E. Space & Data: The Tools of a Geographer

STANDARD: Identify different methods of geographic data collection

Data, Data, Data…

Where does a geographer get their information about Earth's space and the objects that are distributed within that space? With billions of people living upon millions of miles of space, there is a nearly infinite amount of data, or information, that can be collected and analyzed. This enormous amount of information can be broken into two main categories: qualitative and quantitative data.

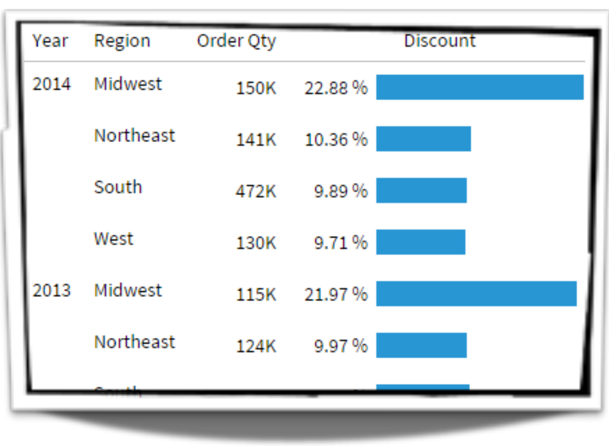
Qualitative data refers to the qualities of what is being observed and experienced, but *cannot be directly measured*. This data includes, but is not limited to: color, taste, smell, appearance and emotional appeal. Qualitative data is very subjective and can change based upon the person who is completing the data collection. When you finish a meal or return from a trip, friends and family may ask about your experiences. They are requesting qualitative data bout the meal or the location you visited: how did the food taste? Did you enjoy the atmosphere? How did the trip move your emotions? One person can go to a modern abstract art gallery and write a review about being overwhelmed by the beauty and creativity of the artist. Another person may go on the same art tour and be underwhelmed by the seemingly random and haphazard nature of the "art." Qualitative data is hard to gather, most commonly taking the form of personal interviews, field observations, media reports, and travel narratives.

Qualitative Data
- White Cup
- Creative Teal Logo
- Delicious tasting coffee
- Amazing aroma

Quantitative Data
- 12 Fluid Ounces
- 8 inches tall
- 5 inches wide
- Coffee temperature 195*F
- Coffee Cup Cost $12

Quantitative data refers to the *measurable quantities* of what is being observed. This is data that can be shared and understood across time and cultures by using standardized units: length, height, age, area, volume, weight, cost, speed, time, etc. A 5 kilometer race in the USA is the same distance as in Uzbekistan. The Eiffel Tower can be measured as the exact same height by observers from Latin America, Africa, and Australia. The area of a city can be precisely measured, or a population of a country can be counted. Data may be presented in the form of business reports, scientific studies, and government policies. Quantitative data can also include identifying/labeling the specific species of plants/animals in a location.

Zip Code	2017 Sales	2018 Sales	%Change
60007	10,000	10,200	2.0
10001	21,284	25,584	20.2
48127	584	500	-14.4
90001	400,483	410,002	2.4



Small Scale Gathering

The most basic form of data collection is done at the single person or small group level. For example, field research consists of a person or small group, driven by a certain hypothesis, entering specific space(s) or accessing databases to collect relevant information to be analyzed and synthesized. An example of field research would be a woman taking a t-shirt from the store and tracing the journey of the shirt from the cotton field to the department store. Another example would be a person standing in a restaurant collecting observational quantitative data on the race and gender of the students that sit at each table during lunch time, along with the qualitative data about the experience the customers were having. Along the same line would be a business running a sales report. The company collects the quantitive data of who purchased their product, where those customers are from, then produces reports about how sales in each location change over time. This data allows tables, charts and graphs to be made to display the quantitative data, allowing the company to make informed decisions for future efforts.

Akin to field research are personal interviews and travel reports. Interviews are conversations between two (or more) individuals, discussing a person's life experiences or opinions about certain topics. Interviews can be conducted face-to-face, over the phone, or asynchronously through e-mail or letter writing.

