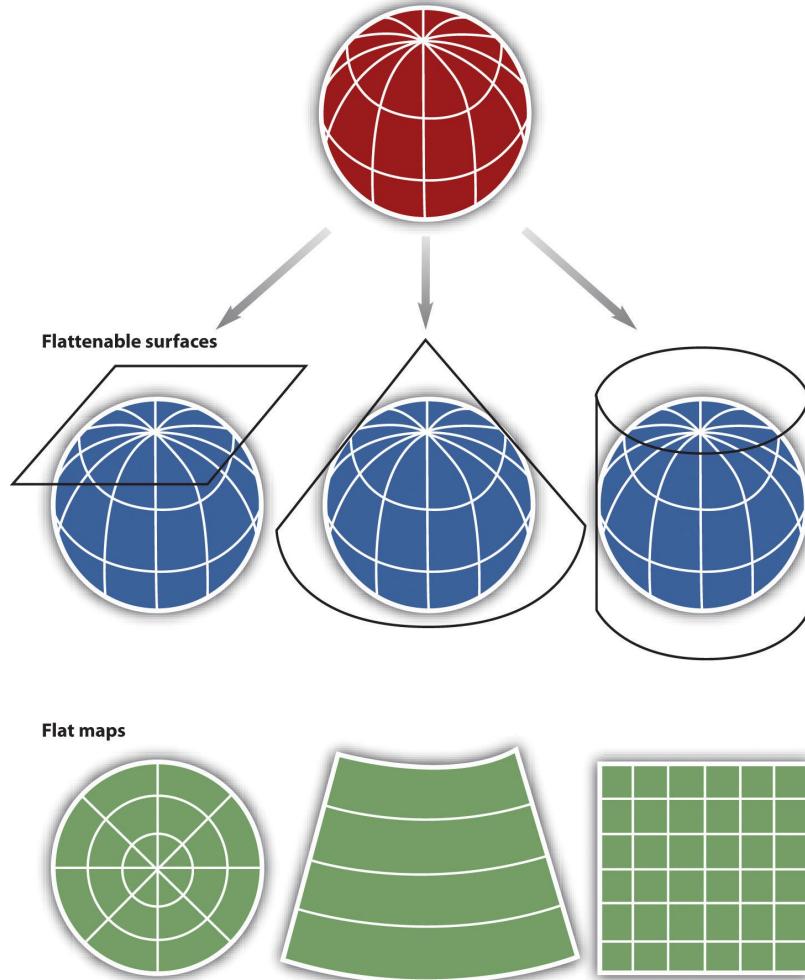
Robinson Projection

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

<http://geodesicsomeness.com/wp-content/uploads/2013/09/projections.jpg> 19

Three example
ways to categorize
projections...

