EXTRA CREDIT

Extra Credit Atlas Exercise

for Exam I is available

on the course home page.

Submit answers to me using the blue Scantron sheet by **Feb. 19, 2019**.

Once you have completed the exercise, transfer your answers to the blue Scantron sheet using a #2 pencil.
Completely erase all mistakes and stray marks.
LATE answer sheets will NOT be accepted.

6
Geographers' Tools
Maps and their Parts

Prof. Anthony Grande

Hunter College Geography

MAP MAKING QUANDRY

How do we transfer information from a large 3-D spheroid *(Planet Earth)* ***onto a smaller 2-D object*** *(flat sheet)* ***without distorting that information?***

With difficulty!

The mapmaker must deal with **3 obstacles:**

1. **Conversion** of a sphere *(curved surface)* to a plane *(flat surface).*
2. **Shrinking** of the earth's surface to fit the smaller flat object.
3. **Portrayal** of information to make it understandable to the viewer.

MAP MAKING

The mapmaker confronts the problem by using:

1. PROJECTION **to convert** a sphere to a flat surface.
2. SCALE **to shrink** the earth's surface proportionally to fit the object.
3. SYMBOLIZATION **to portray** information and make it understandable.

MAP PROJECTIONS

- **Only a globe can portray the earth's surface without distortion.**
- **Only a globe can show:**
  - ✓true **shape**
  - ✓true **relative area**
  - ✓true **distance**
  - ✓true **direction**

Any flat map will sacrifice 1 or 2 or 3 or all 4 advantages of a globe.

- **A map cannot show more than three advantages at any one time!**

But which 3?

MAP PROJECTIONS

- A **map projection** is a **representation** of the **3-D earth's grid** on a **flat surface**.

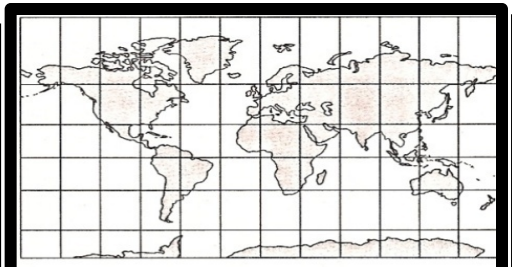


Figure 7. Miller Cylindrical Projection.

Figure 8. Mollweide Homolographic Projection.

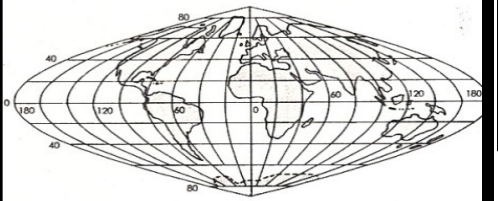


Figure 9. Sinusoidal Projection.

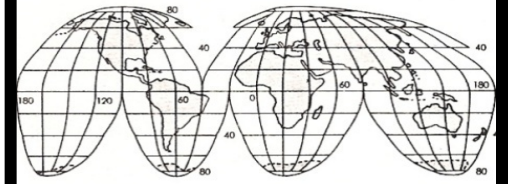


Figure 10. Goode's Interrupted Homolosine Projec

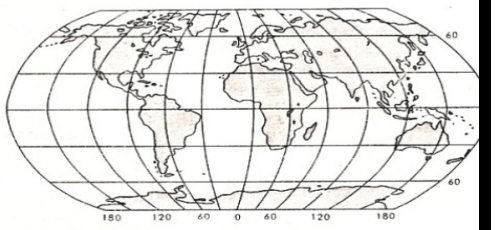


Figure 11. Robinson Projection.

Each of these projections has **a combination of unique characteristics** to show shape, relative area, distance and direction.

Read the section on maps and map projections in any thematic atlas.

MAP PROJECTIONS

- **The basic concept behind a map "projection" is having a light source within the globe and having that light source project the earth's grid on to a flat object.**
  - However, today most map projections are **mathematically derived** and cannot be "projected."

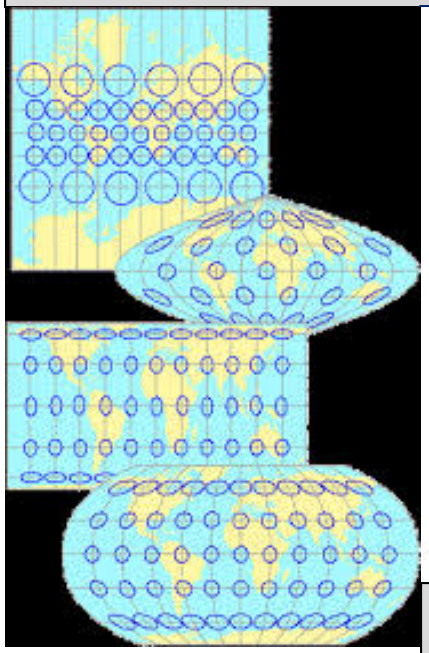
https://www.youtube.com/watch?v=pZ1z4lW8f_E 1 min intro to map projections

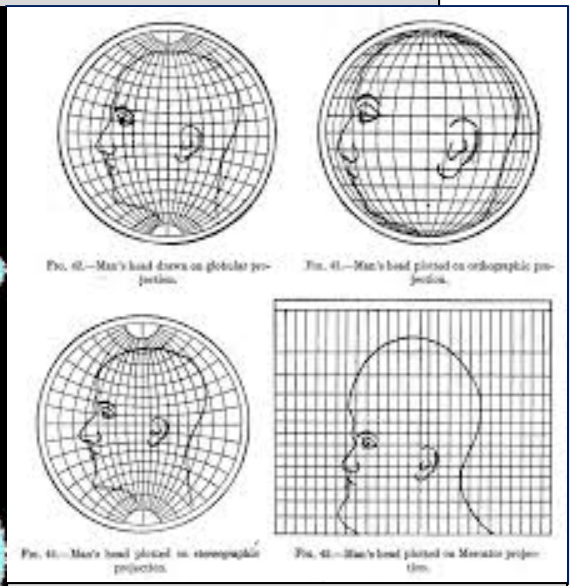
https://www.youtube.com/watch?v=kIID5FDi2JQ 6 min illustration why all world maps have inaccuracies.

MAP DISTORTION

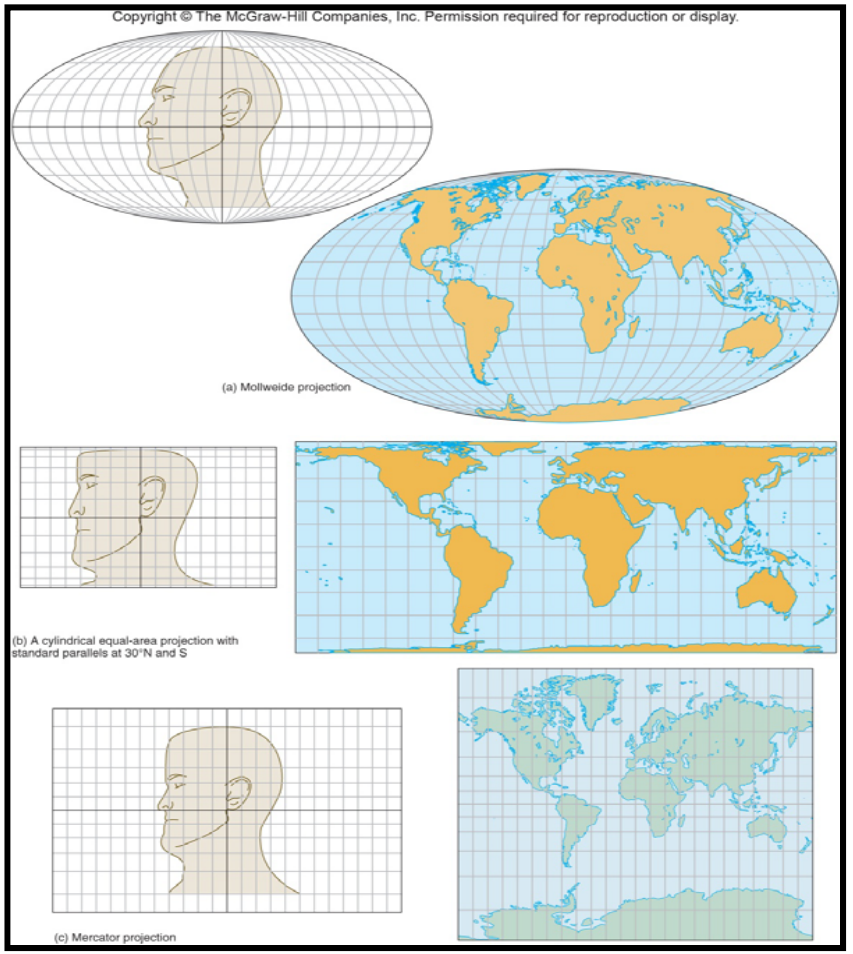
Based on the spacing of lines of latitude and longitude (as illustrated by "heads"), **the continents have different appearances.**

- **<u>All</u> maps distort shape in some way.**
  - NOTE: In these illustrations, the "circles" and "shape-of-head" diagrams are used to show distortion.

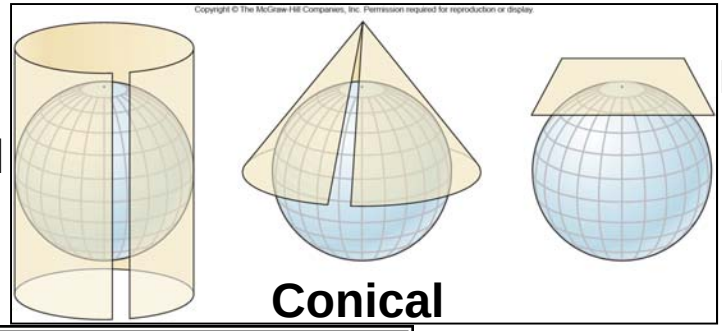


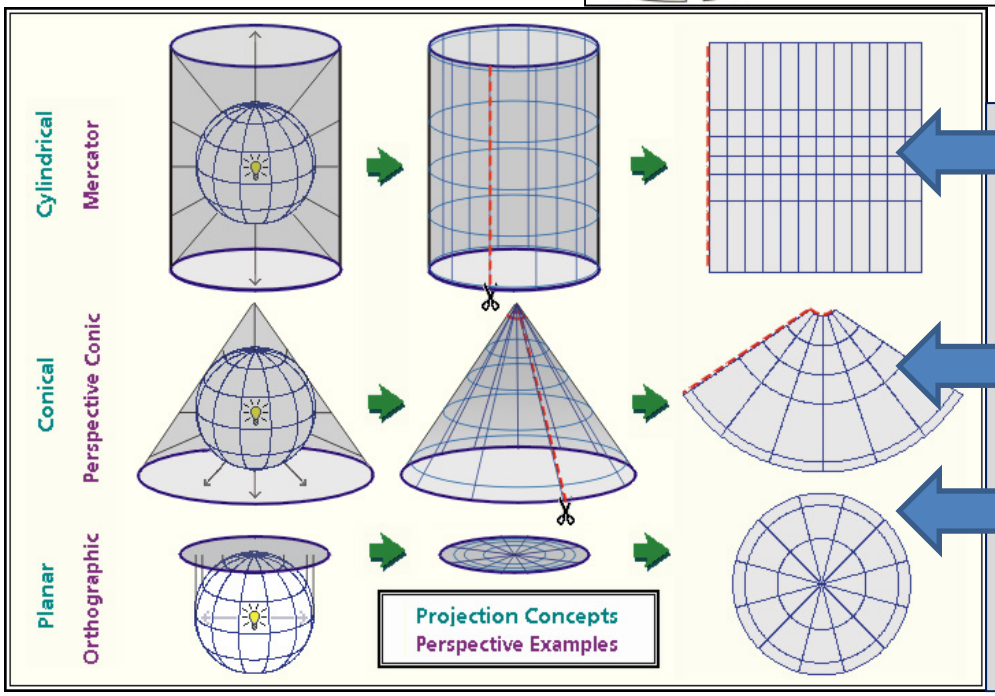


Distortion occurs because of the way lines of latitude and longitude are spaced in the different projections.