This is a very powerful tool for gaining qualitative data about a topic on both a personal and regional scale. For example, for a state government to better understand the care and treatment of patients with long term illness or disabilities, an employee would interview patients and their families to gain qualitative data about their health care experiences. Travel narratives and media reports are the result of one person (or a small group) researching a location, event, or cultural group and then providing qualitative/quantitative data about the author's experiences.

A third data gathering tool is photographic and landscape analysis. The researcher studies photographs taken either in person or by drones to gain an understanding of places and locations. A person/group walks through or flies over various landscapes making observations about the physical features or the cultural influences of the inhabitants. Landscape analysis can also be done with before-after pictures of the same location. Tools such as ESPN and 4 Level analysis are used to attempt to gain a full understanding of any phenomena being witnessed.

APPLICATION #1. Read the Travel Narrative about Brazil. List the qualitative and quantitative information provided. How is this narrative different from the table on the previous page?

APPLICATION #2. Complete an 4 Level analysis of this photograph. Pay attention to what qualitative & quantitive data are made available by this picture. What are the limits of this small scale photograph?

When in Brazil, Just Follow the Music

By Sebastian Modak (Source, NYT)

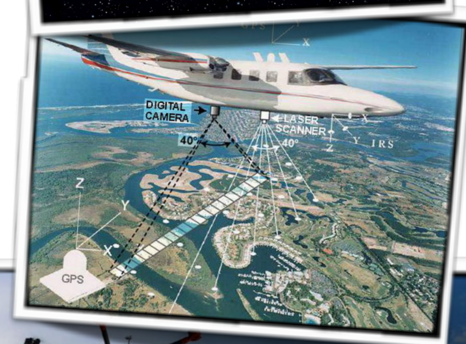
For the first time in six months, I would have to rely on memory alone: No cameras allowed. In my packed section of male spectators (women were at the other end of the room), there wouldn't have been enough space to lift my camera to my face even if I'd been allowed.

The pattering of long cylindrical atabaque drums, a sound like rainfall with occasional syncopated claps of thunder, bounced off the room's white walls. Over a floor strewn with leaves, women dressed in billowing white dresses danced in circles while answering every sung call from the lead drummer. Occasionally, a dancer would fall into a trance, body shaking, head rolled back until another woman would approach her, rub her back and whisper words that would bring her back to this plane.

Over the course of the night, I watched as practitioners of Candomblé, a religion originating with the enslaved Africans brought to Brazil hundreds of years ago, paid their respects to Oxóssi, one of the pantheon of orixás that form a link between this world and that of the divine. For four and a half hours, the music barely stopped…