Basic types of Map projections

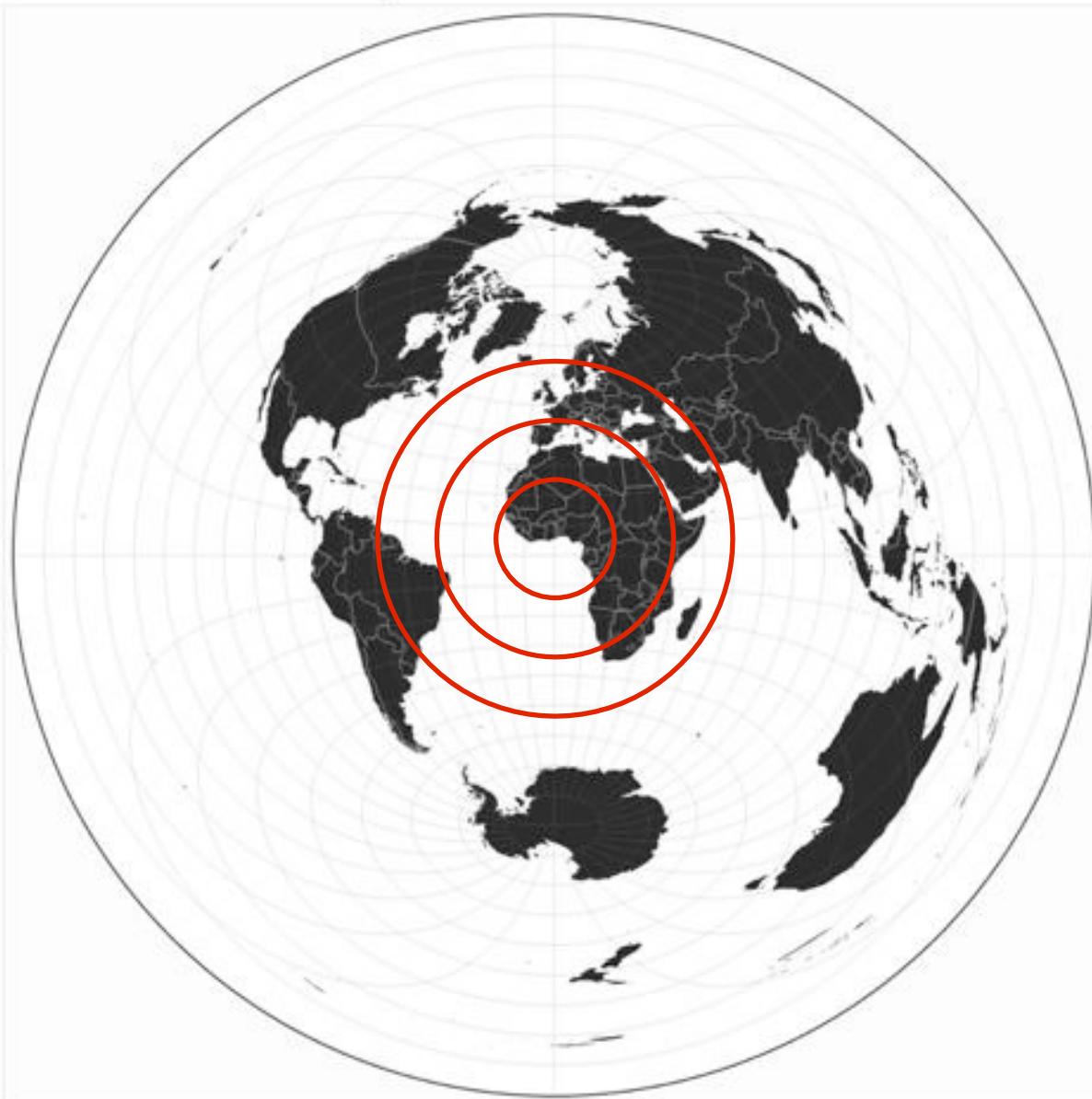




Azimuthal

Preserves direction / distance

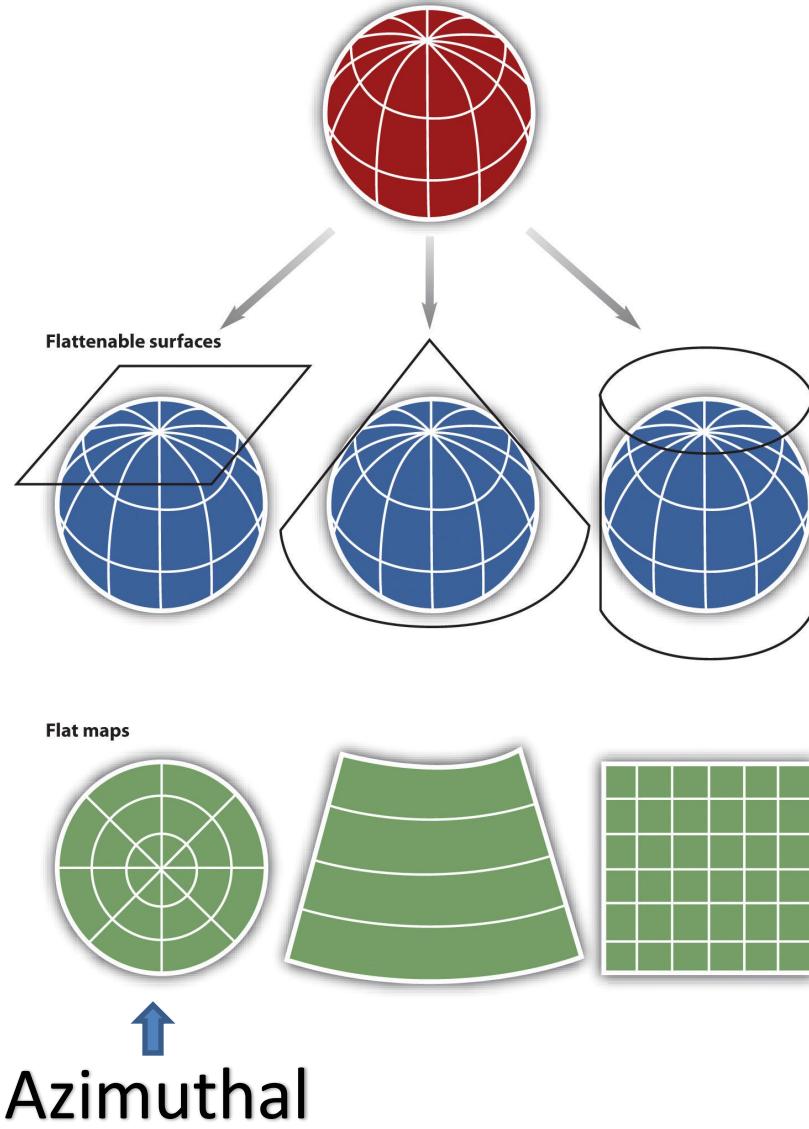
Azimuthal Equidistant



The azimuthal equidistant projection is available as `d3.geo_azimuthalEquidistant`.

[Open in a new window.](#)