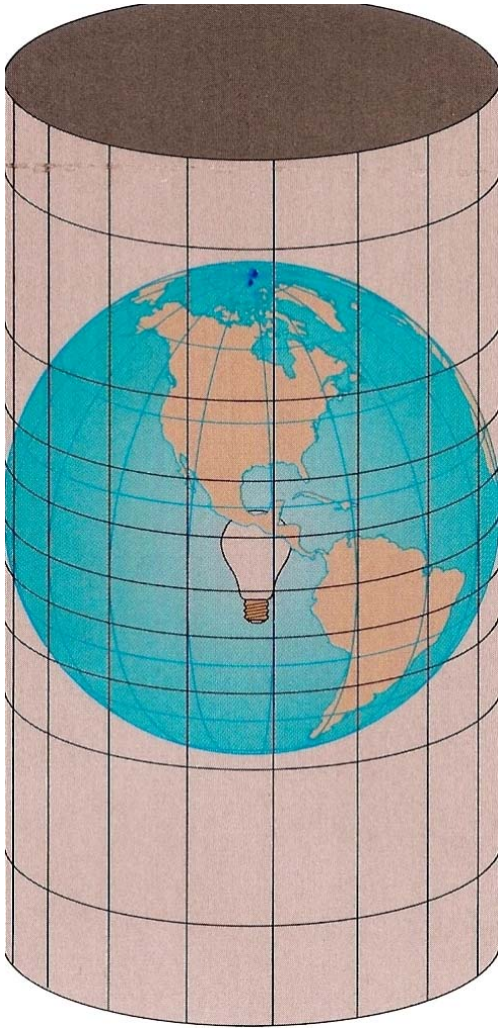
Geometrical Map Projections

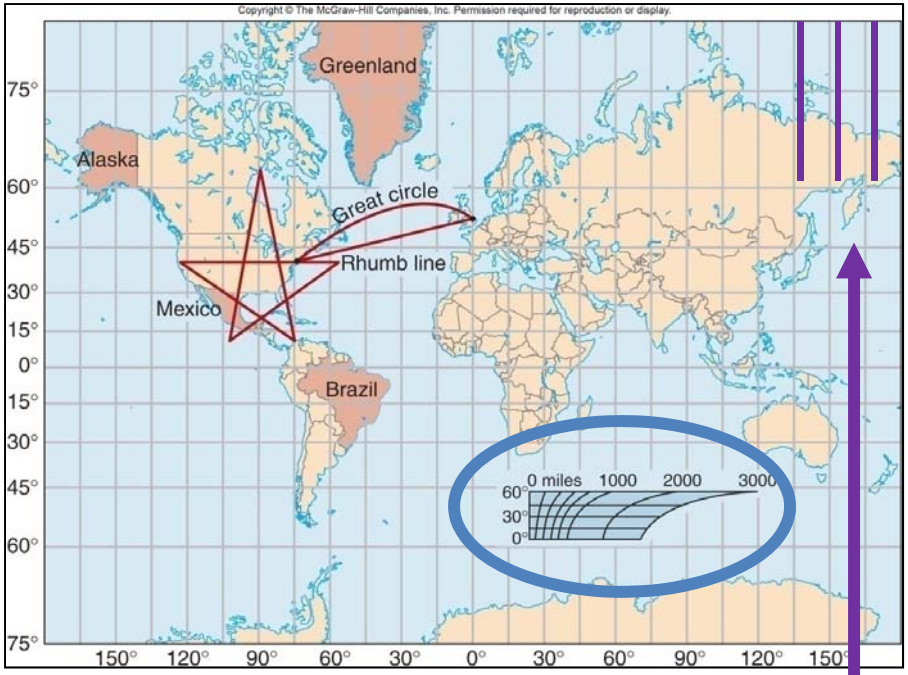




- If the globe is wrapped in a **cylinder**, a "cylindrical" projection is created.
- A **cone** creates a "conical" projection.
- A **plane** (flat sheet) creates a "planar" projection.

CYLINDRICAL PROJECTION





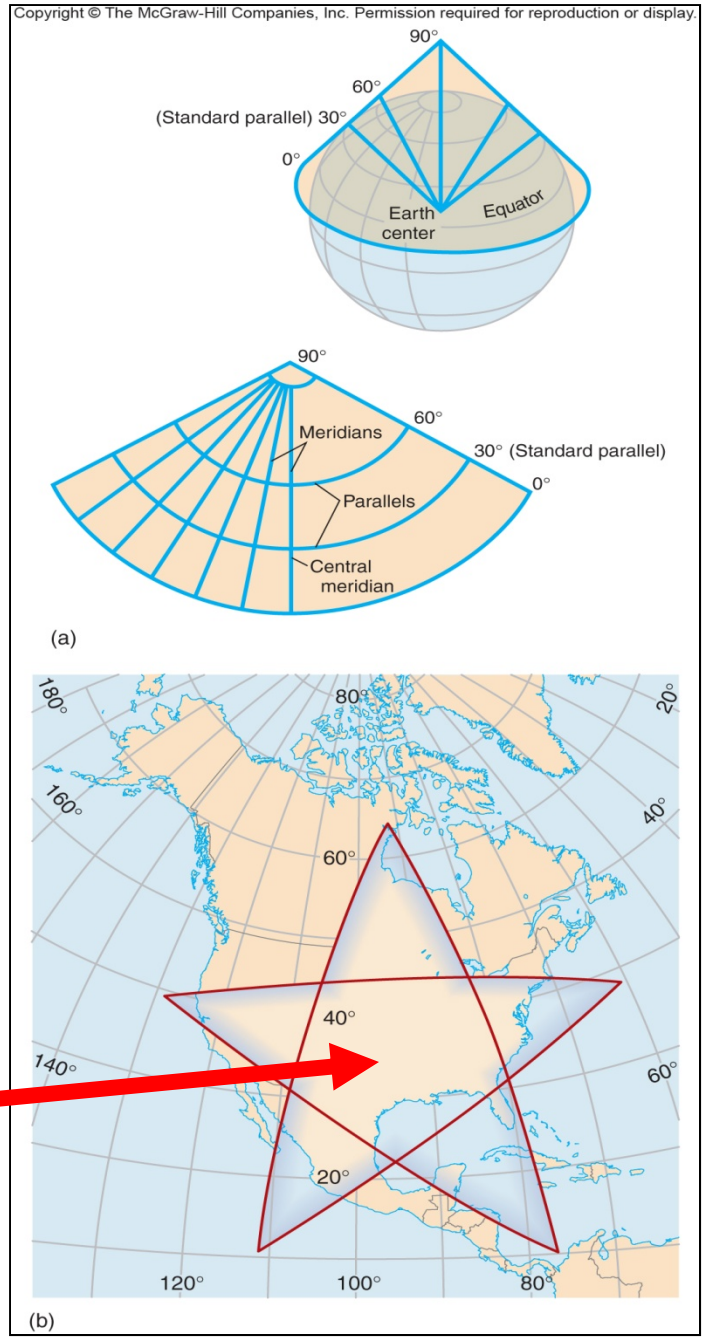
In this projection the lines of longitude are <u>parallel</u>!

- **<u>Cannot</u> show the polar regions.**
- Star illustrates areas of distortion.
- Notice the unusual scale on the map.

CONICAL PROJECTION

In this projection:

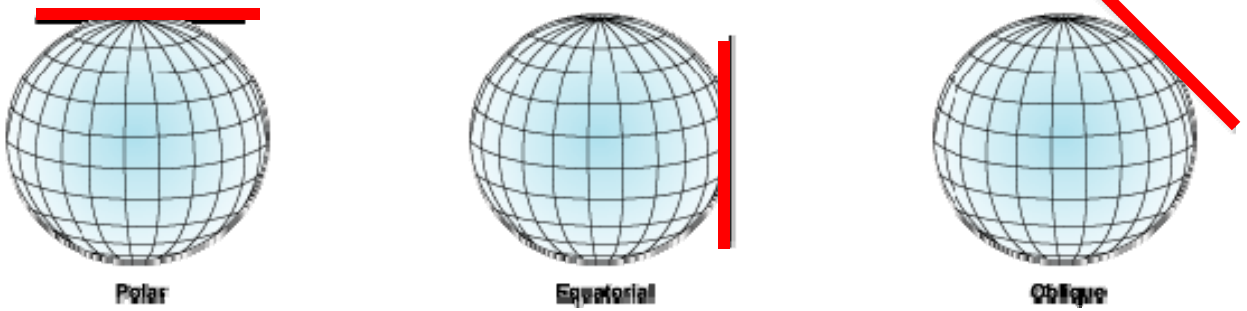
- **Lines of longitude are <u>too close nearing the poles</u>.**
- **Lines of longitude are <u>too far apart at the equator</u>.**
- **Least distortion in the mid-latitudes**



PLANAR PROJECTION

In this projection, a plane (flat sheet) **is placed tangent to the globe** and the earth's grid is transferred to the plane.

- ➢ **<u>Least distortion in the center of the map</u> but perimeter areas are stretched.**
- ✓ **Used mainly for polar areas.**



https://www.quantil.com/resources/hp-globe.gif

Comparing Projections

So depending on the map maker's choice of projection, the result-ing flat map will have a unique appearance with a unique set of distortions.

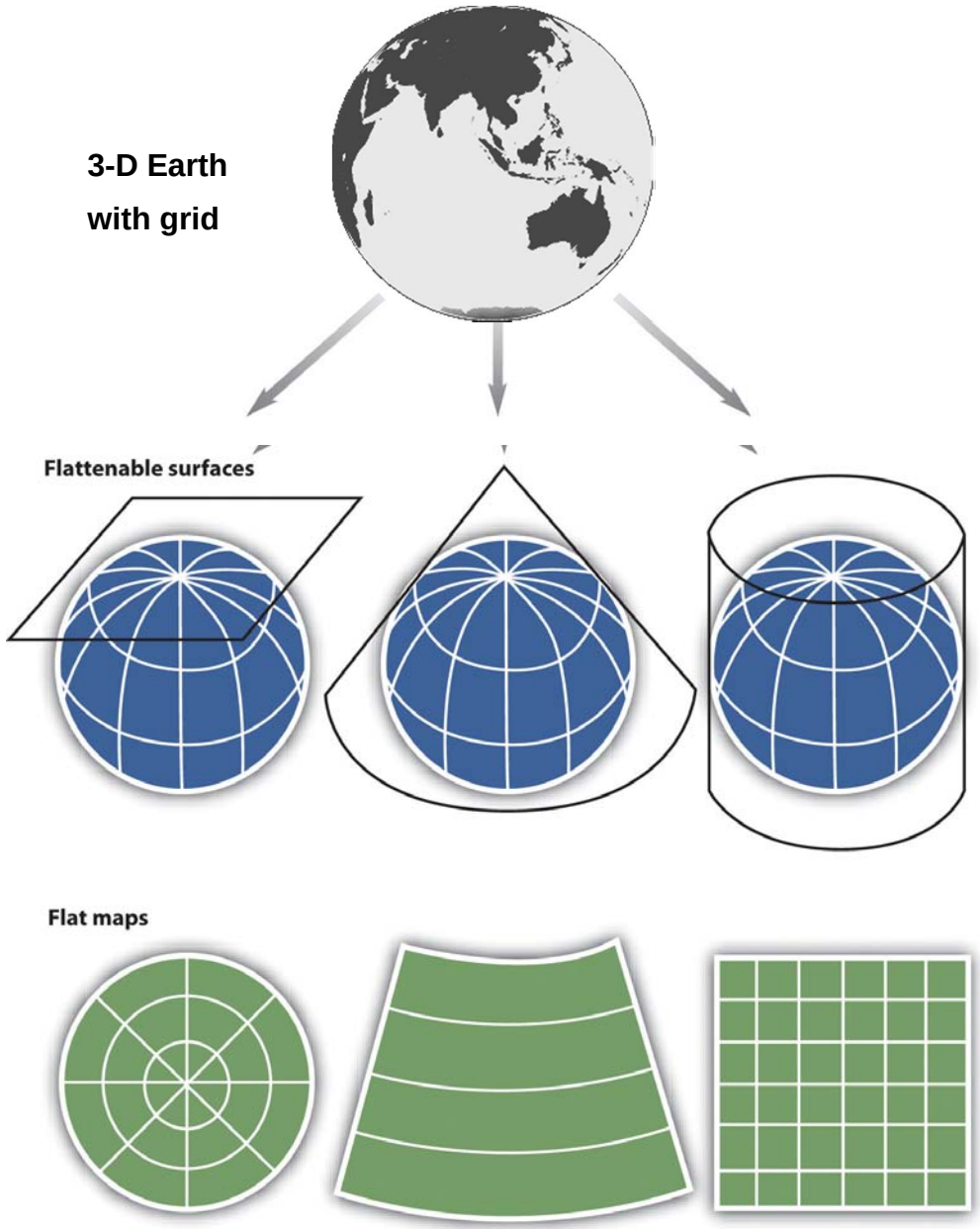
3-D Earth

Comparing Projections

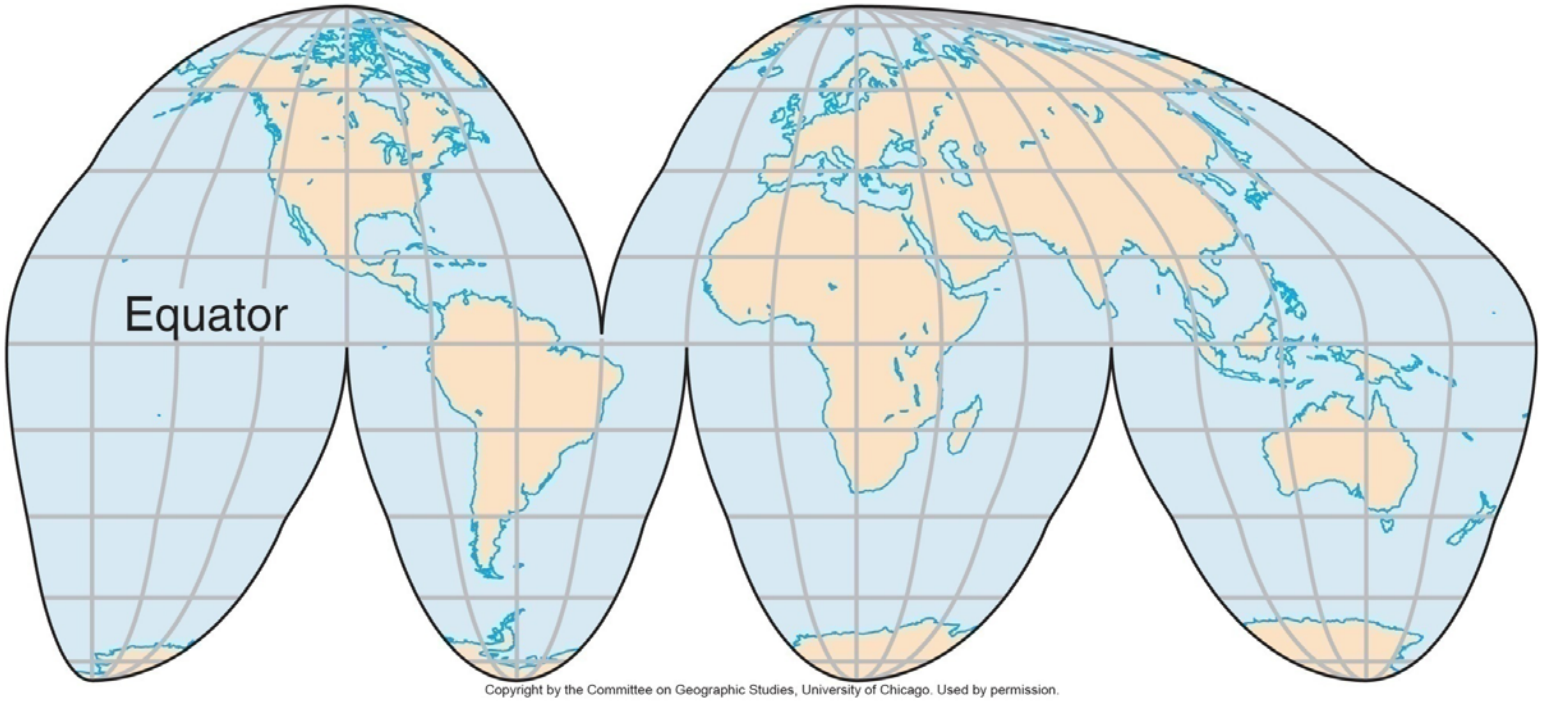
So depending on the map maker's choice of projection, the resulting flat map will have a unique appearance with a unique set of distortions.