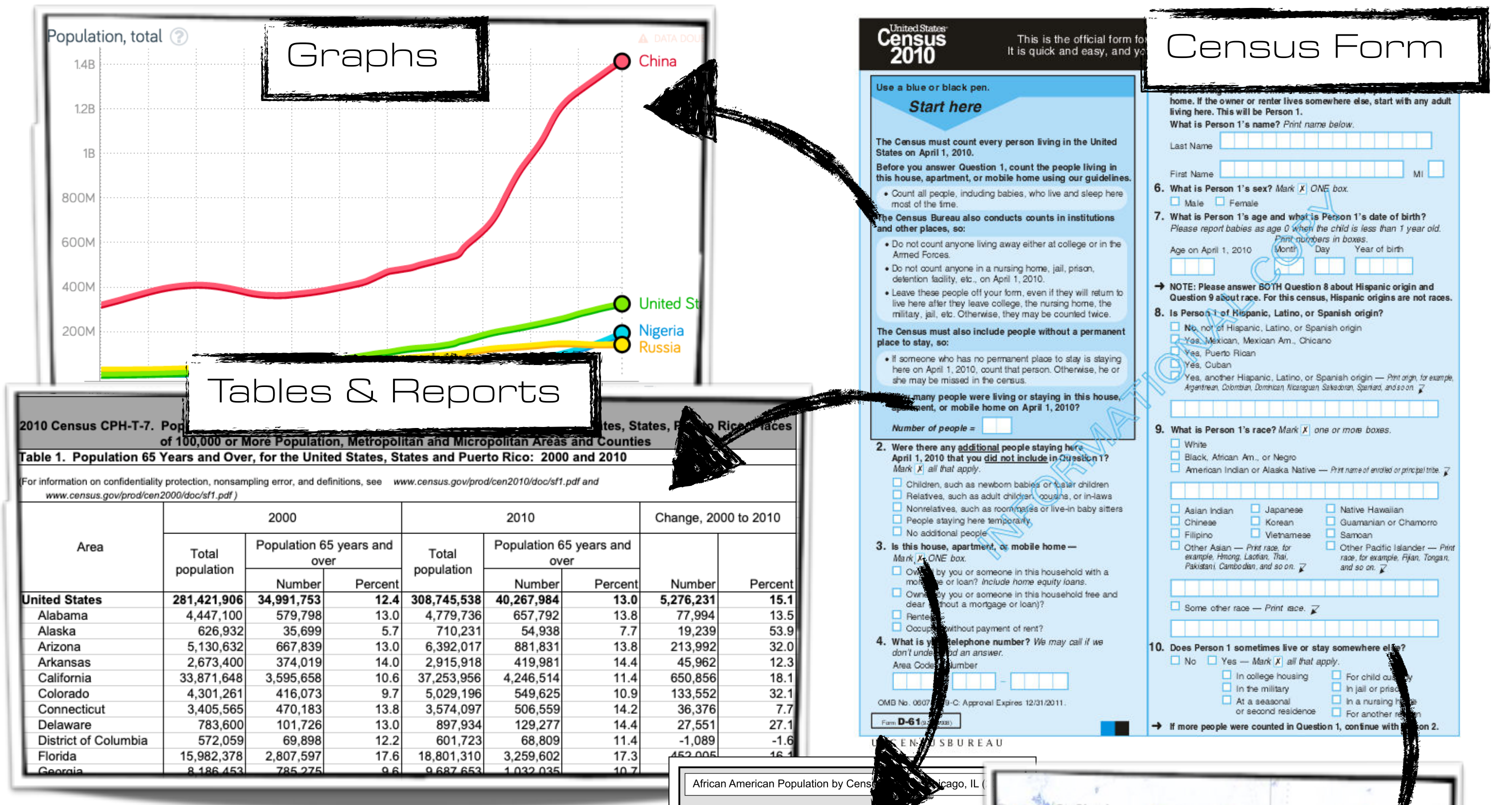
Large Scale Gathering

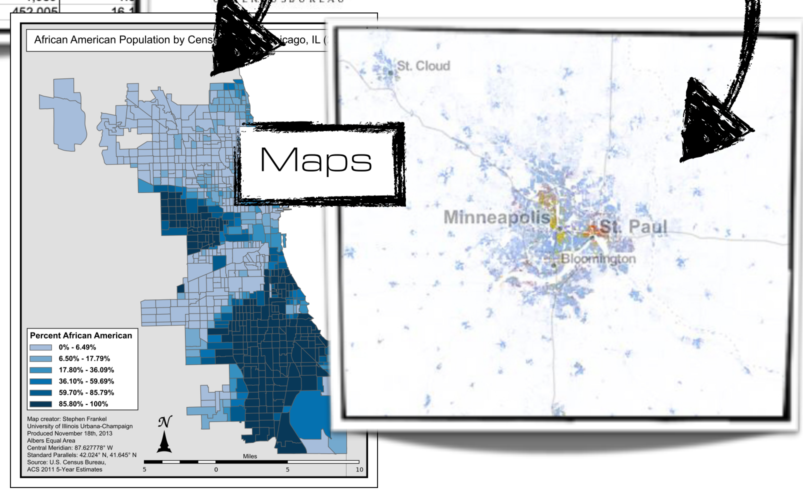
In the modern industrial age, governments and large business corporations have developed many powerful, large scale data gathering tools. Tools such as satellites provide a unique perspective that the average human is not capable of achieving: a view of Earth's space from a distance. A series of over 24 satellites stationed around the earth use the Global Positioning System, or GPS to determine the absolute location of objects on earth's space. A high quality GPS device can track the difference in location of an object down to a couple inches. GPS is also capable of measuring the distance between locations and can calculate the distance between objects on opposite sides of the earth in mere milliseconds.