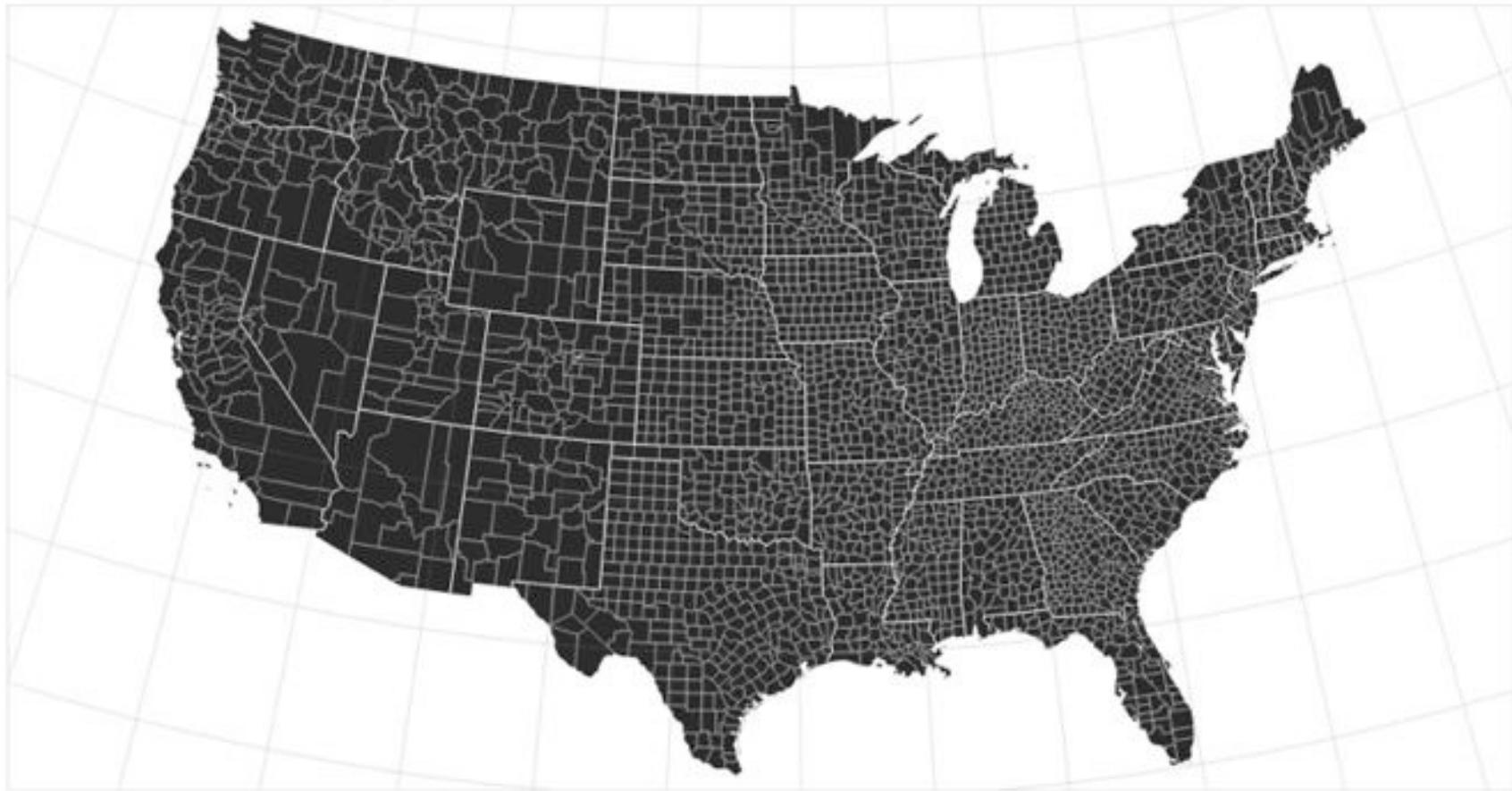
Basic types of Map projections



Equal-Area

Preserves area

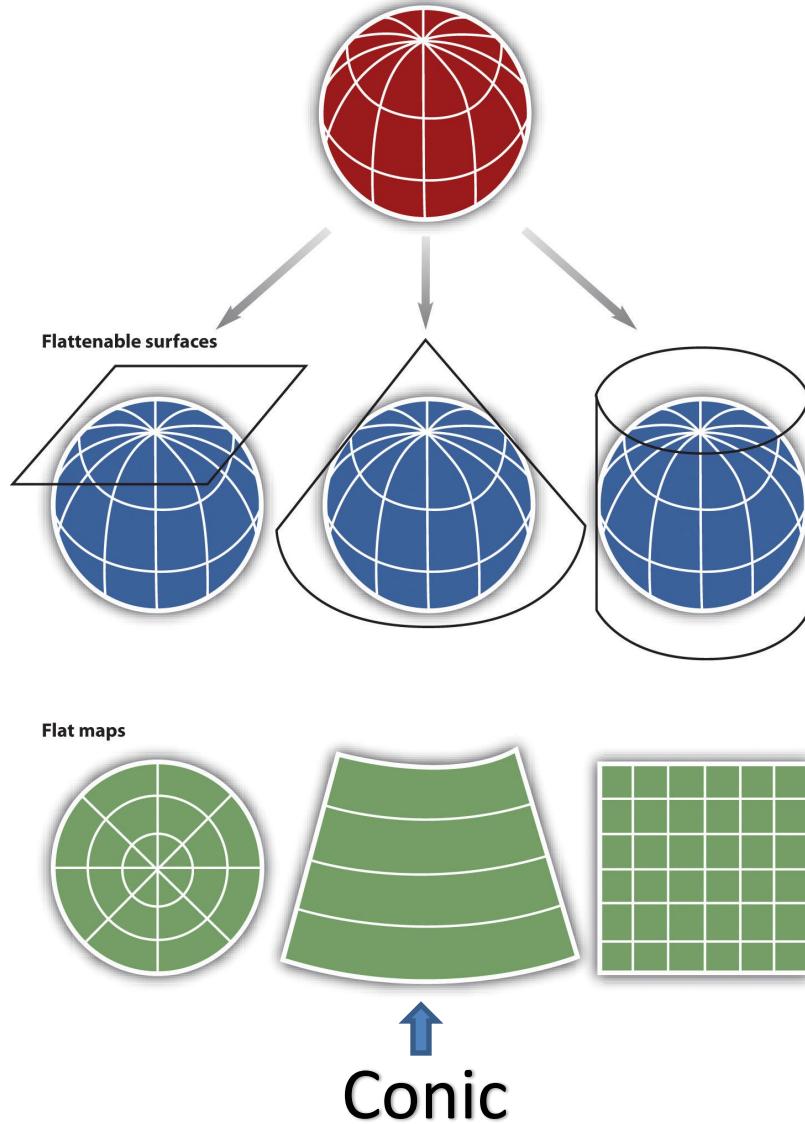
Albers Equal-Area Conic



The [Albers equal-area conic projection](#) is available as `d3.geo.albers`. See also the [interactive version](#).

[Open in a new window.](#)