And then there are the numerous interrupted projections and mathematically derived projections!

https://www.quantil.com/resources/hp-globe.gif



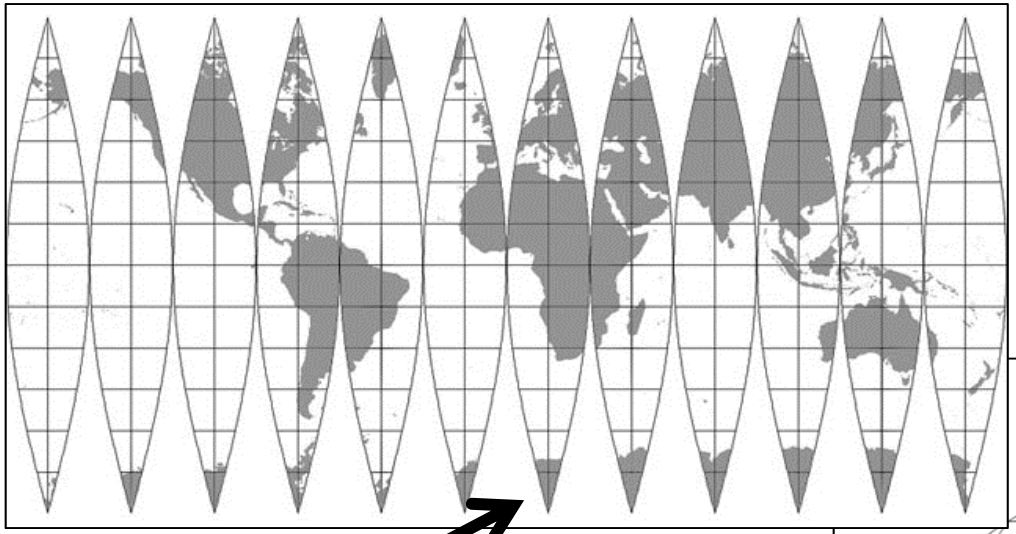
Goode's Homolosine Projection

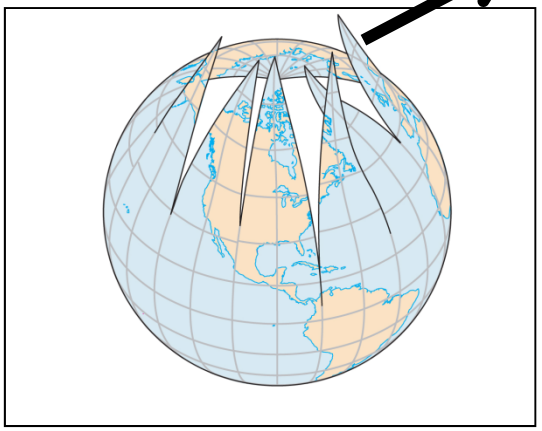


A mathematically derived projection providing the illusion of a "peeled orange".

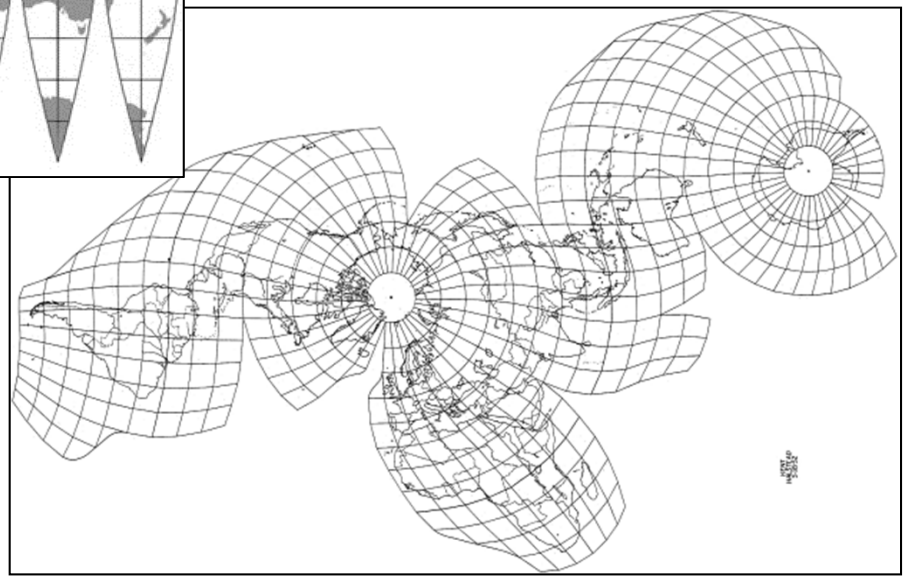
Its classification is "interrupted projection".

Other Interrupted Projections



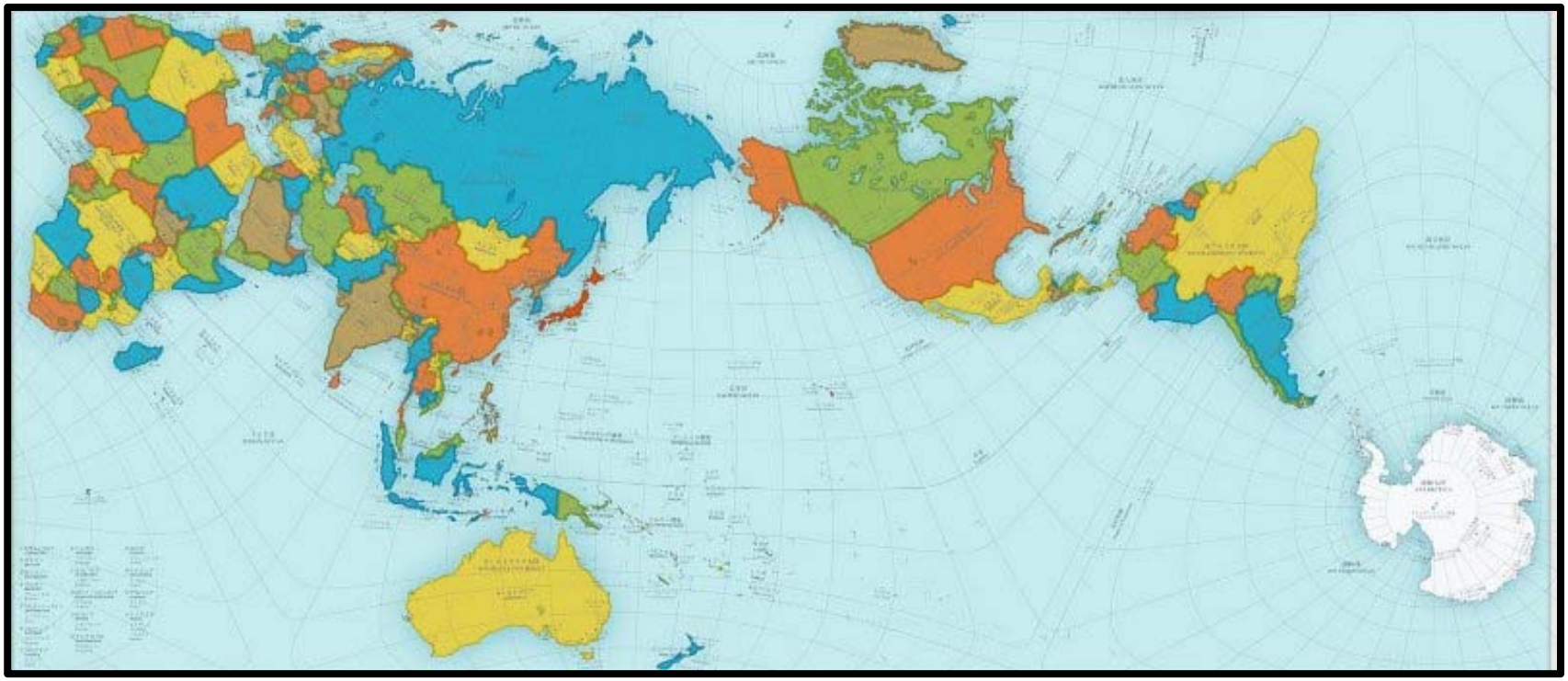


"Peeled globe designs"

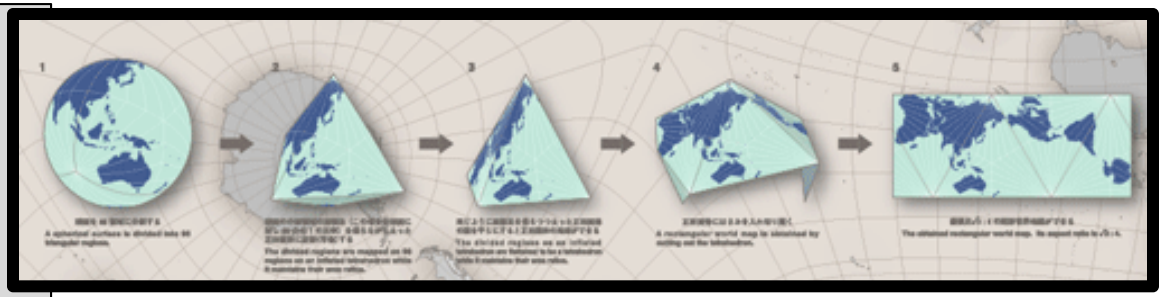


https://www.youtube.com/watch?v=b1xXTi1nFCo 1.3 min video map projection (no sound)

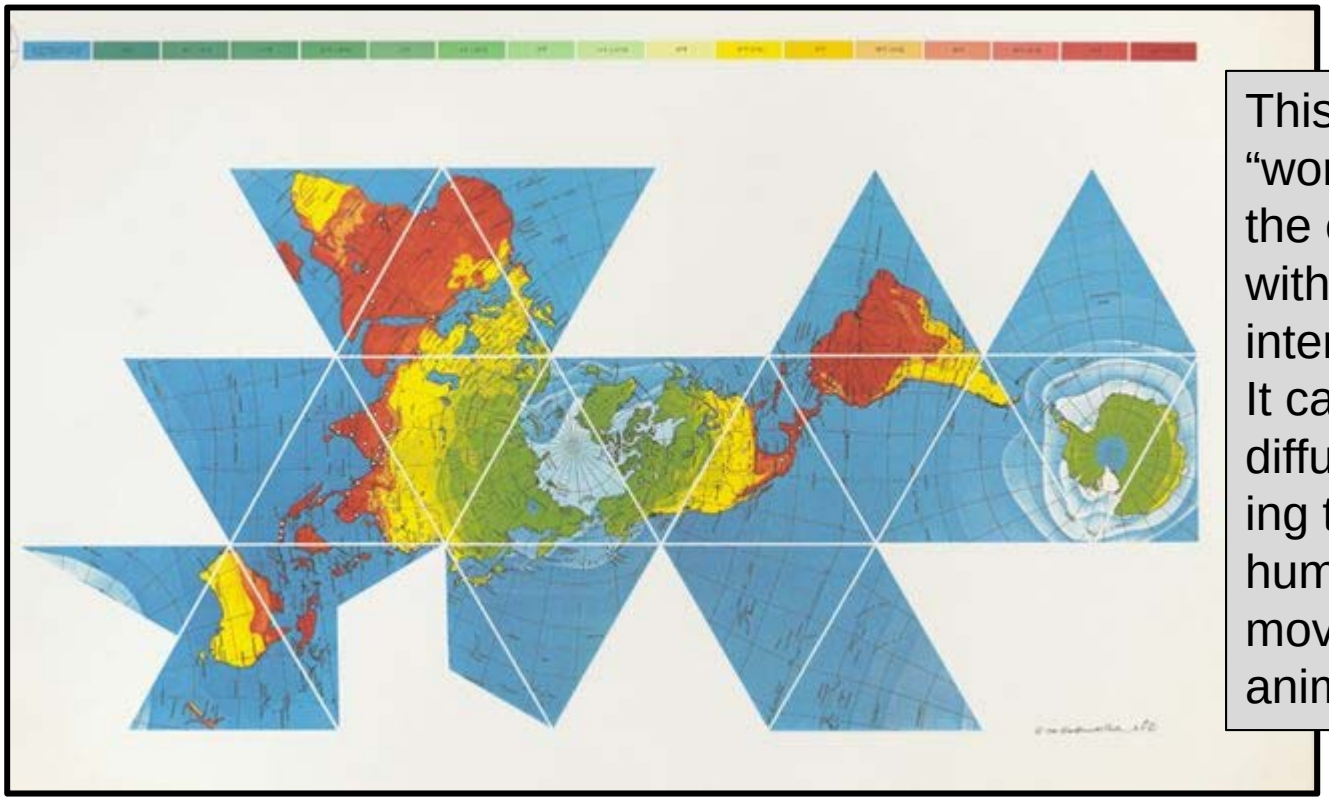
AuthaGraph Projection



Attempts to accurately show the **size** of land areas in relation to each other by using 96 triangles placed on the sides of a 3-D pyramid and then converting it into a 2-D rectangle.