Another means of data collection is remote sensing. Remote sensing equips satellites and aircraft with lasers and photography equipment to capture quantitative data for the purpose of obtaining a tremendous amount of information about the earth and the activity of its inhabitants. This includes: pictures of Earth's surface, heights/shapes of mountains, weather patterns, ocean temperatures, chemical emissions, coast line measurements, the size of urban areas, traffic patterns, animal migrations, military unit positions… The quantity of information that is gathered through satellites and aircraft every second of the day is unfathomable. Remote sensing can be conducted at every scale of analysis. Satellites can collect time lapse data from the entire world to give the global perspective - like the "world at night" picture you analyzed in the last reading. Regional and national data can be gathered an analyzed. This is frequently seen in weather forecasts. Remote sensing has evolved in recent years to include drones, which has rapidly expanded the ability to gain data from the local scale.

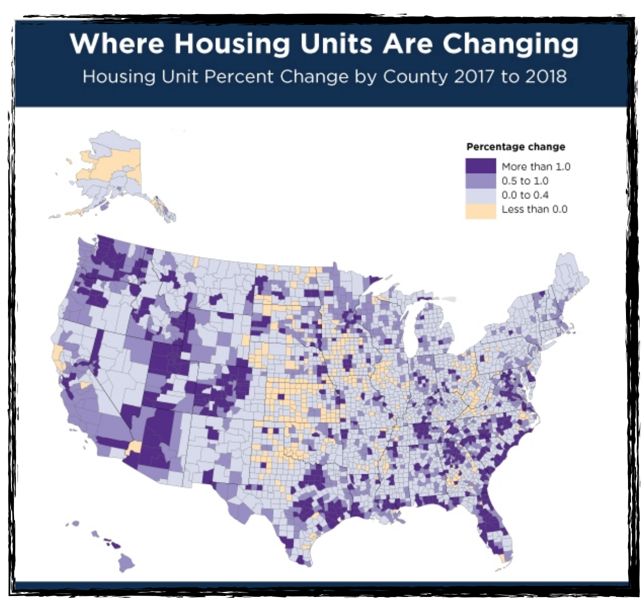
APPLICATION #3. These images were captured of Palu, Indonesia using remote sensing technology, showing the space and after the 2018 Earthquake and Tsunami. Brain storm how Palu changed from these natural disasters. How could the Indonesia government and relief organizations use these images in their policy/decision making?





Adding to the endless amounts of information is census data. Every 10 years in the USA, the government sends out a mandatory survey to each household. The survey collects quantitative demographic information about the people dwelling at that address: age, race, occupation, income, number of cars, level of education, etc. This data is collected and used to track trends within the population. Based on these trends government organizations and businesses at the national and local scale use the data to make decisions. Businesses can use the data to find ideal clients and markets, watching for emerging trends or new business opportunities. Marketers can locate their ideal clients or help identify where to place a new store. State governments can see changes in demographics and income, helping them to plan upcoming policy for providing services to people like education, transportation, and health care. In the USA, census data is used for the following purposes:

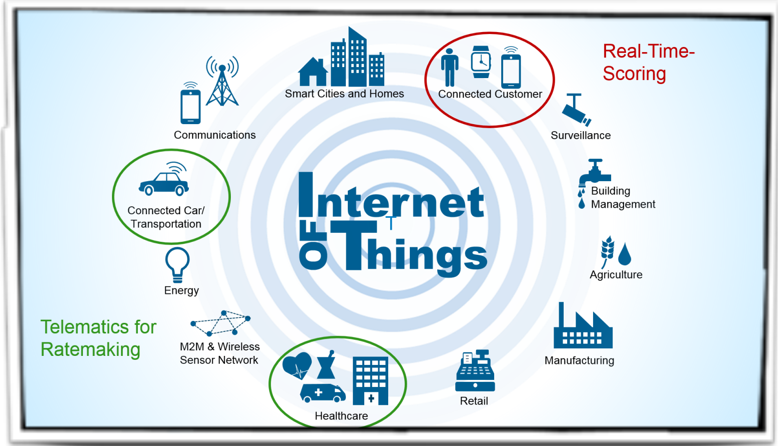
- legislative/congressional voting districts,
- planning and emergency measures,
- distribution of government funds and services,
- intelligent maps of businesses,
- tracking economic, social and demographic trends, and
- zoning rural and urban land.

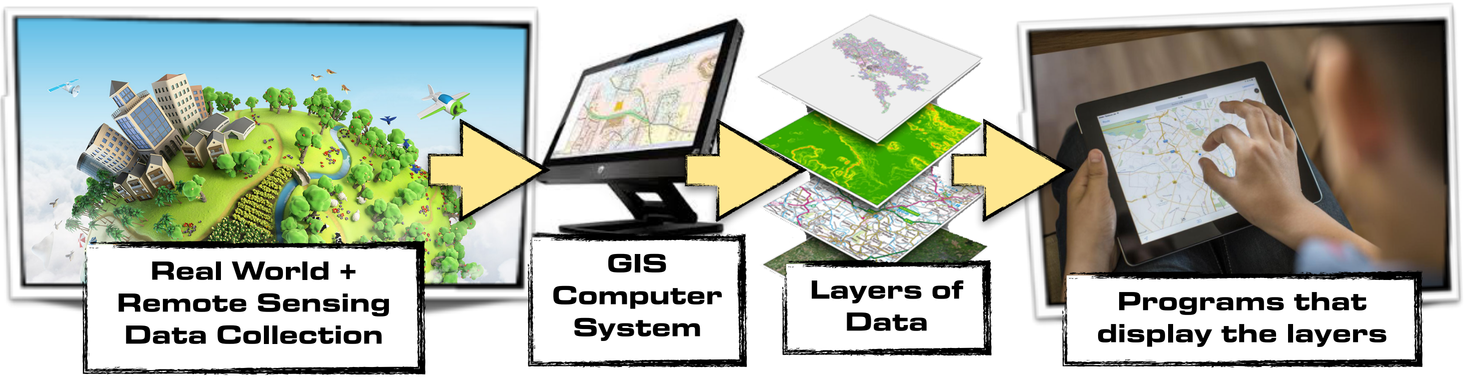


Any country with a semi-functional and stable government performs a census at regular intervals because of the immense value of the quantitative data. If a country is "lacking data" it is either a sign of the government being unwilling to share that information publicly, or a lack of ability to gather it.

STANDARD: Geospatial data is used at all scales for personal, business, gov't decision making purposes.

A fourth source of information gathering is the Internet. When users access the internet through their phones or computers, it instantly creates a trackable trail of data that governments and businesses aggregate and interpret in real-time. Everything a person searches, posts, tweet, selfies, purchases, views, and clicks are tracked (even in "private/incognito" mode)… not to mention the location of where that data was accessed is gathered. The "Internet of Things" has been the evolution of our tools and technology to always be "on" and communicating through the internet. From phones and tovs, to cars and airplanes, to hospital equipment, factory machines, refrigerators, sidewalk sensors, doorbells, and thermostats. It is projected that over 25 billion technological devices will be connected to the internet around the world by 2020. This creates up-to-the-moment snapshots of where people are located, their age and gender, what they look like, what they are wearing, their thoughts/emotional states, what ideas/topics/products are popular, what activities they are participating in… a nearly endless stream of qualitative and quantitative information for businesses and government organizations to interpret and utilize. The downside of data gathered from the Internet is that it only gathers data from those who are *on the Internet*. Regions with limited Internet access are not accounted for in the data-gathered; thus data is skewed and only shows the rich and developed regions with internet access.