Basic types of Map projections





Conformal

Preserves local angles

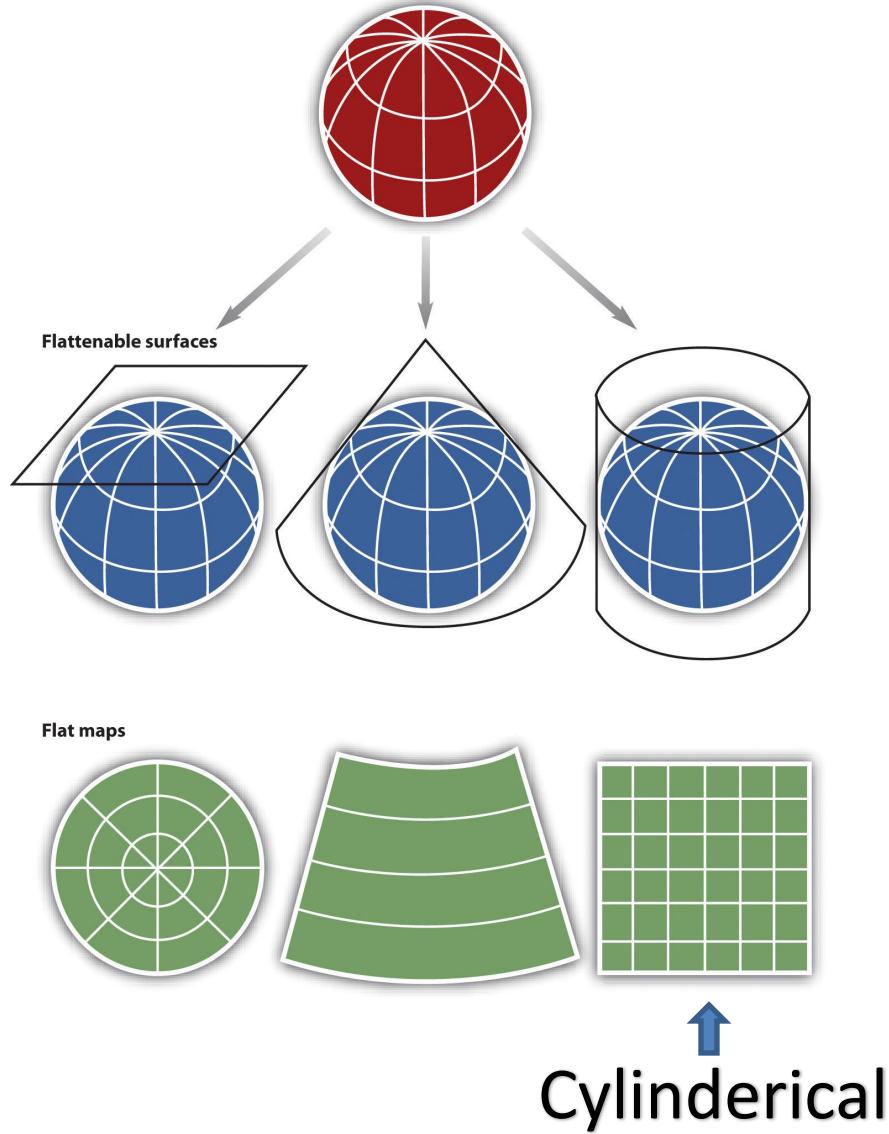
Spherical Mercator

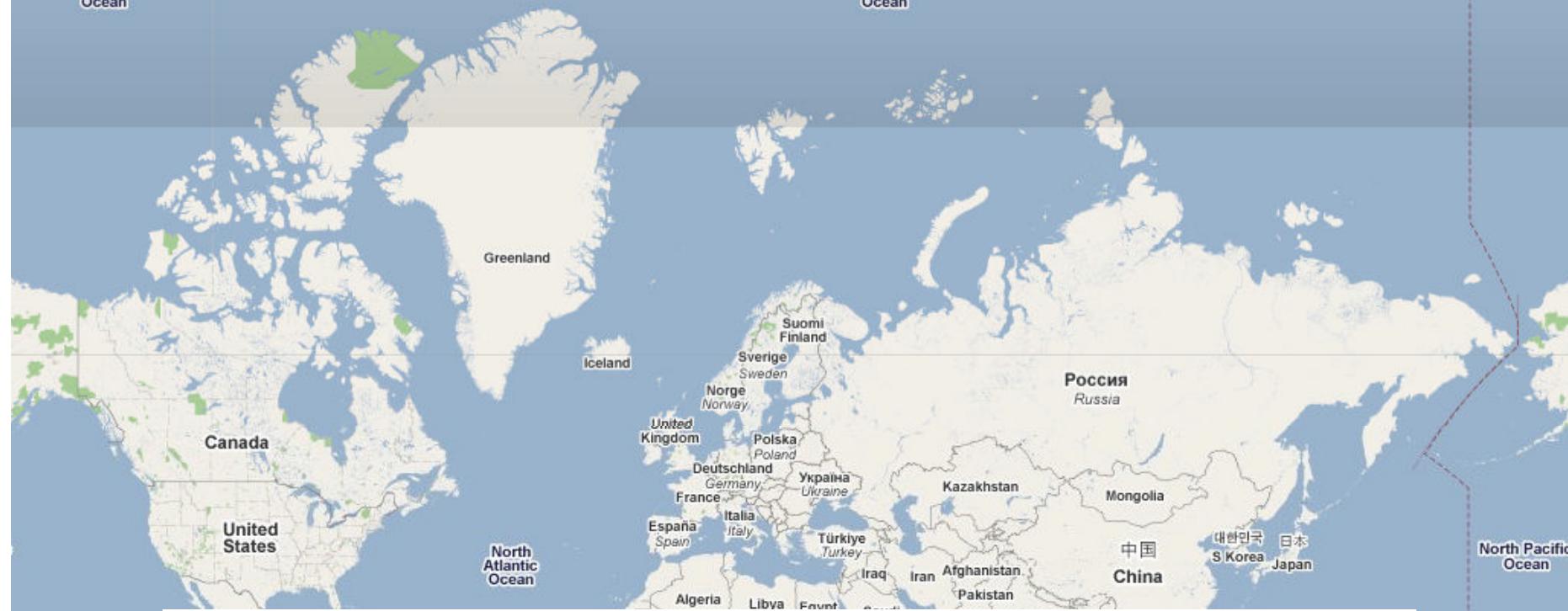


The Mercator projection is available as [d3.geo.mercator](#).

[Open in a new window.](#)

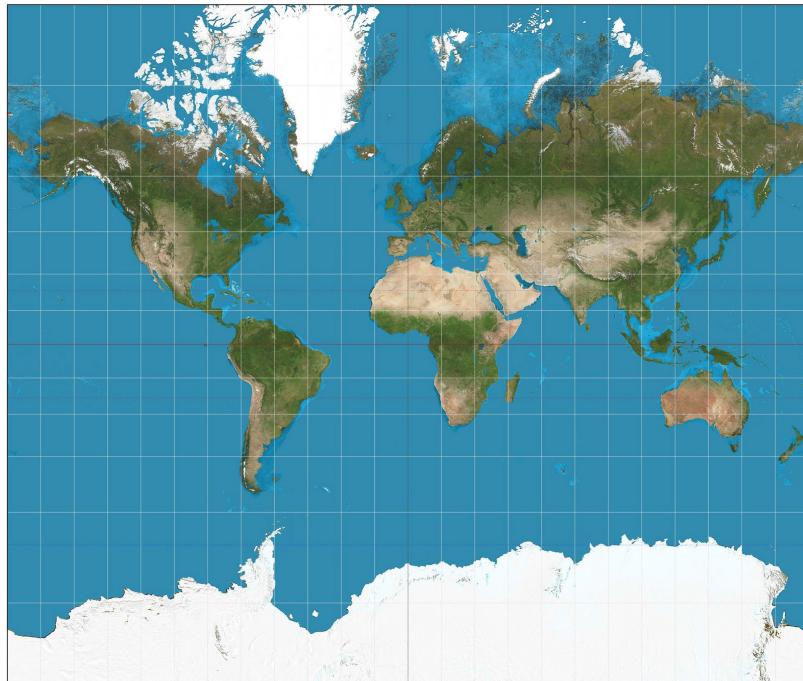
Basic types of Map projections





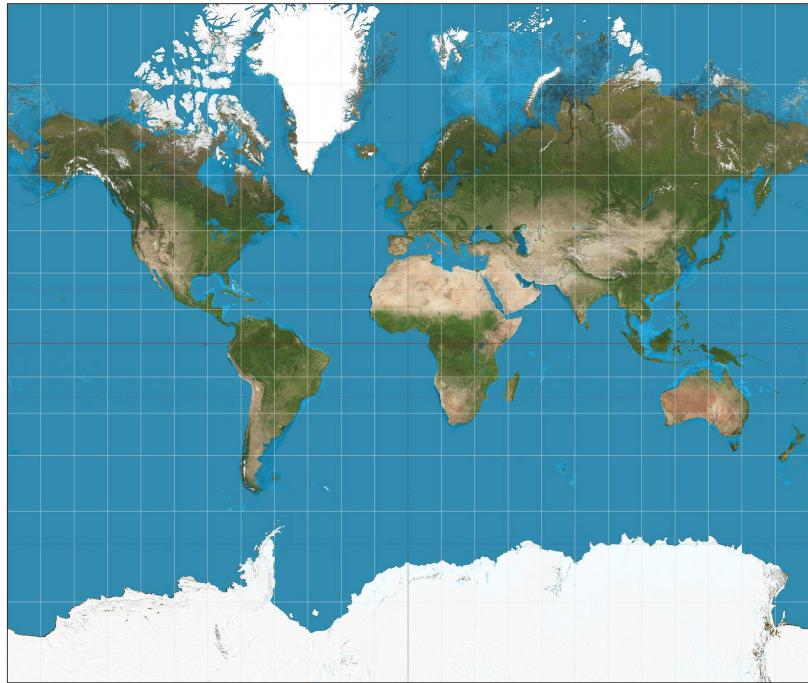
Spherical Mercator is ubiquitous on the web