R. Buckminster Fuller Map Projection



This map illustrates the "world island" nature of the earth's landmasses without an unnatural interruption.
It can be used to illustrate diffusion (spread), including the migration of early humans and the recent movements of plants and animals.

- ✓ There is only a maximum distortion of 2% at any one place, thereby maintaining relative (true) **shape** and **size**.
- ✓ However, true **direction** and **distance** are sacrificed.

SCALE

❖Scale is a RATIO.

It is the **relationship between distance:** the distance on the map to the equivalent distance on the earth's surface (map to earth).

- ➢Scale is a means of **measurement.**
- ➢Scale influences **detail** (symbolization).
- There are **3 ways** to show scale.

Showing Scale

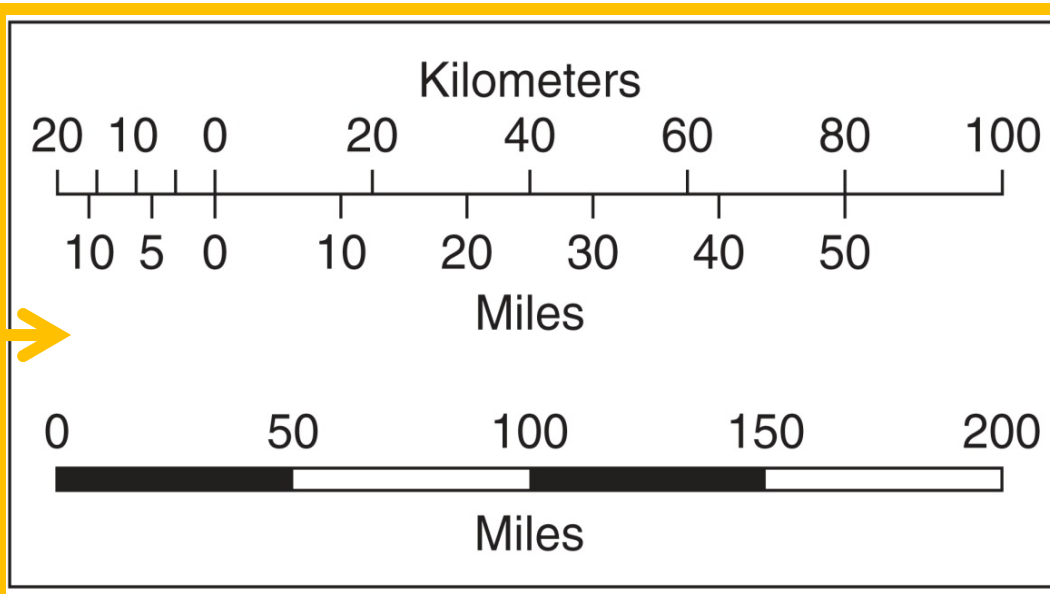
a) **VERBAL/Written**: in words

b) **GRAPHIC/Bar**: as a line or bar

c) **FRACTION/Ratio**: as a mathematical equation

"1 inch to 1 mile"
"1 centimeter to 5 kilometers"

(a) **Verbal scale**



(b) **Graphic scale**

$\frac{1}{62{,}500}$ 1:62,500

(c) **Representative fraction scale**

SCALE

Scale can be designated **large** or **small.**

Large scale:

Shows **greater detail** but less of an area.

Small scale:

Shows **greater area** but in less detail.

(A globe is a **very, very small** scale map.)

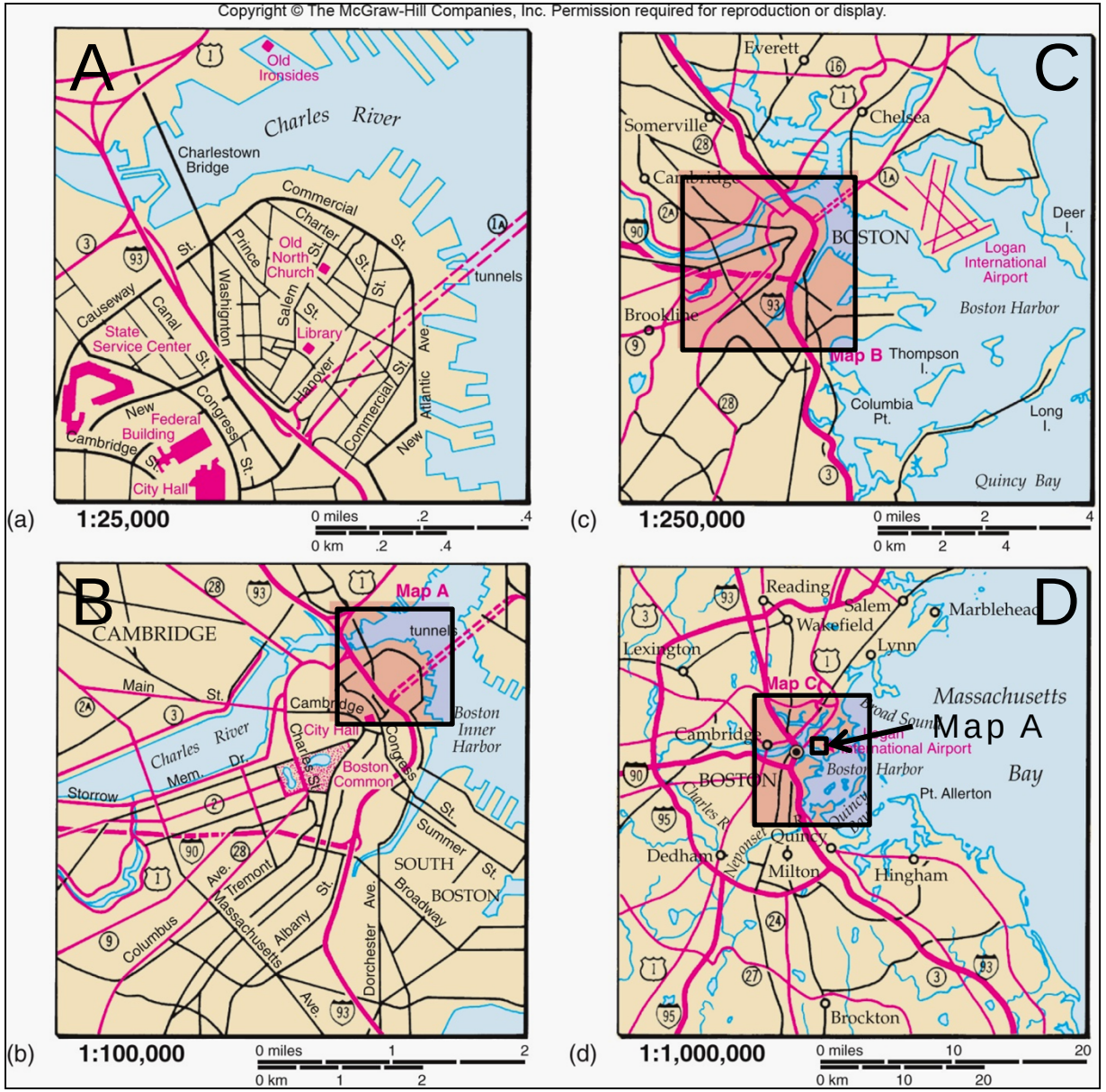
Small scale
Large area, little detail

Large scale
Small area,
great detail

Effect of Scale on DETAIL

Same size squares but each square shows **different** total surface **area** and **different detail**.

- ✓ **Note that each shaded box (a, b, c, d) fits into the next one.**

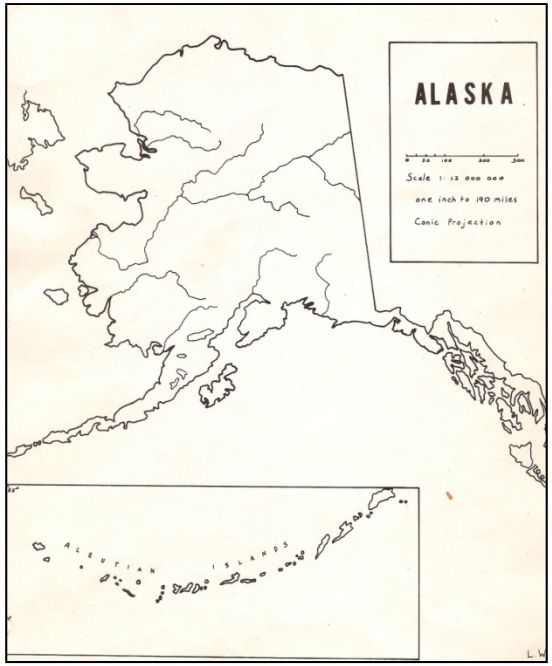


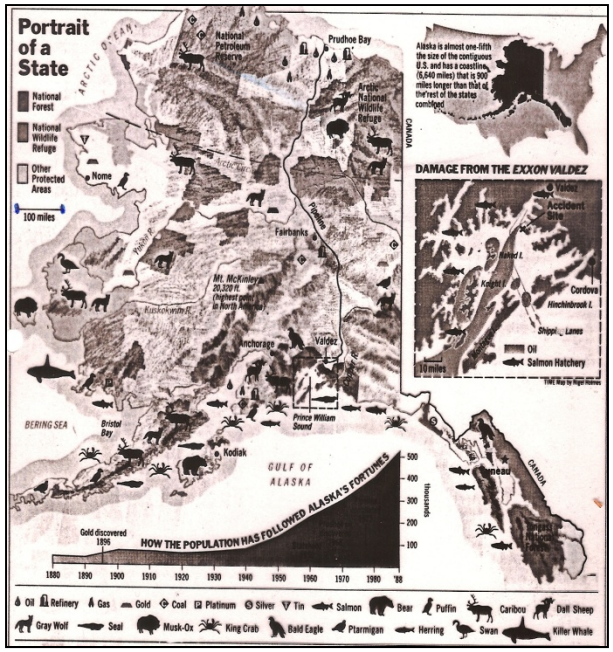
SYMBOLIZATION

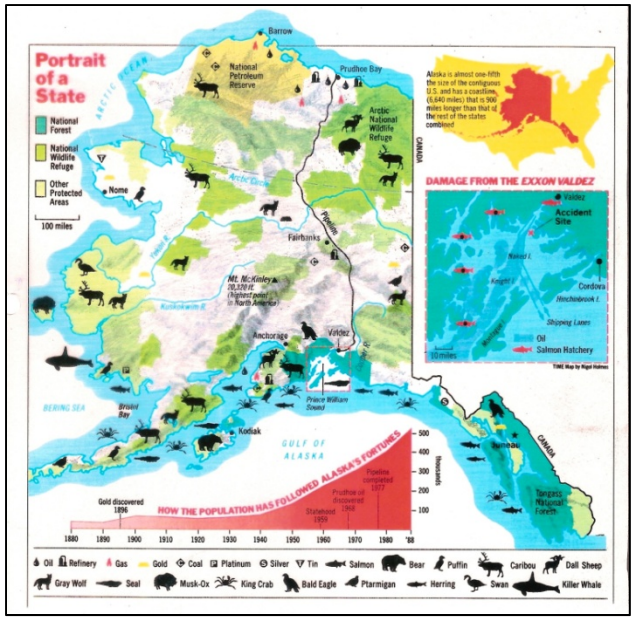
- **Symbolization is the portrayal of information.**
  - ✓ **Ideal maps should have the following seven elements:**

1. **Title**
2. **Date**
3. **Grid**
4. **Direction**
5. **Scale**
6. **Projection used**
7. **Legend or key**

Maps and Symbolization



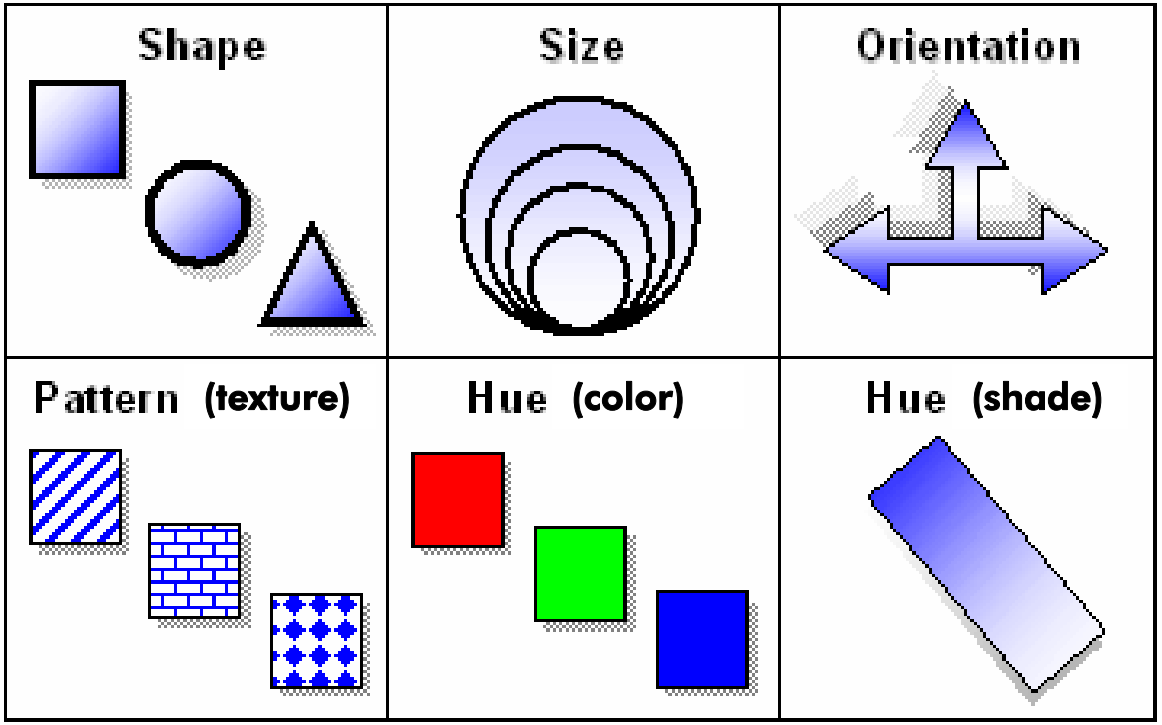




Map Symbols: with a legend or key

The reader must know what the shapes, colors, patterns and sizes mean.

