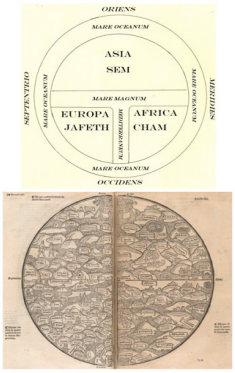
Projections and Globe-Making

Introduction

We're going to take ten or fifteen minutes to look at some maps that were made, in some cases, hundreds of years ago. But before we start I want to introduce you to the word, "Projection." Any mathematical two-dimensional portrayal of a three-dimensional object is a projection. It's basically a fancy word for drawing a flat picture of something that is not flat in real life.



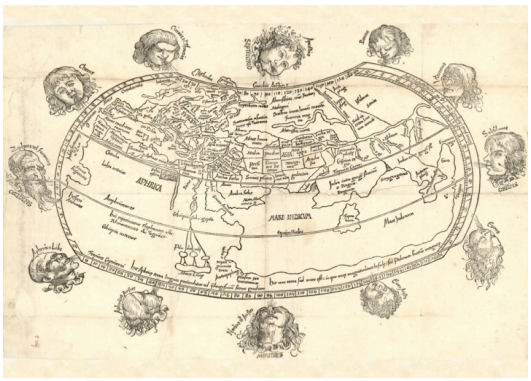
This map of the world, made in 1475, is set up as a T-O map, which is how Europeans made maps during the Middle Ages.

The Middle Ages was the period of time in Europe where there was very little trade or contact with other parts of the world. Medieval maps are called T-O maps because they show the continents surrounded by an "O" of water and separated by a "T" of water.

Interaction: What continents did they know of in 1475? (Asia, Africa, and Europe). Where is north on T-O maps? (to the left). Would you like to travel using this map? (You would get very lost).

Maps made in the medieval style were not trying to show the world as it really looks. First of all, they didn't know the exact shape of the continents, and second of all, they generally weren't traveling anyway, so there wasn't a lot of demand for maps they could travel by.

This is a map of the world printed in 1504, but based on the mapping methods of a 2nd century Greek-Egyptian, Ptolemy. Ptolemy wrote a book about how to map using Longitude and Latitude.



Interaction: Can anyone tell me what I mean by longitude and latitude? (They are the imaginary lines on the globe that say how far north, south, east, or west a place is.)

Latitude tells you have far north or south from the Equator a place is, and longitude tells you how far east or west from the prime meridian a place is. In longitude and latitude, the earth is separated into 360 degrees. A place's longitude can be anywhere between 0 degrees and 360 degrees, but its latitude can only be between 0 degrees and 90 degrees.

Interaction: Can anyone tell me why that is? (When you go one degree over a pole, you are back at 89 degrees.)

OLDER STUDENTS Interaction: Who can calculate the number of degrees the earth turns in one hour. (15 degrees).

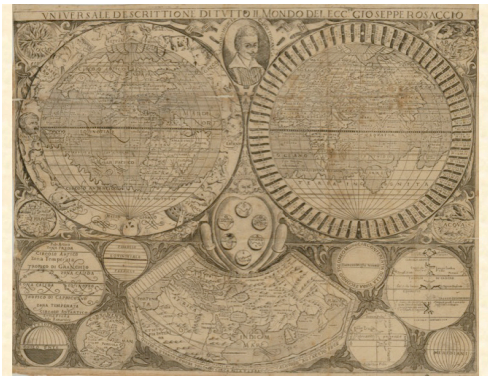
Interaction: Can anyone find the compass rose on this map? (It is the windheads.)

Interaction: Which wind is the same as our Northwest? (trick question: the Greco-Roman system of 12 winds doesn't have NW, SW, NE, or SE).

This map was made by an Italian mapmaker a bit after the Middle Ages had ended.

They called these Portolan Charts because they were made to help sailors sail between ports in the Mediterranean Sea. There's something on this map that wasn't on the last-- a traditional compass rose. It was Italian sailors who came up with the 8 wind system that replaced the Greek and Roman 12-wind system. Of course, today we think of them as directions rather than winds.

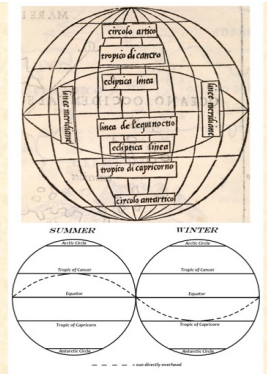
Interaction: Can anyone guess why this map is shaped like this? (It is made of Vellum, not paper. Vellum is animal skin, and the skinny part to the left is the neck).



This map was also made by an Italian, but during the 1600s, when Italy and other European nations were conquering parts of the New World and Africa. They mostly stayed near the coasts for two reasons: first, it was easier to ship people and things to and from coastal areas; and second, many Europeans couldn't survive inland, especially in Africa.