Mercator Projection

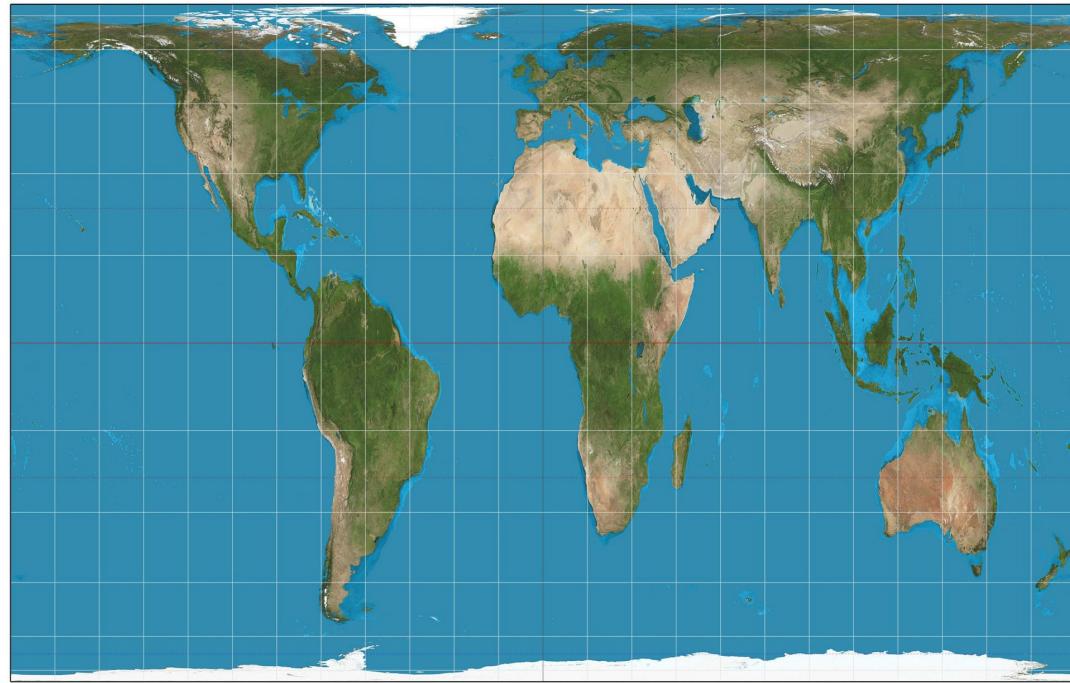


<http://www.usciencealert.com/it-s-official-boston-public-schools-have-ditched-this-distorted-and-misleading-world-map>

Mercator Projection



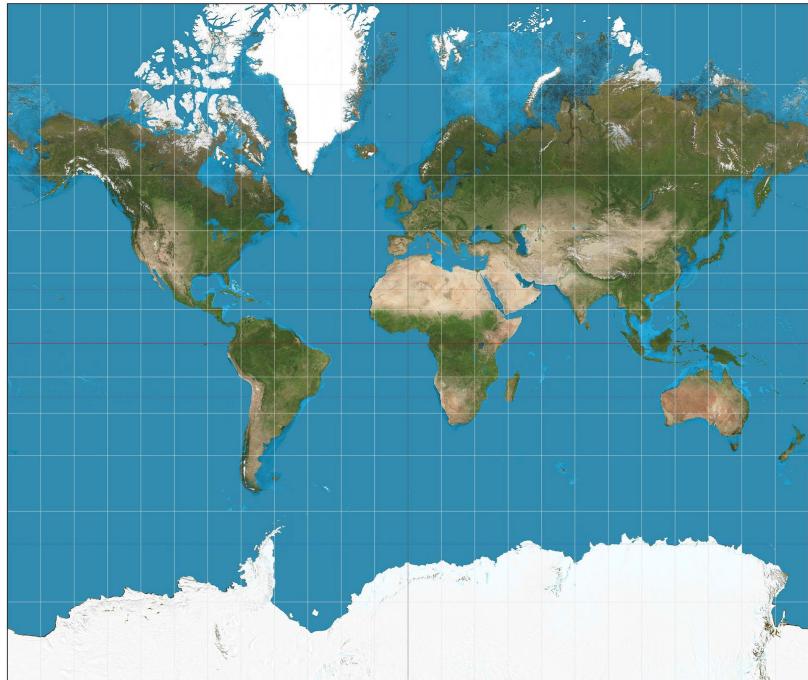
Gall-Peters Projection



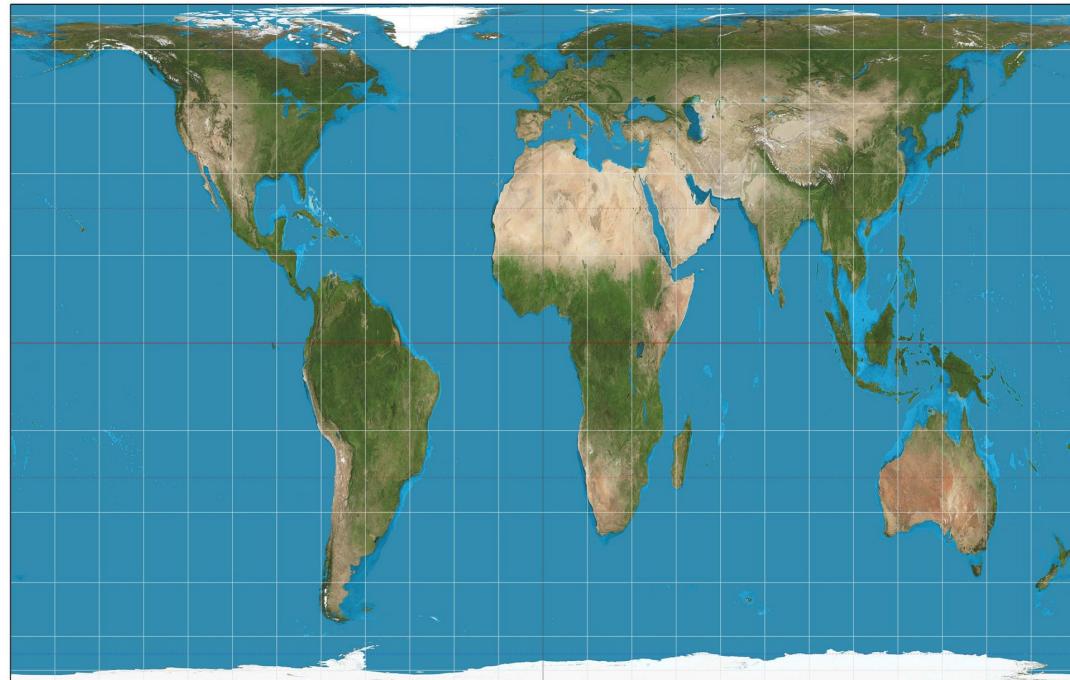
Great for ocean navigation,
but dramatically exaggerates poles.

<http://www.usciencealert.com/it-s-official-boston-public-schools-have-ditched-this-distorted-and-misleading-world-map>

Mercator Projection



Gall-Peters Projection



Great for ocean navigation,
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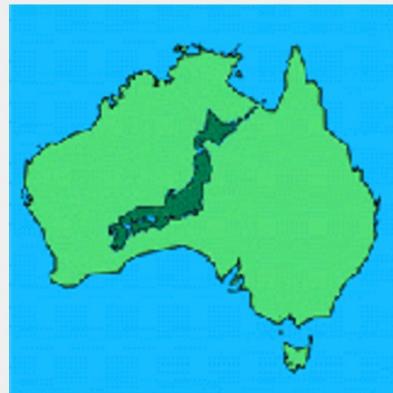
More accurate land areas.
(Officially endorsed by the UN.)