Visual Variables

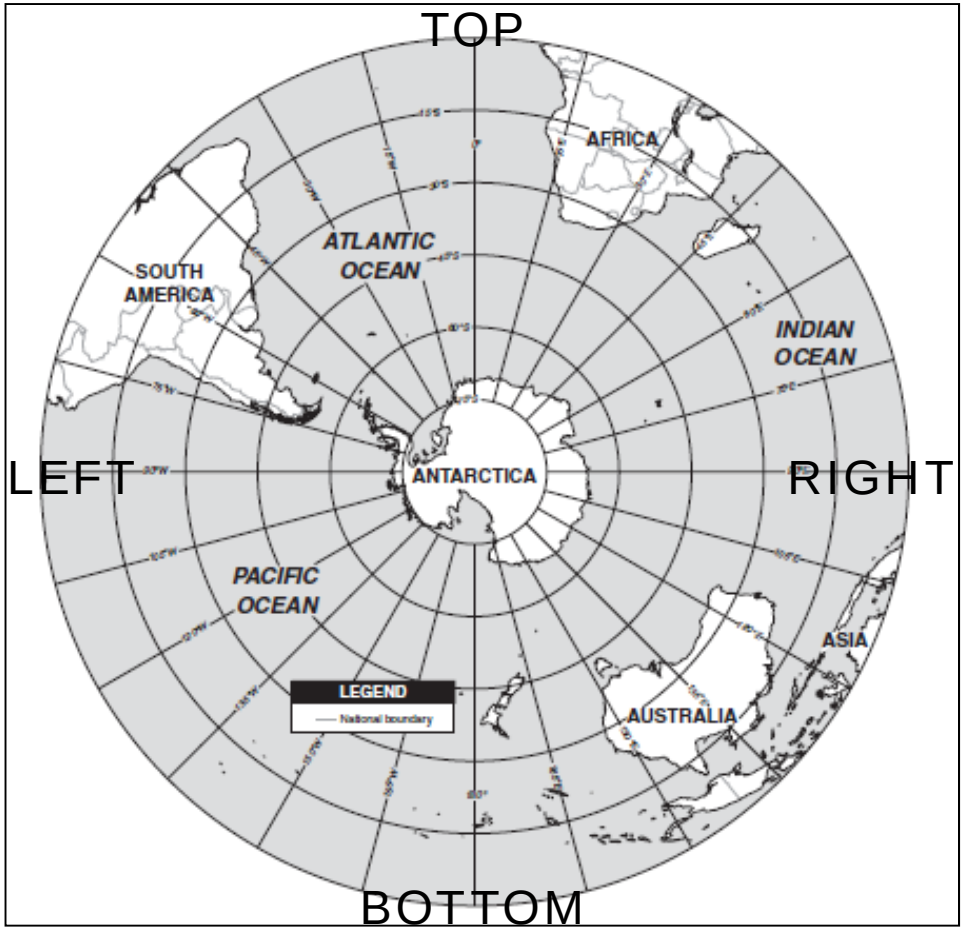


Therefore a LEGEND or KEY is needed.
Without it, what is presented are just meaningless shapes and colors.

DIRECTION

Every map needs to have an indication of major compass points: north, south, east and west.

This can be done with a compass arrow, marking of lines of latitude and longitude and/or indication of quadrant.

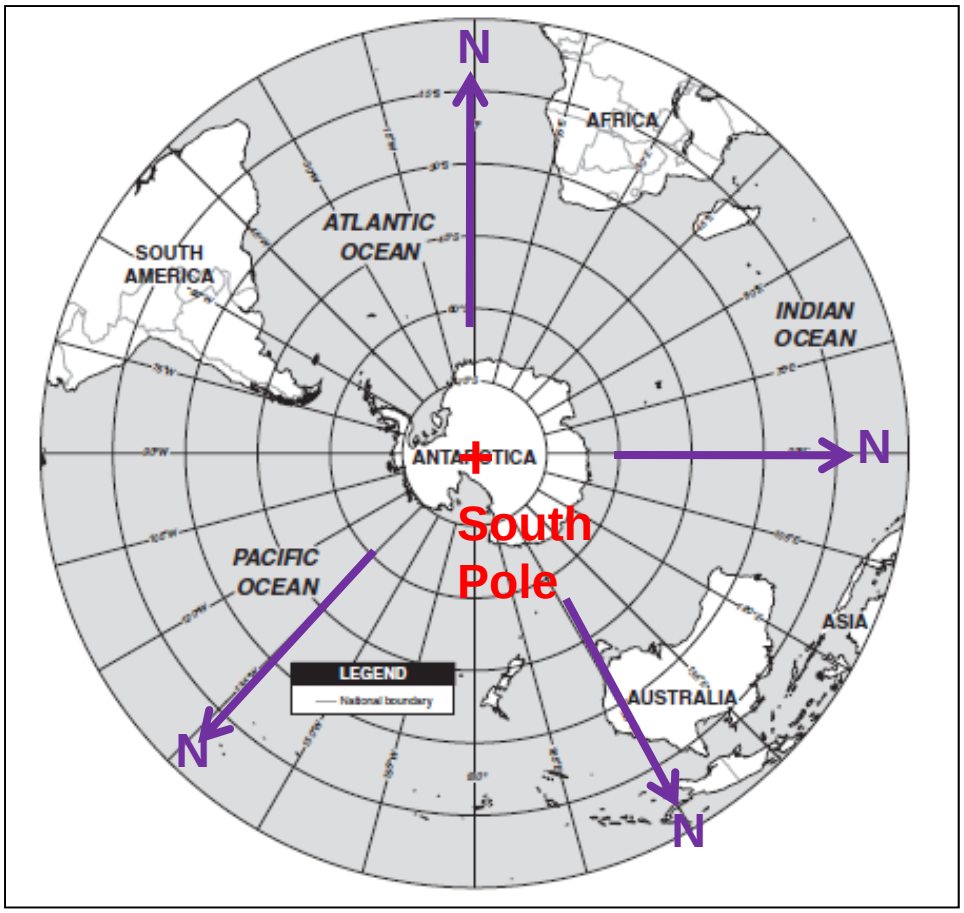


Where is north on this map?

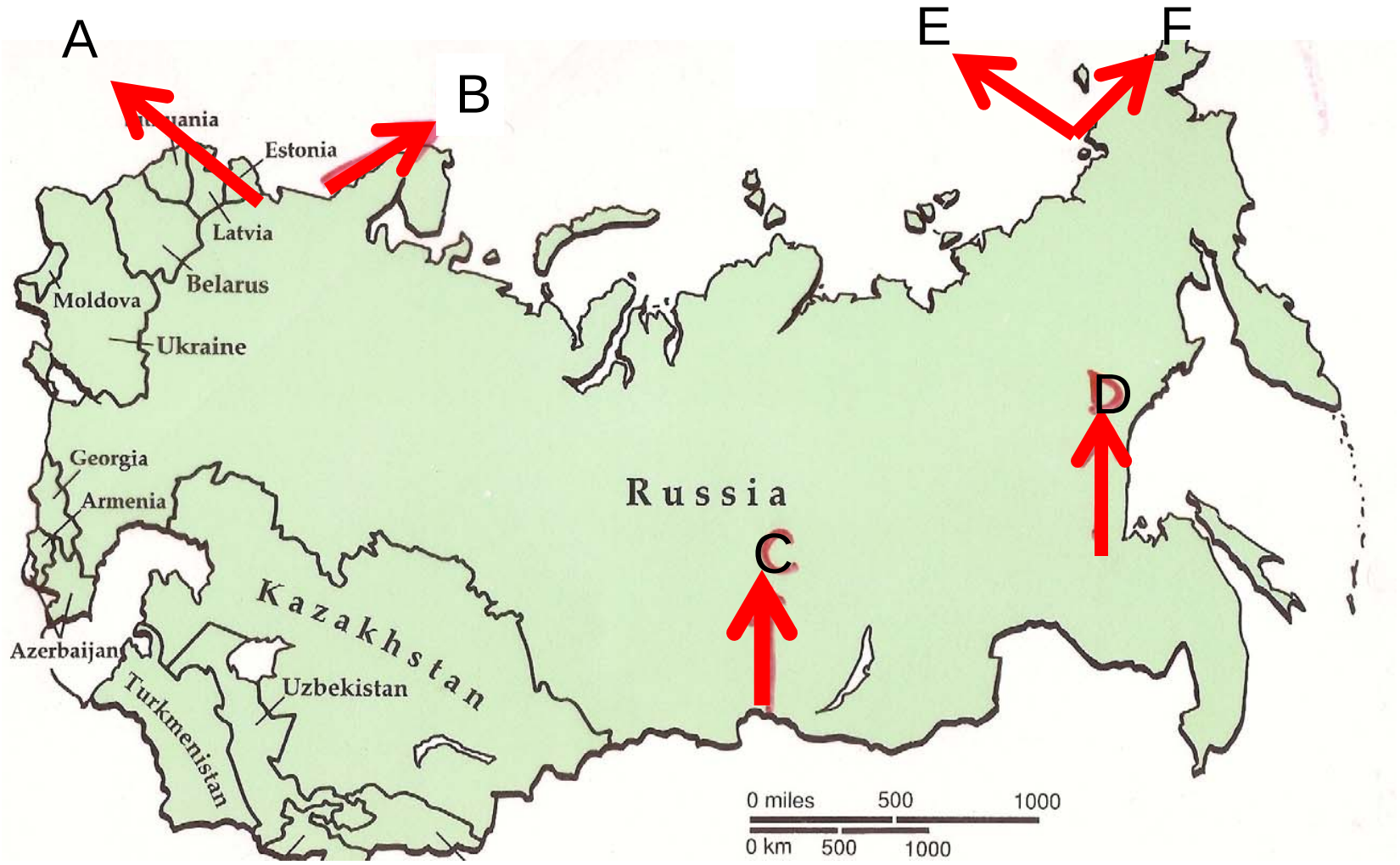
Southern Hemisphere

Which way is north?

- ✓ **By following the meridians of longitude away from the South Pole, you will eventually end at the North Pole.**



Which arrows point North?

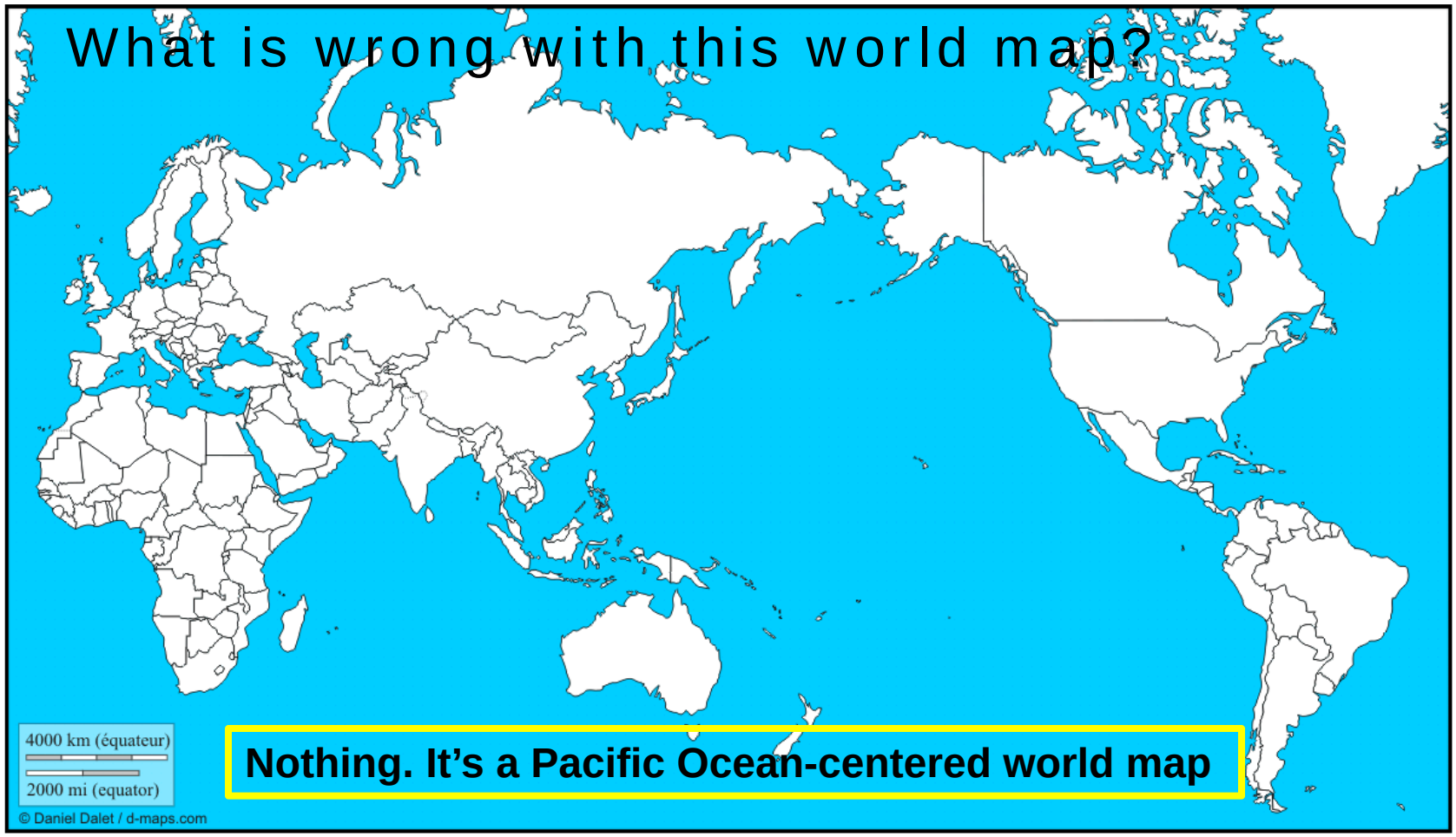


This way is North!!

