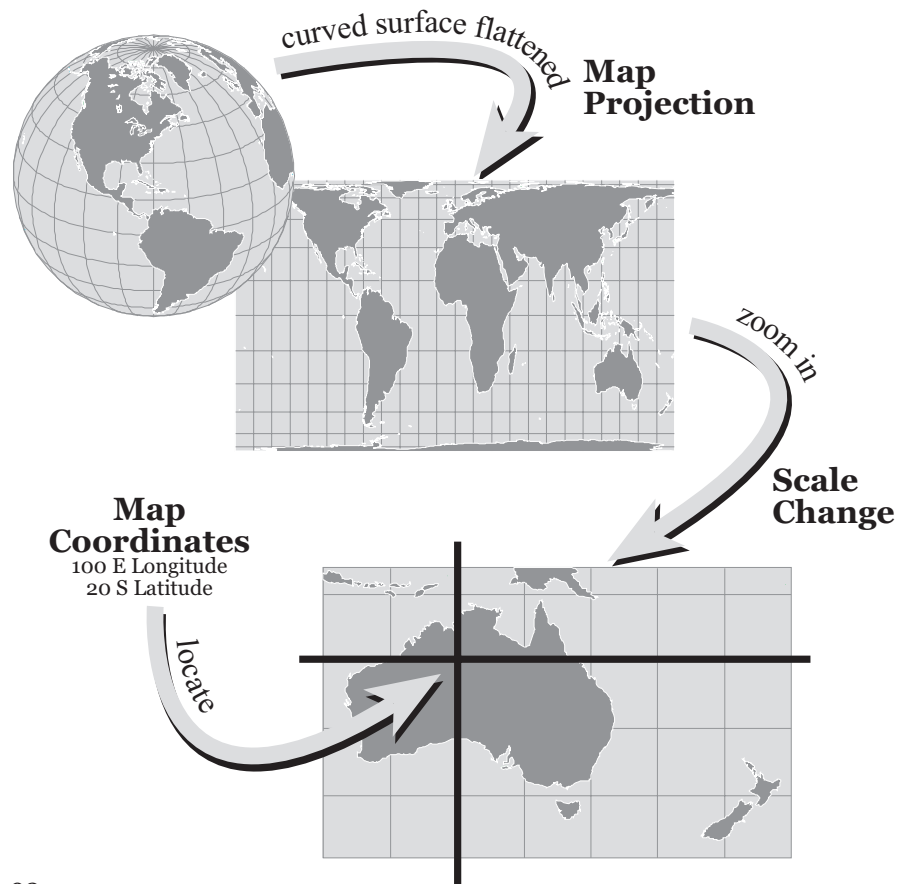


Geographic Framework

We use maps to flatten the curved surface of the earth, shrink it down to a size we can handle, and systematically locate things.

We make maps for particular reasons, and those reasons guide the selection of a particular geographic framework - a map projection (which gets us flat), an appropriate scale, and a coordinate system (which helps us locate things on the map).



Choosing a **geographic framework** involves:

1

Map Projection: Flattening the earth's curved surface, and the resulting distortions of area, shape, distance, or direction



2

Map Scale: How much of the earth to show, and at what size?



3

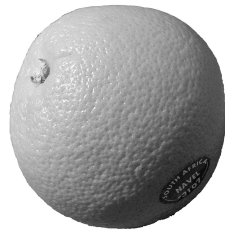
Map Coordinates: Graph-like grids placed on the earth to assist with locating phenomena



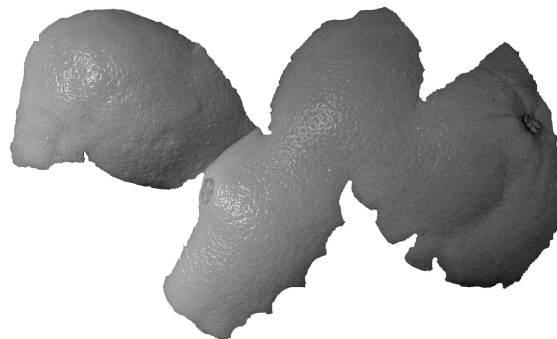
1

Map Projection

Our earth's surface is curved. Most maps are flat. Transforming the curved surface to a flat surface is called map projection. All projected maps are flat, compact, portable, useful, and always distorted. Any curved surface gets distorted when you flatten it.



An orange peel *tears* when you peel and flatten it.



A toad skin *tears* when you peel and flatten it.



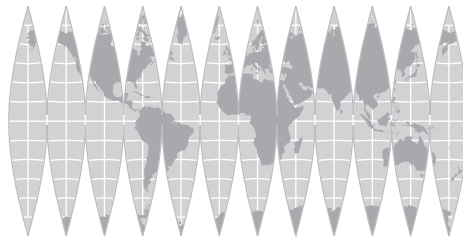
Strike flat the thick rotundity o' th' world!