How large is Australia?

Australia/Europe



Australia/Japan



Australia/British Isles



Australia/United States



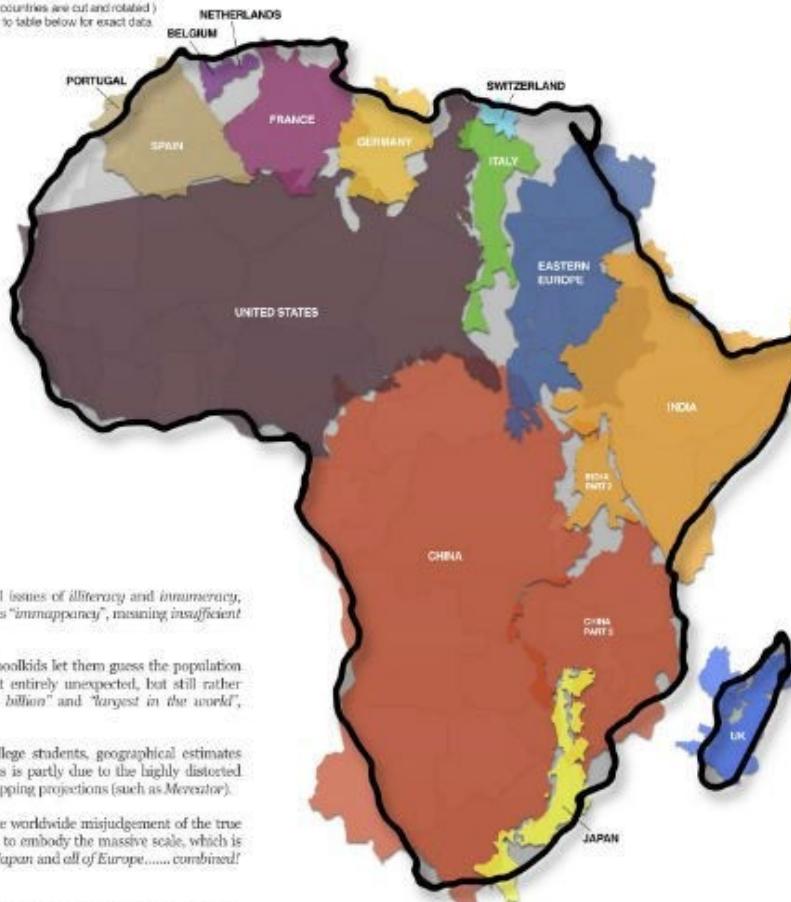
Maps can
deceive...

The True Size of Africa

A small contribution in the fight against rampant Ammappancy, 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 $\times 10^6 \text{ km}^2$
China	9.597
USA	9.629
India	3.287
Mexico	1.964
Peru	1.935
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 "ammappancy", 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: Wikipedia, Wikipedia, Wikipedia 2010

	AREA km^2	%
1	9,597,000	11.58
2	8,960,470	9.72
3	8,956,191	9.63
4	8,890,440	9.49
5	8,814,477	9.75
6	7,955,024	5.25
7	3,917,265	0.35
8	3,890,400	0.35
9	2,754,365	1.83
10	2,630,815	1.75
11	2,484,050	1.55
12	2,344,650	1.60
13	2,065,080	1.35
14	2,140,515	1.40
15	1,980,515	1.32
16	1,880,380	1.30
17	1,720,549	1.21
18	1,690,710	1.13
19	1,681,180	1.12
20	1,265,219	0.86
21	1,261,029	0.86
22	1,254,190	0.86
23	1,246,760	0.85
24	1,240,182	0.84
25	1,234,000	0.84
26	1,231,264	0.84
27	1,106,869	0.74
28	1,038,820	0.71
29	1,032,820	0.68
30	1,032,080	0.67
31	940,107	0.63
32	935,000	0.63
33	912,058	0.61
34	904,118	0.55
35	886,000	0.54
36	768,015	0.53
37	756,192	0.51
38	752,000	0.51
39	738,778	0.51
40	622,029	0.44
41	619,000	0.43
42	603,656	0.43
43	602,000	0.43
44	622,094	0.42
45	600,000	0.41
46	592,058	0.41
47	584,000	0.40
48	576,000	0.40
49	575,000	0.40
50	572,129	0.40
51	568,000	0.40
52	567,000	0.40
53	564,000	0.40
54	562,000	0.40
55	561,000	0.40
56	557,000	0.40
57	554,000	0.40
58	551,000	0.40
59	551,114	0.40
60	548,000	0.40
61	547,000	0.40
62	546,000	0.40
63	545,000	0.40
64	542,448	0.39
65	541,000	0.39
66	537,000	0.39
67	536,000	0.39
68	535,000	0.39
69	534,000	0.39
70	533,000	0.39
71	528,359	0.39
72	526,000	0.39
73	525,000	0.39
74	525,487	0.38
75	520,488	0.38
76	518,000	0.38
77	518,269	0.38
78	518,457	0.38
79	510,000	0.38
80	504,000	0.37
81	503,000	0.37
82	502,157	0.37
83	501,000	0.37
84	501,000	0.37
85	501,114	0.37
86	500,000	0.37
87	499,000	0.37
88	498,000	0.37
89	497,000	0.37
90	496,000	0.37
91	495,000	0.37
92	494,000	0.37
93	493,000	0.37
94	492,000	0.37
95	491,000	0.37
96	490,000	0.37
97	489,000	0.37
98	488,000	0.37
99	487,000	0.37
100	486,000	0.37
TOTAL	18,459,614	69.34