Must always follow lines of latitude and longitude to ascertain direction.

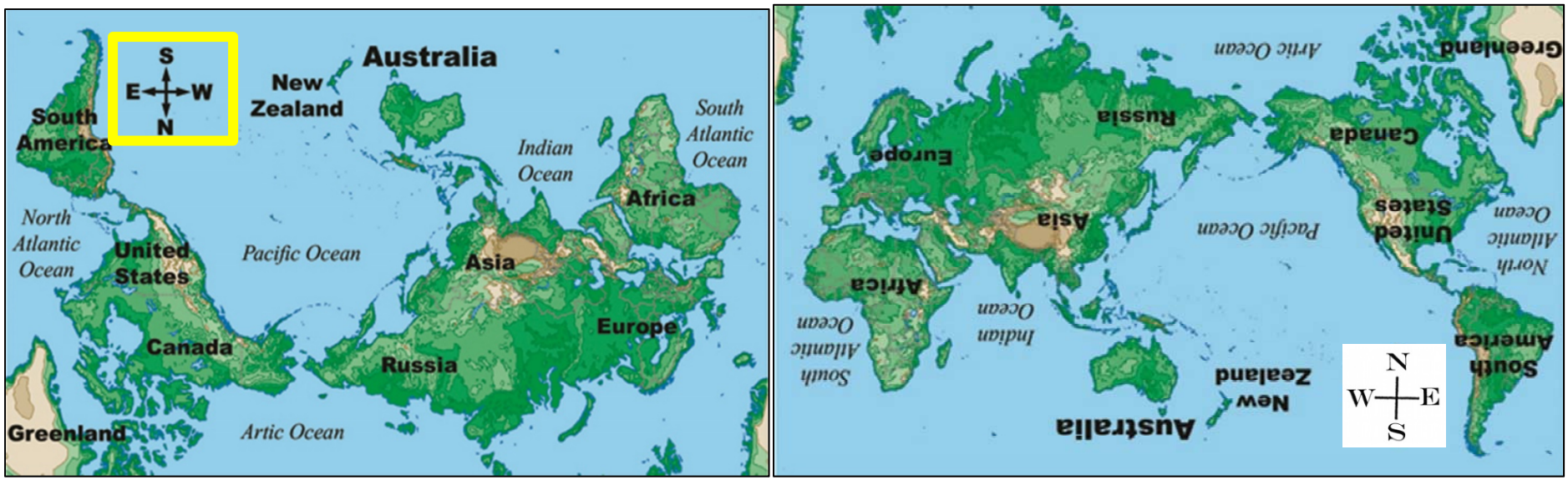
Arrows **B**, **C** and **E** point to the North Pole.

Representing the World



World Map

What is wrong with this map?



It's a World Map Centered on Australia.

Presenting Mapped Information

Mapped data can be presented in various formats.

There are **5** general categories of maps.

1. **Point**
2. **Flow line**
3. **Isoline**
4. **Choropleth**
5. **Cartogram**

The five can be sub-divided into seven groups which present mapped information differently.

See Fig. 1.27 in your textbook.

Map Formats

1. **Point Symbol:**
    a. **Dot -** Uses dots to indicate values at a location; shows distribution and density.
    b. **Graduated symbol -** Uses proportionally-sized circles or symbols to indicate quantities present.
2. **Isoline:** Uses lines to connect points of equal value.
3. **Flow Line:** Uses lines of varying widths with arrow-heads to portray amount of movement.
4. **Choropleth:** Uses colors or shading to convey information
    a. **Qualitative** = characteristics
    b. **Quantitative** = amounts
5. **Cartogram:** Uses data other than land area to portray the size of a unit.

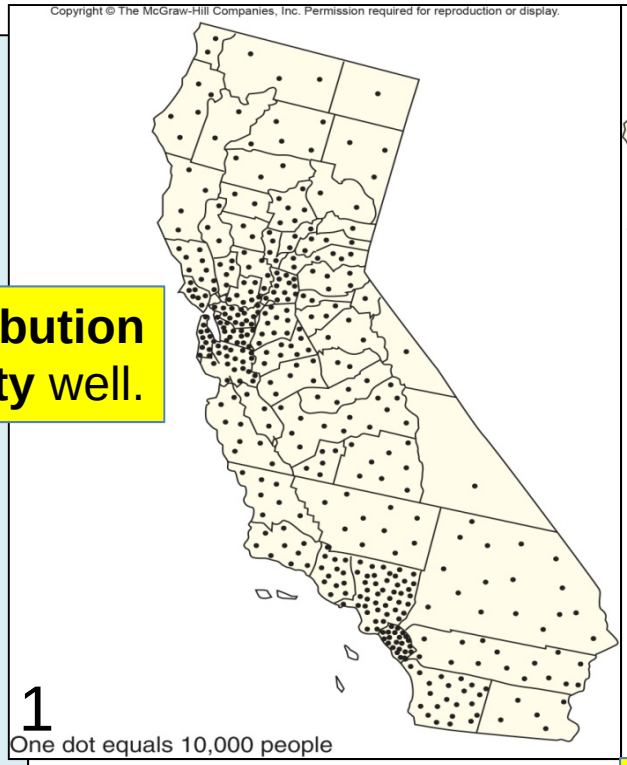
Types of Maps: Point Symbols

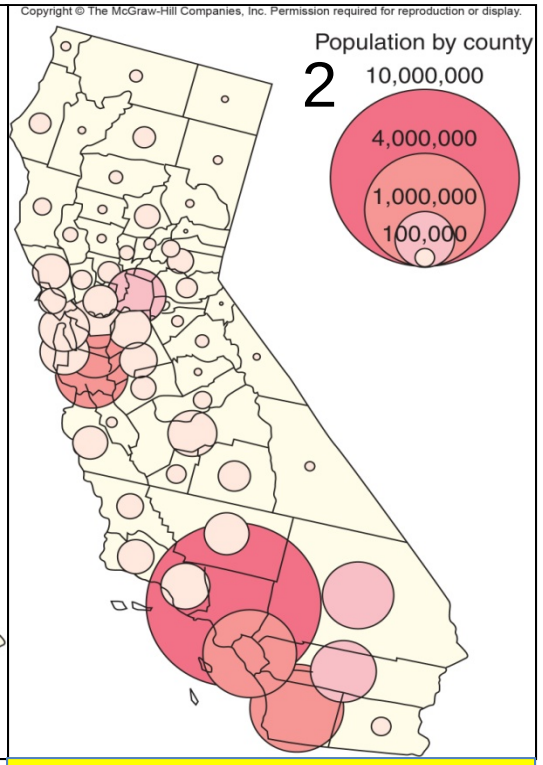
Both maps portray the population distribution of California.

1. **Dot:** Uses dots to indicate point values at a location.

Shows **distribution** and **density** well.

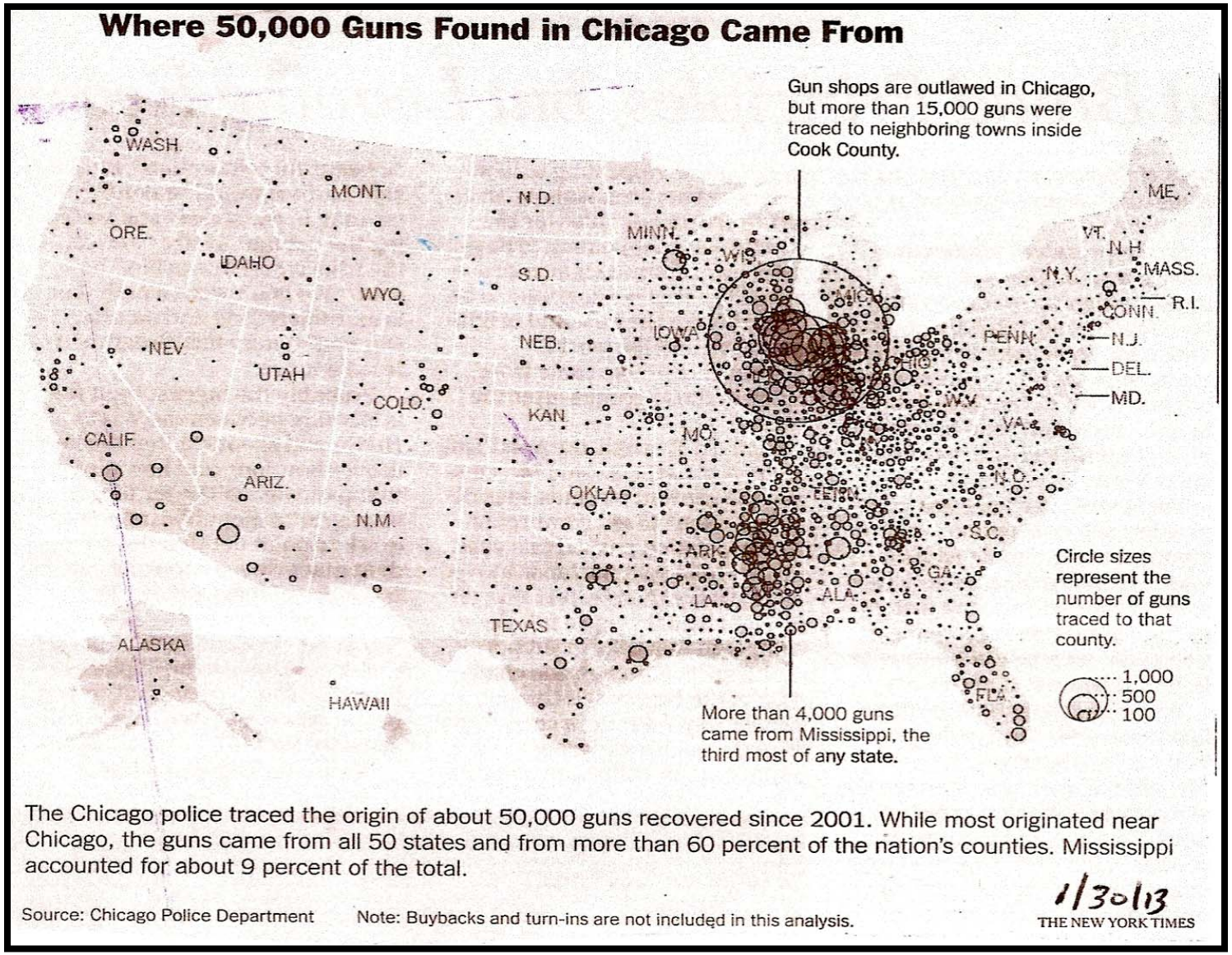
2. **Graduated:** Uses proportionally-sized circles or other symbols to indicate quantities present at a location.





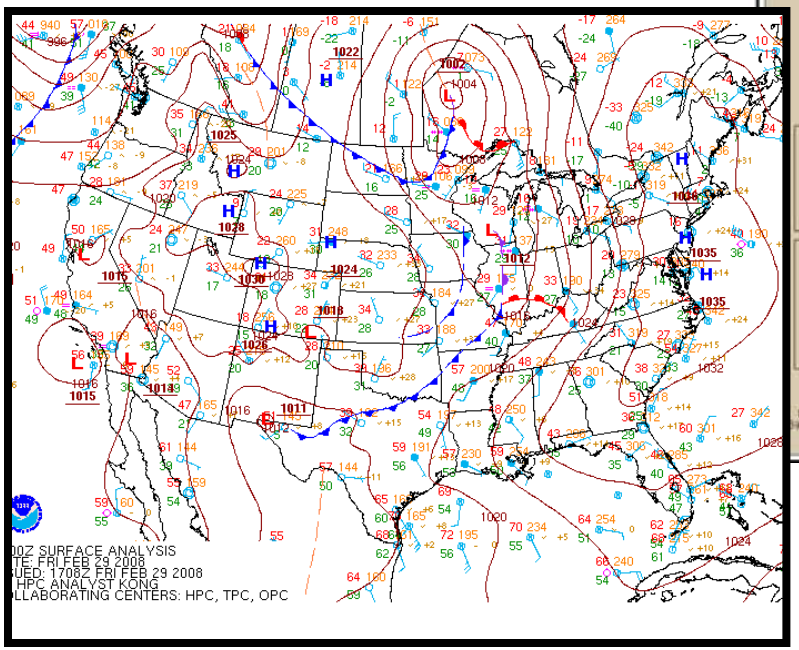
Good for **comparing** areas although the map may become visually cluttered.