Interaction: Does anyone know why it was so dangerous to go inland? (Malaria)

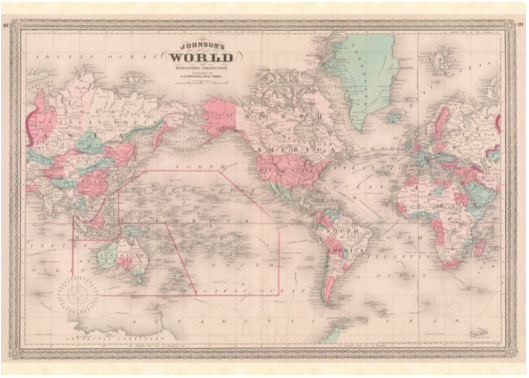
Today we know that malaria is spread by mosquitoes, but in the 1600s, it was thought that malaria and other diseases were carried on southern winds. This is why some maps show southern windheads as skulls.



There was a time during the middle ages when Europeans believed that the Equator, the line exactly between the North and South poles, would be so hot that humans wouldn't be able to breathe. By the time this diagram was made in the 1500s, however, they had not only figured out that breathing was quite possible at the Equator, they had mapped out which places would get the most sunlight at different times of the year.

The four lines on a globe or map that have to do with sunlight are the Arctic Circle, Tropic of Cancer, Tropic of Capricorn, and the Antarctic Circle.

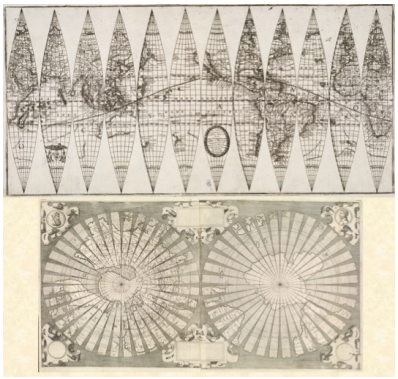
> *Interaction*: At the very peak of summer, the lands around which tropic will get the most sunlight? (Tropic of Cancer). So the Tropic of Capricorn will get the most sunlight at the peak of winter. What about the Arctic and Antarctic circles? Does anyone know why these are important? (At the very peak of summer, called the summer solstice, lands south of the Antarctic circle will go a full day in complete darkness. On that same day, land north of the Arctic circle will go a full day with sunlight. This is sometimes called "midnight sun." The opposite happens at the Winter Solstice.)



This map was made hundreds of years after the other maps we've seen. But it still does not show the Earth exactly as it is. Even today, with our satellite pictures, all maps have something wrong with them.

> *Interaction*: Why is that? (Because you cannot take something round like the earth and show it's surface as flat without stretching or splitting up parts).

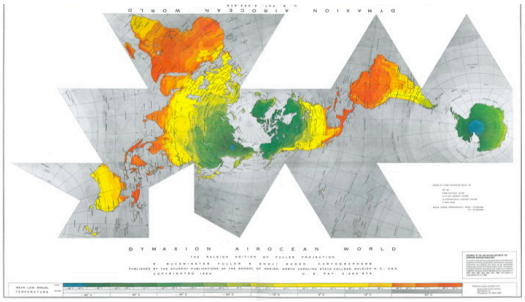
The man who made this map, Gerard Mercator, stretched out the parts of the Earth around the North and South pole to show the earth as flat. So on his map, Greenland looks as big as Africa. In reality, however, it's only the size of Argentina.



This top map was made by a man named Vincenzo Coronelli.

The parts of the Earth that Mercator stretched out, Coronelli simply split apart. Each of these rounded-diamond shapes are called gores. If you were to cut them out and paste them around a ball, you would have a globe. But when it is just laid flat like this, places like Greenland are split in half, even if they're about the right size.

The bottom map works the same way. If you were to cut out the long, skinny triangles and paste them on a ball, you'd get another globe.



A man named Buckminster Fuller, or Bucky, made this map in the 1940s.

Like the last map, this one can be turned into a globe, except Bucky's globe would have 20 triangular sides. Bucky designed his map so that the 20 triangles can be rearranged. Also, Bucky often said that North, South, East, and West don't really exist.

> *Interaction*: I'd like everyone to imagine yourself in outer space. Can you go North? (no).

If you're floating in the middle of outer space, you can't go up or down or East or North. You can only go in or out. In other worlds, you can only go towards a gravitational body, like a planet, or away from it. So Bucky didn't think showing North or South on his map was important.

Activity Transition

Older Students: For our activity, we are going to take Coronelli's map and Bucky's map and turn them both into globes that you get to take home with you.

Younger Students: For our activity, we are going to practice drawing a map that we can then turn into a globe that you can take home with you.