<http://www.sciencealert.com/this-is-the-true-size-of-africa> 23



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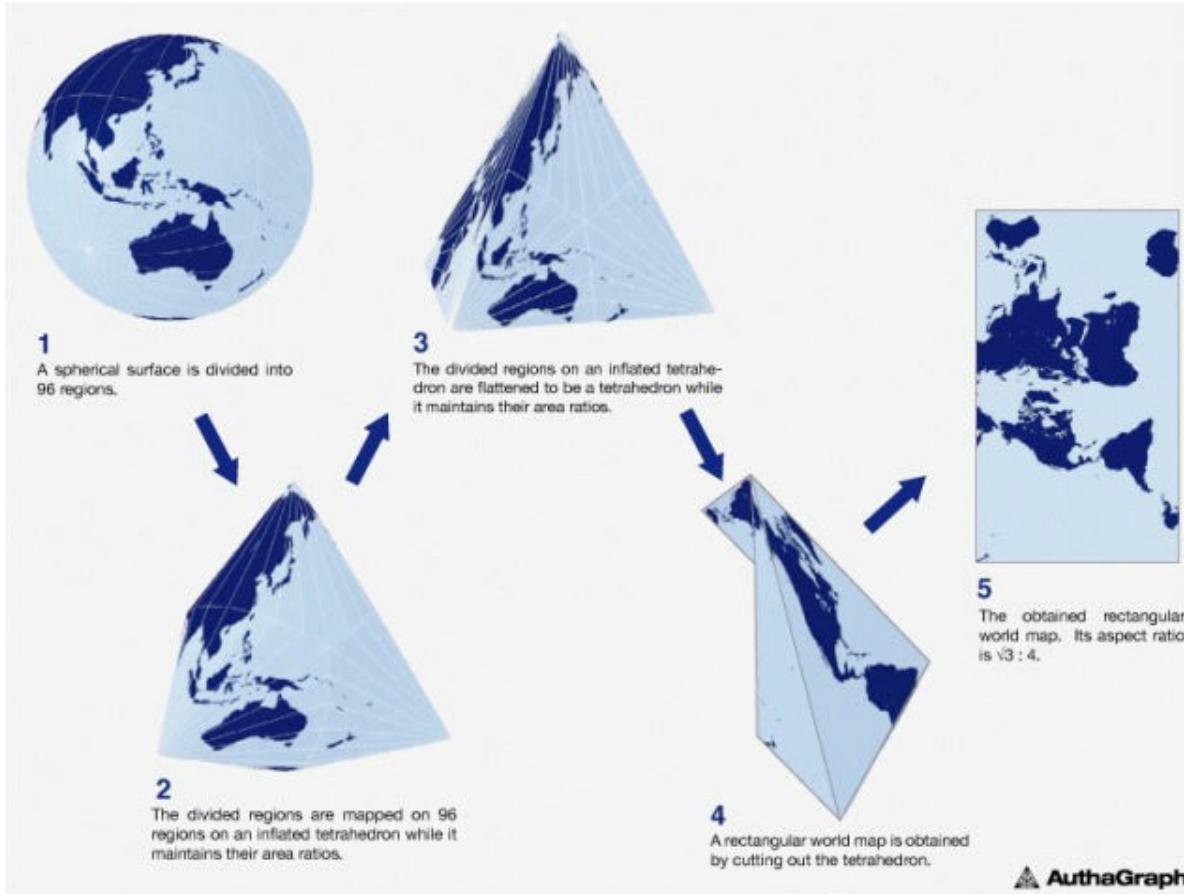
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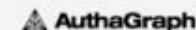
Recently invented! Popular!

<http://www.sciencealert.com/this-bizarre-map-of-the-world-is-so-accurate-it-folds-into-a-globe>

Authagraph



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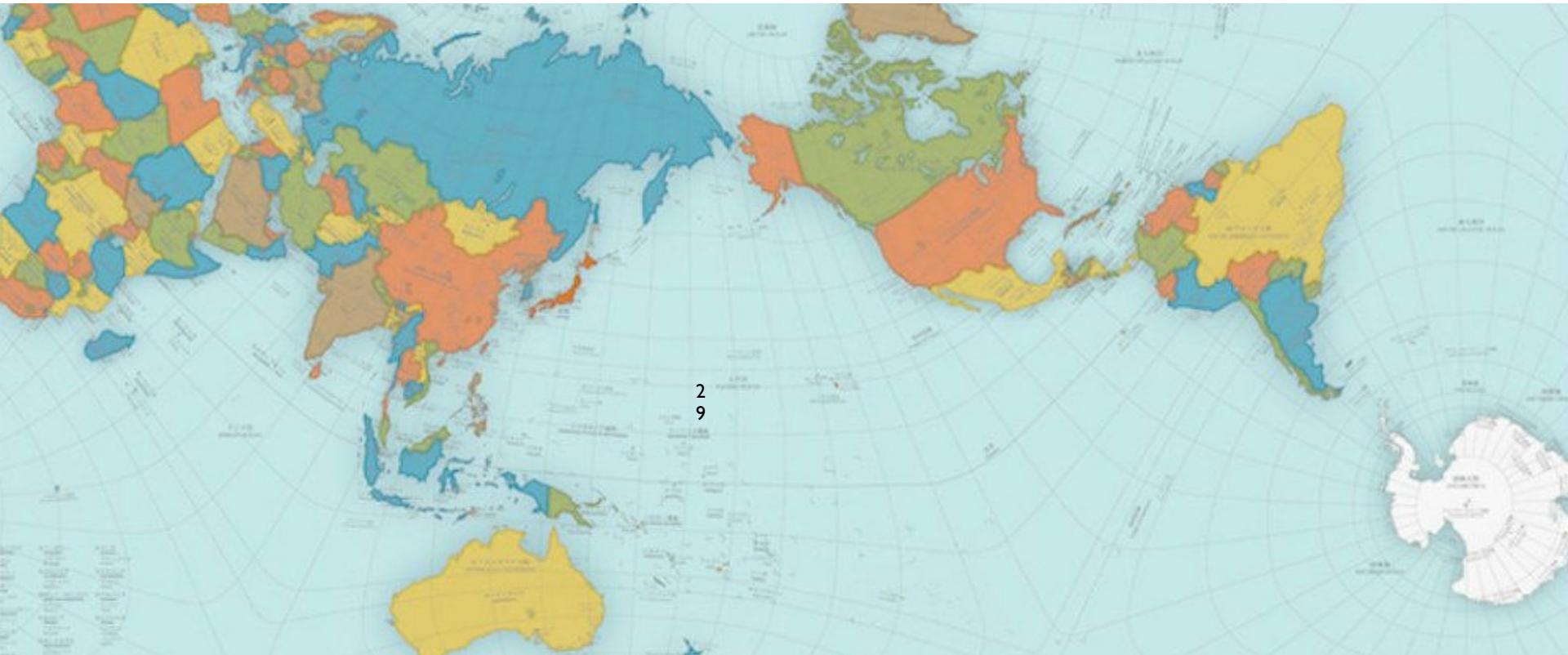