William Shakespeare, *King Lear*



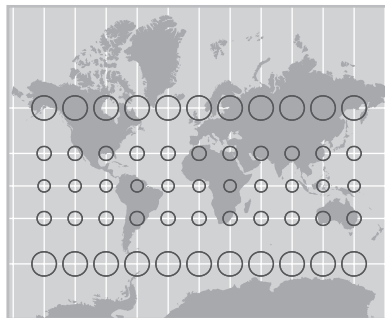
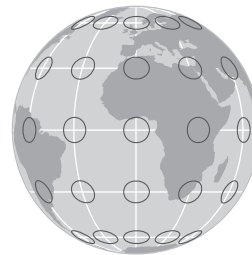
The surface of the Earth *tears* when you peel and flatten it. Peel a globe and you will get globe gores (below).

Most map projections stretch and distort the earth to “fill in” the tears. The Mercator projection (bottom) preserves angles, and so shapes in limited areas, but it greatly distorts sizes. Look at the size of Greenland on the globe compared to the Mercator.



distorting circles

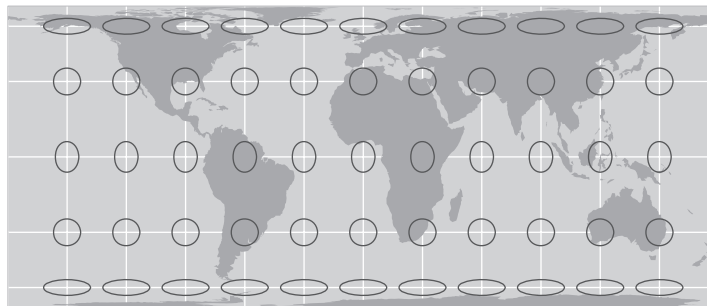
In the 19th century, Nicolas Auguste Tissot developed his “indicatrix,” which can be used to evaluate map projection distortion. Imagine perfect circles of the same size placed at regular intervals on the curved surface of the earth. These circles are then projected along with the earth’s surface. Distortions in the size and shape (angular distortion) of the circles show the location and quality of distortions on the projected map.



Mercator Map Projection:
Preserves shapes, distorts areas.

Left: Tissot's circles change size as you move north and south of the equator on the Mercator map projection. The more distorted the circles, the more distorted the areas of the land masses. Circle *shapes* are not distorted.

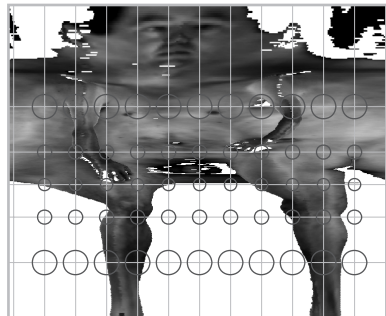
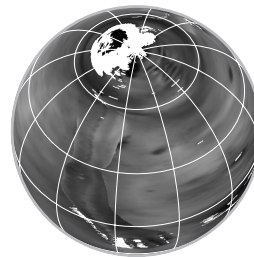
Below: Tissot's circles change *shape* over the surface of this area-preserving map. The more distorted the circles, the more distorted the shapes of the land masses. Circle *sizes* are not distorted.



Equal-Area Map Projection: Preserves areas, distorts shapes.

distorting bodies

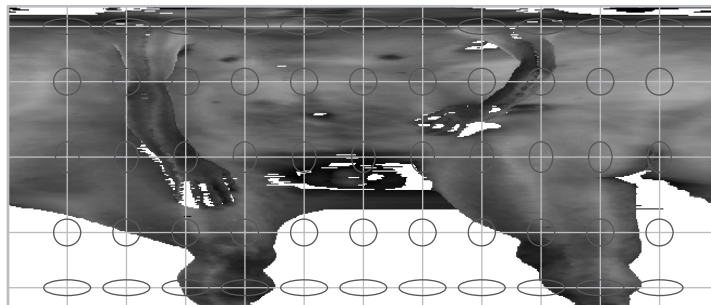
We can use Bill Outcault's projected body to more clearly see map projection distortions. Whenever you look at a projected map of the earth, think about what is happening to the earth. Cripes!



Mercator Map Projection:
Preserves shapes, distorts areas.

Left: Tissot's circles change size as you move north and south of Bill's waist on the Mercator map projection. The more distorted the circles, the more distorted the areas of the body.

Below: Tissot's circles change shape over the surface of this area-preserving map. The more distorted the circles, the more distorted the shapes of different parts of the body.



Equal-Area Map Projection: Preserves areas, distorts shapes.