**Lesson:** Map Projections

**Purpose:**

This lesson will explore how objects from a spherical surface are distorted when projected to a flat surface like a map.

**Approximate lesson time:** 30 minutes

**What you will need:**

* Globe
* Three large sheets of paper (11x17)
  + Leave on sheet complete (rectangle for cylinder)
  + Cut one into a flattened cone (across the wide portion)
  + Cut one into a circle (as large as possible)
* Scissors
* Masking tape
* 3-D printed model of map projection distortions (Figure 1)
  + Please contact me for 3-D printer file
  + Will need to be printed in advance of the meeting

**Introduction of Distortion on Maps:**

* Discuss the three basic methods of projecting the globe onto a map (cylindrical, conic, planar)
* Have the student take each sheet of paper and “wrap” it around the globe
  + Tape the edges of the paper in place to hold the paper in place wrapping the paper as best possible around the globe
* Fold triangle shapes into the bulged edges of the paper to finish fitting the paper to the globe as best as possible
* Remove the sheets of paper and cut out the triangle fold representing the overlapping area of the map which would need to be altered
  + Repeat the process for each projection type
* Lay the sheets out flat and have the student feel where and how prevalent the “missing” areas are for each map projection family
* Discuss how each of these missing areas represent areas where the location information needs to be “stretched” to display the spherical information onto a flat map representing the large area

**Generalized Distortion by Map Family:**

* Have the Map Projections distortion model (Figure 1) 3-D printed or use a 3-D pen or hot glue gun to create a similar flat tactile graphic
  + Note if creating your own image: we created lat-long lines every 30 degrees covering one hemisphere and Printed on a smiley face that extended to 45 degrees in all cardinal directions. This pattern holds for all map projections so they are directly comparable
  + Please use the contact page to acquire a printable file download
* Discuss how the introduction of distortion for each map family would create the different shapes that appear on the different projection families on the 3-D model
  + Cylindrical Family: stretches east-west to a greater extent near the poles creating an ellipse shape
  + Conic Family: stretches eat west to a greater extent I the southern hemisphere creating an egg shape
  + Planar Family: compresses space near the standard point 0 lat, 0 long in this case and stretches further away from the standard point creating a compression in the center and a stretch near the edges of the map

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| **Figure 1:** Rendering of 3-D printer model of basic map projection distortions. Please use the contact page to acquire printable file. |