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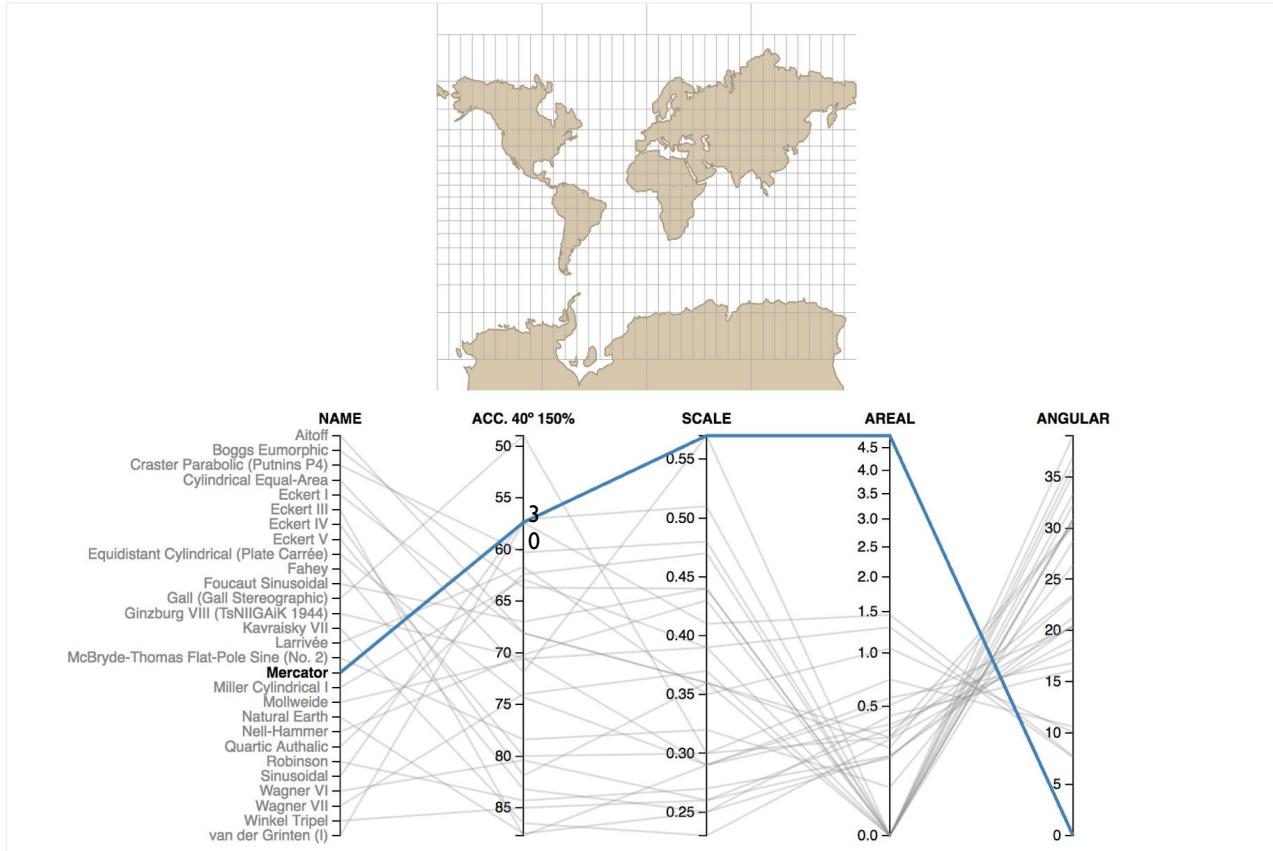
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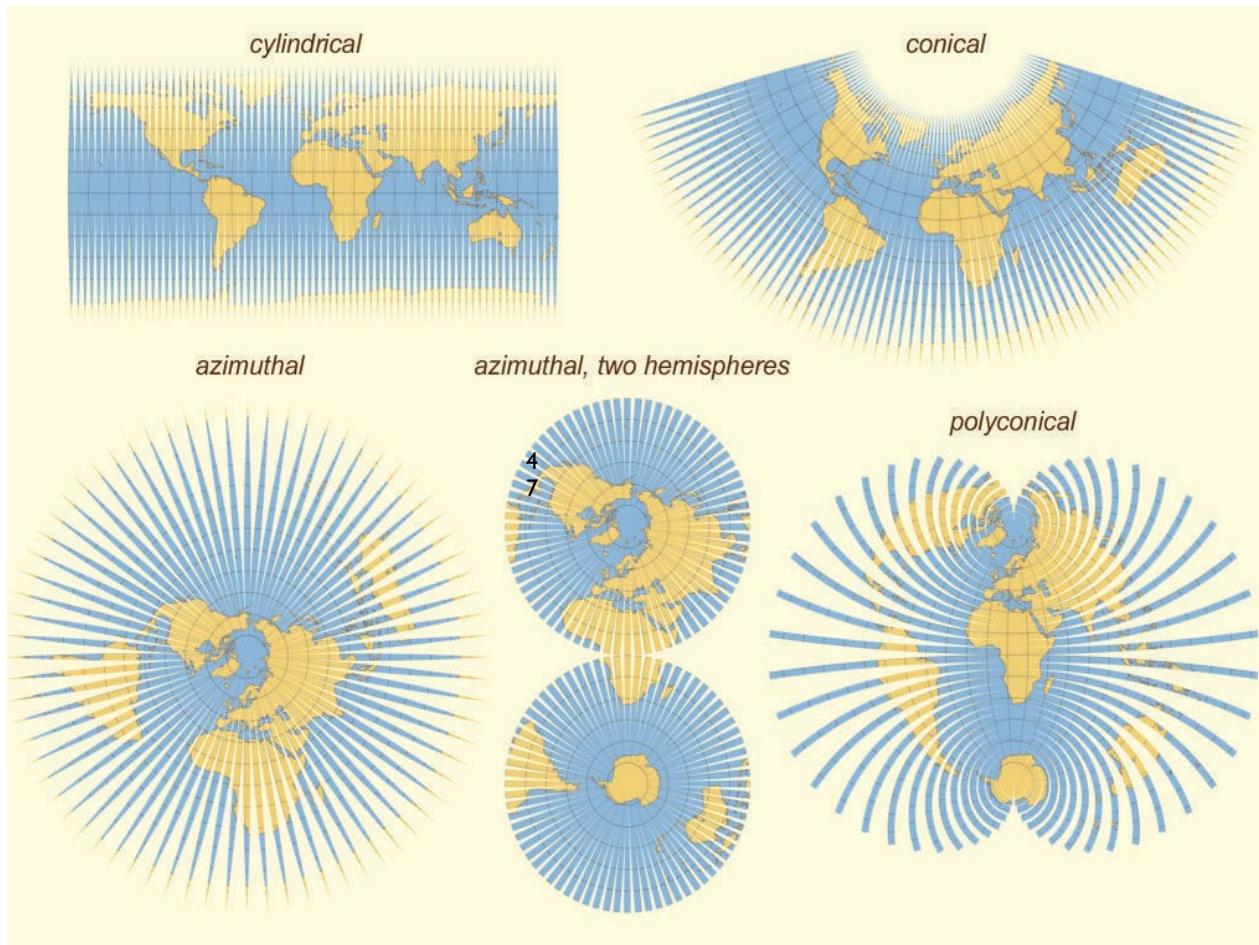
<http://www.sciencealert.com/this-bizarre-map-of-the-world-is-so-accurate-it-folds-into-a-globe>

Comparing Map Projections



<https://blocks.org/syntagmatic/ba569633d51ebec6ec6e>

Illustration of different map projections



[J. van Wijk, 2008]

Some other Projections - Geographically-aligned