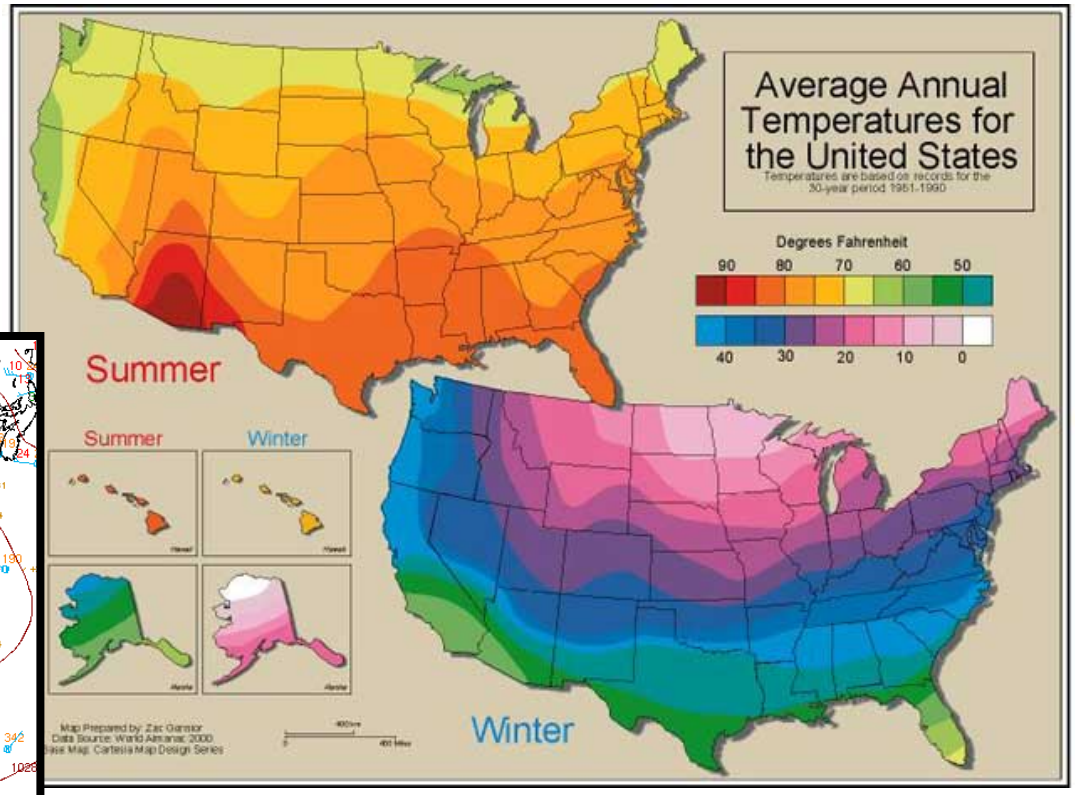
Graduated Circles Format



Types of Maps: Isoline

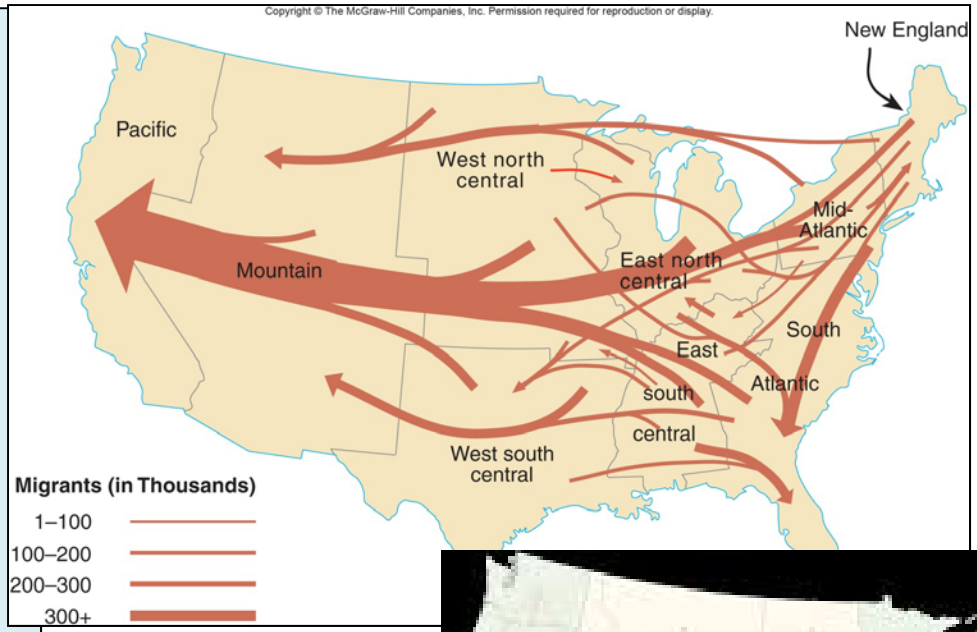
Uses lines to connect points of equal value.

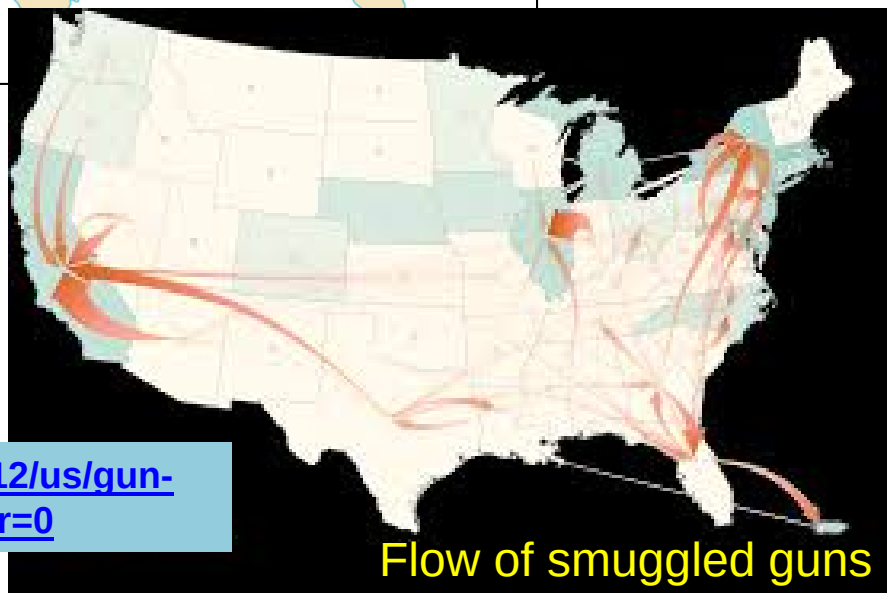




Types of Maps - Flow Line

Uses lines of varying widths (representing amounts) **with arrowheads** (indicating direction) **to portray linear movement.**

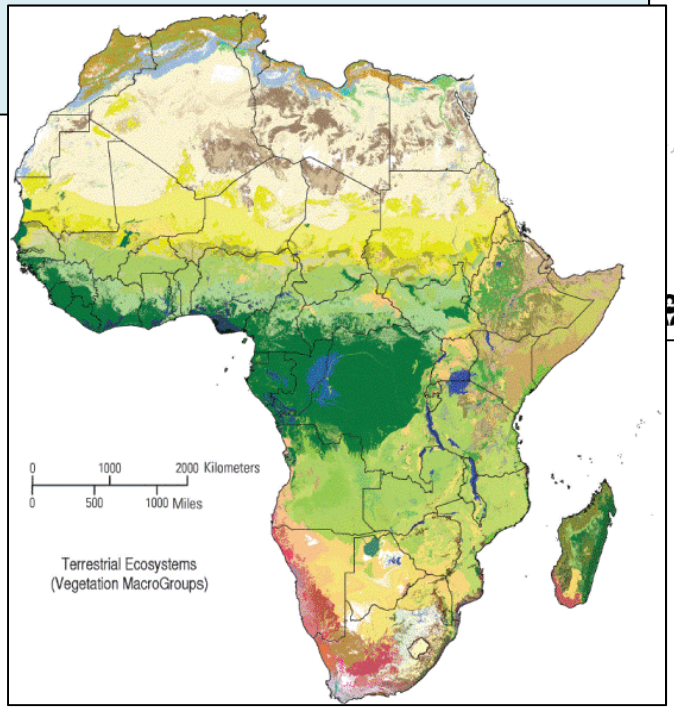


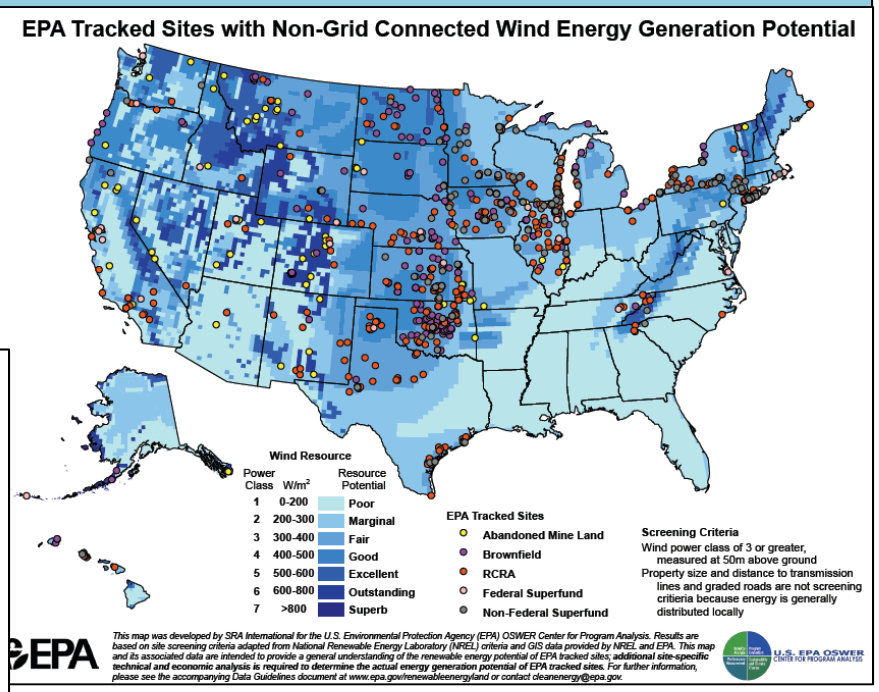


http://www.nytimes.com/interactive/2015/11/12/us/gun-traffickers-smuggling-state-gun-laws.html?_r=0

Types of Maps: **Choropleth** (qualitative)

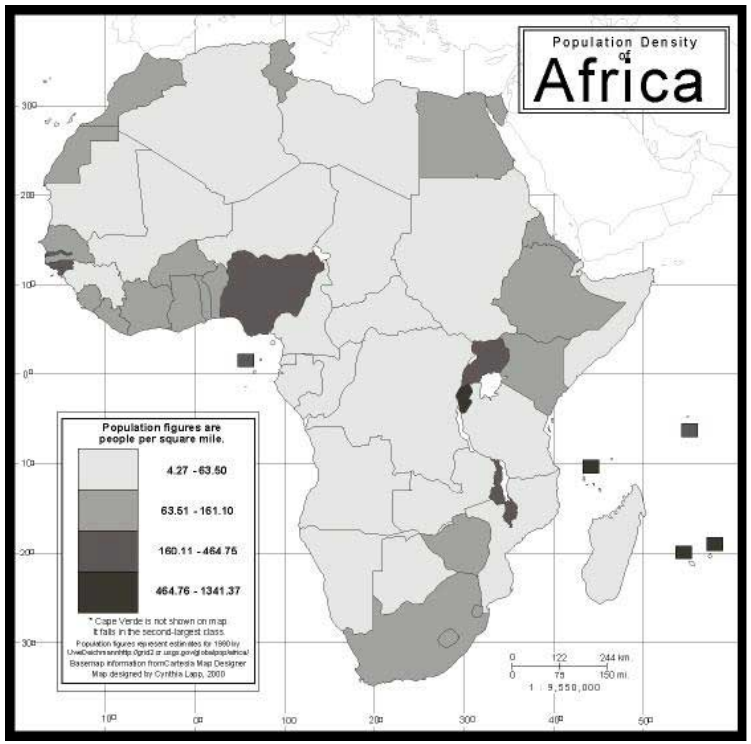
Uses colors, shading and symbols to convey an area's <u>characteristics</u> (qualitative) without regard for man-made borders.

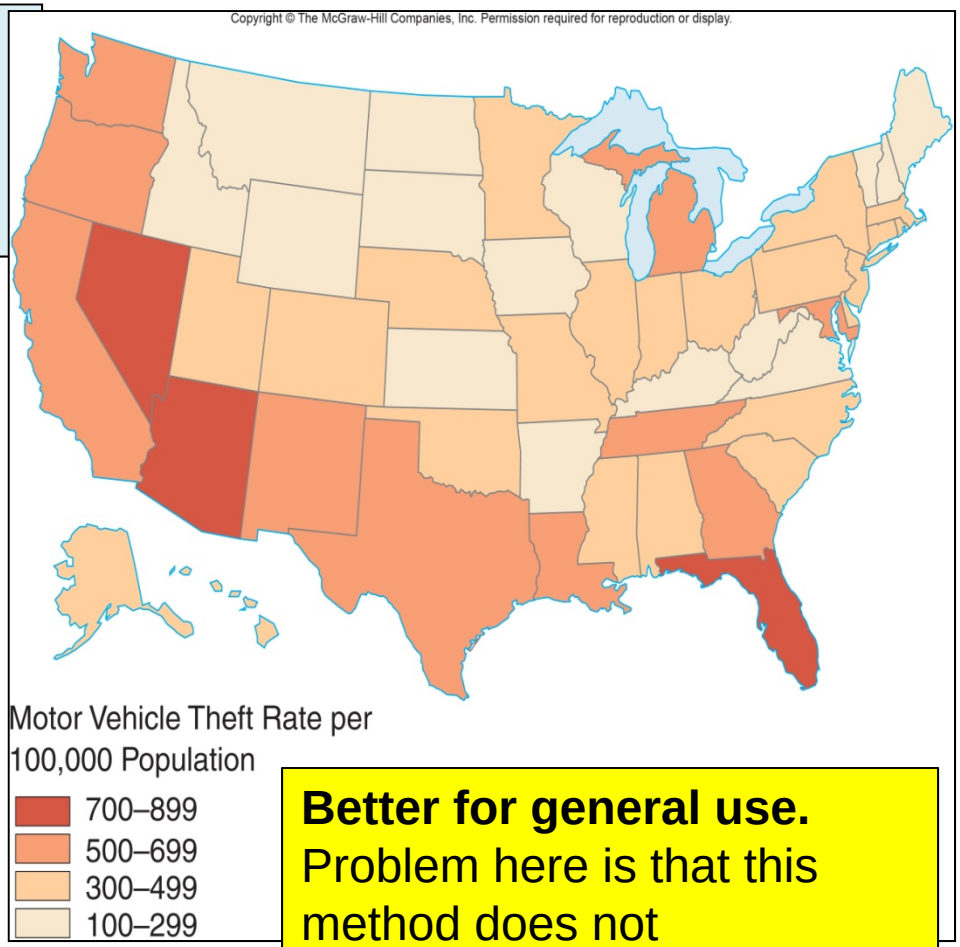




Types of Maps: **Choropleth** (quantitative)

Uses colors and shading to convey amounts by <u>unit area</u> (quantitative).



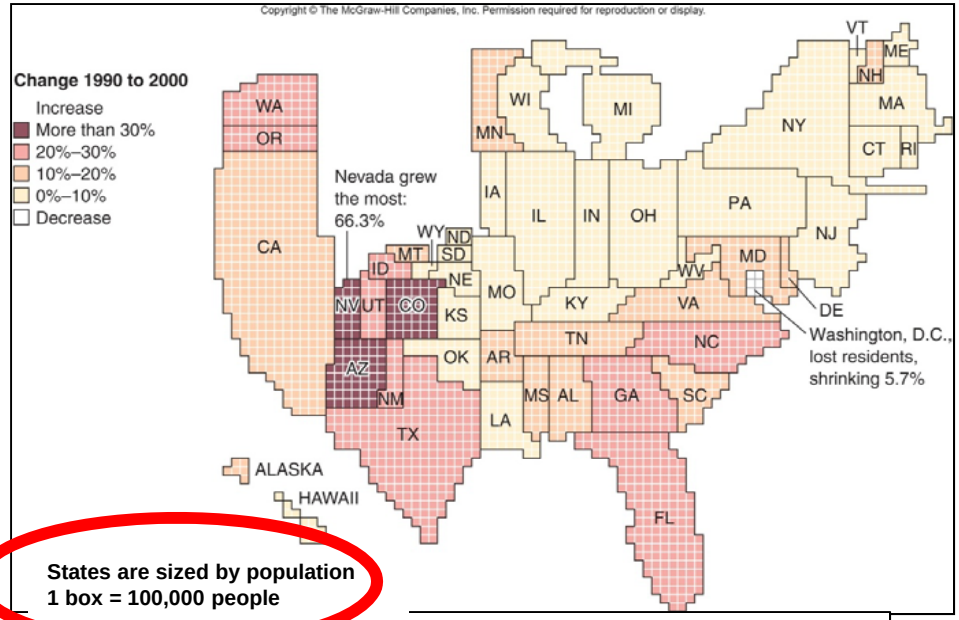


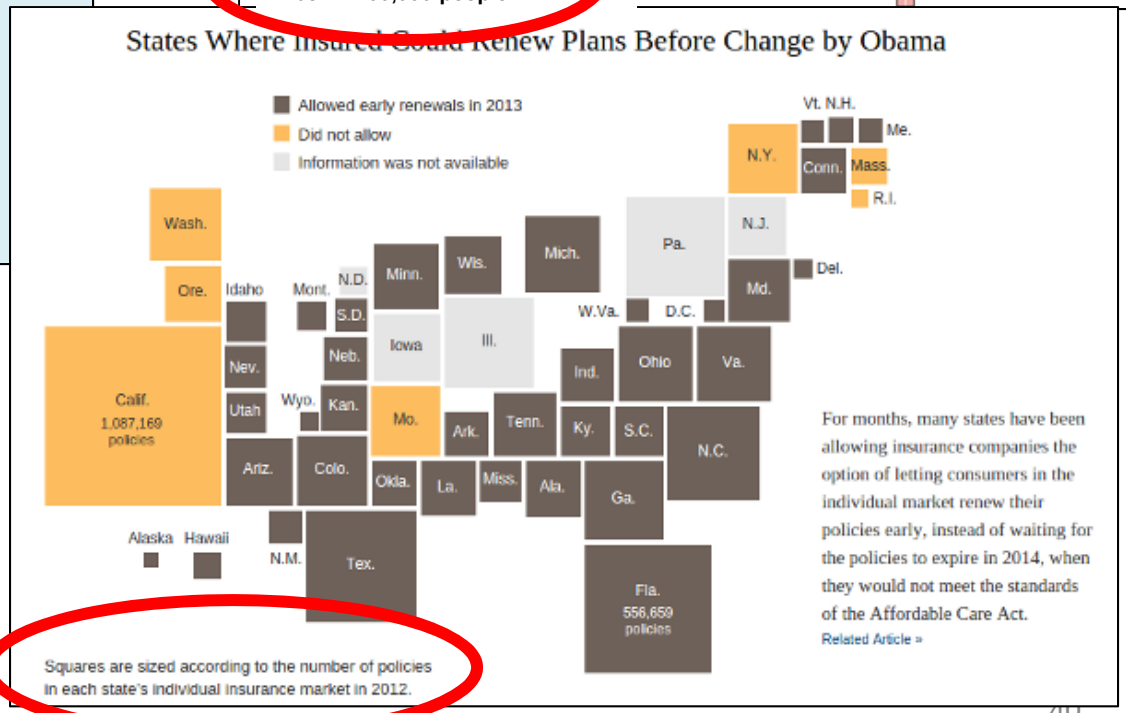
Better for general use. Problem here is that this method does not differentiate within an area.

Types of Maps: Cartogram

Uses data other than land area to portray the size of an area.

It is based on the **unit value of the topic** portrayed, **not land area**.





Portraying Data

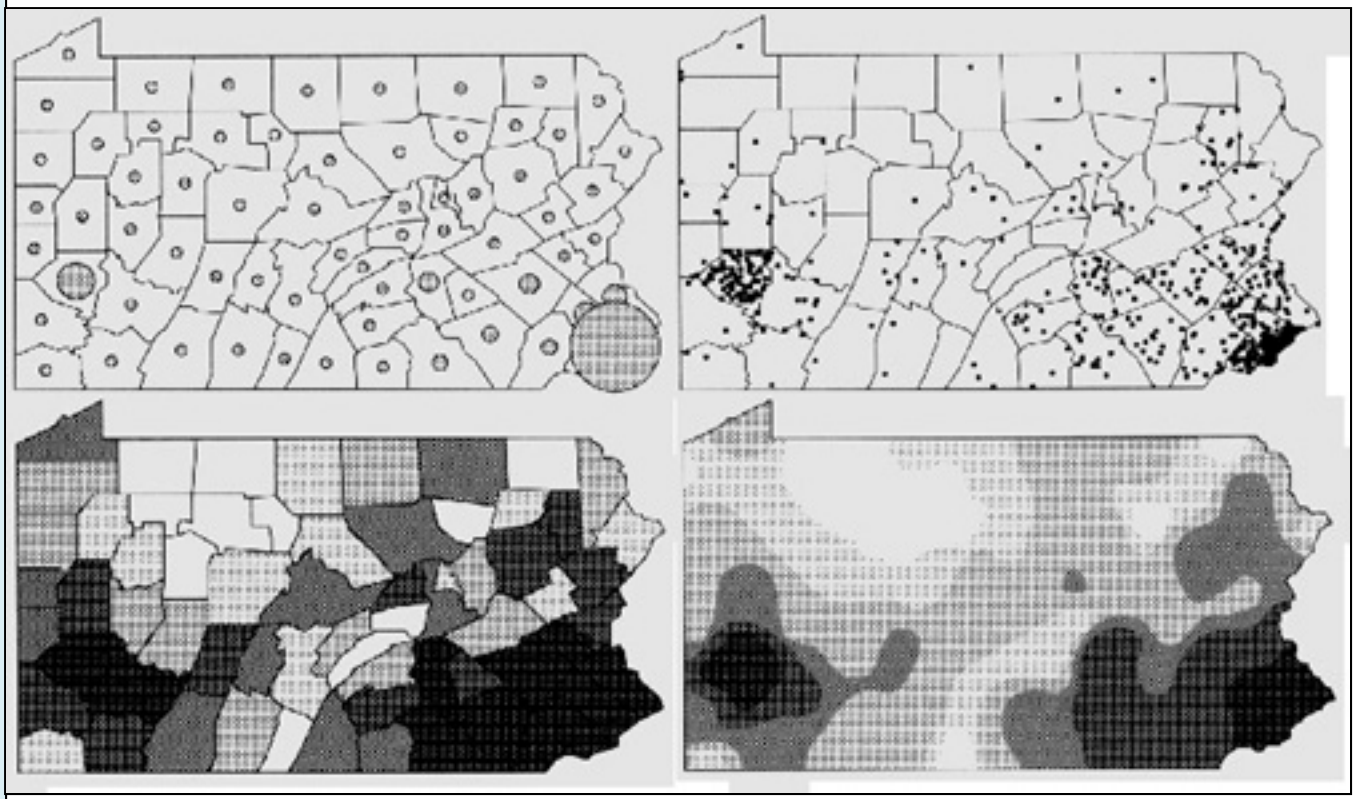
Based on the patterns can you guess what data is being shown?

Presentation of same data in 4 formats:

A. Graduated Circle map
B. Dot map
C. Choropleth map
D. Isoline map

A

B



C

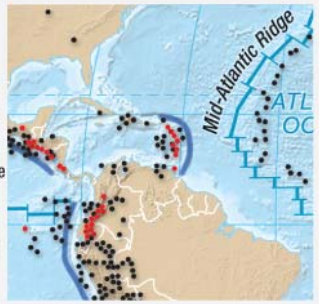
D

Four ways to portray AIDS cases in Pennsylvania

Summary: TYPES of MAPS

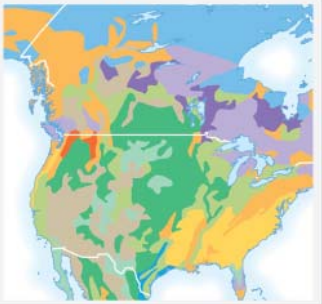
1. **Point:** dot distribution
2. **Point:** graduated symbol
3. **Flow Line**
4. **Isoline**
5. **Choropleth:** qualitative
6. **Choropleth:** quantitative
7. **Cartogram**

Dot distribution maps use points to show the location or distribution of a feature. Some display quantities by assigning a value to each point. The visual impression in such maps is of some areas with dense concentrations of dots and other areas with very few dots, conveying the spatial distribution of the phenomenon. For example, Figure 3-5b shows the location of earthquake epicenters. Figure 9-4 displays the approximate source of every 100,000 metric tons of potatoes and rice grown around the world.



1

Qualitative maps identify a characteristic of a place that has qualitative rather than quantitative meaning, such as the name of a place, using nominal area symbol maps in which color or shading designates differences between areas. A map showing countries or U.S. states is of this type. Figure 4-14 shows different soil regions.

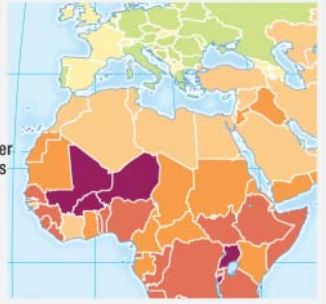


5

Graduated symbol maps use different sizes of symbols to show differences in quantity across locations. A large symbol shows the location of large quantities, while small symbols show locations of smaller quantities. For example, Figure 10-1 uses dots to show the location and proportional quantity of major urban populations.

2

Choropleth maps use color or shading to show quantities at different areas, usually with darker shades indicating larger quantities. For example, Figure 6-7 uses several shades of the same color to represent rates of population growth. Choropleth maps often lump different values into a smaller number of ranges or classes; each class is then assigned a different shade.



6

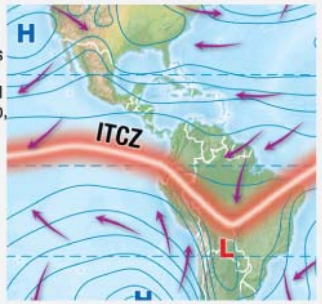
Flow maps use different line thickness to show different quantities moving along a path. Figure 6-26 displays the movement of international immigrants.

3

Cartograms Sometimes we find it useful to convey an idea by deliberately distorting features on the Earth's surface to indicate some characteristic of those features. Cartograms display different quantities by intentionally distorting features, usually areas. Figure 6-2 distorts the land size of different countries in proportion with each country's population.

7

Isoline maps connect places of equal value to show variation across an area. The patterns of the lines convey shapes of surfaces. A topographic map is an isoline map where the lines show equal elevation. Figure 2-24 is an isobar map, a kind of isoline map, where lines connect points of equal barometric pressure.



4

This diagram is from your textbook (1.27)**.**

N E X T

Gathering Information

FIRST EXAM

❖**Tuesday, February 26, 2019.**

- **Combination of multiple choice questions and map interpretation.**
- **Bring a #2 pencil with eraser.**
- **Based on class lectures supplementing <u>Chapter 1</u>.** Review lectures 1-8 on home page.

➢ **If you miss this exam, a written-response make up test consisting of definitions, concepts and explanations, plus the place name maps will be given.**