Displaying Data

What can be done with all this data? The sheer volume is too great for any one human mind to fully comprehend and compute. Geographers utilize Geographic Information Systems (GIS) to assist with the collection, manipulation and expression of the information; a process known as data aggregation. GIS are computer programs that take the data, analyze/categorize it, and then display the information in a variety of digital formats. GIS systems can produce maps, charts, graphs, tables, and 3D images (depending on the data and the end purpose).

One powerful GIS tool is online mapping, with data appearing as "layers" that can be turned on and off. When a person goes to Weather.com to see the weather radar, they are accessing layered information gained through remote sensing. The user can switch between maps displaying temperature, humidity, and precipitation with the click of a button. This empowers apps like Google Maps to allow users the ability to analyze images and information like traffic, business locations, or tourist information. Every map and chart used in these texts was produced by someone collecting data, putting it into a GIS Computer, and creating a visual display of the data. Through GIS, inconceivable amounts of information become consumable through a single image… even updated in real time. The possible uses of data gathering and visual displays with GIS are nearly as endless as the data collected.

APPLICATION #4. Brain storm ways in your life you (a) provide data to business/gov't and (b) use data/maps/charts.

STOP Close your eyes and recall the headings, main ideas, etc from memory. Don't move on until you got 90% correct.

Application: The Human Rights Watch Analyst on the Violence in Myanmar (NPR 9/7/2017)

Aung San Suu Kyi won the Nobel Peace Prize in 1991 for standing up to the military government in Myanmar on human rights abuses. But now that she is in the government, she has remained relatively silent about the systematic attacks on one minority group in that country. They're called the Rohingya, and Myanmar's government refuses to recognize them as legal citizens of the country, even though they have lived there for generations. Those who have fled across the border into Bangladesh tell stories of systematic rape, murder and arson. Aung San Suu Kyi's critics want her to speak out. Here's her fellow Nobel laureate Muhammad Yunus speaking to us via Skype from Bangladesh.

A new round of violence began after Rohingya insurgents launched a coordinated attack on Myanmar police posts and even an Army base in August. Richard Wier is an analyst with Human Rights Watch, and he has worked in Myanmar. He's been analyzing a series of satellite photos over the past few weeks, and I interviewed him, asking what his satellite photos revealed:

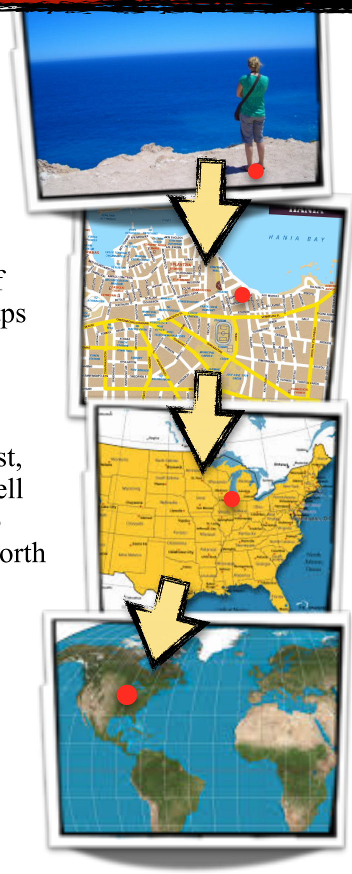
WIER: After the violence broke out on August 25, what we started seeing was thermal heat signatures - that environmental satellites designed to pick up forest fires were indicating that there were large fires burning in northern Rakhine State."
MARTIN: So what did it mean when you saw those indications? I mean, you say that's where fires are happening. Do you know that that corresponds to where villages are?
WEIR: Right. So we saw the indications that there were burnings, and we matched those with known locations, known GPS coordinates of villages in those areas. And we can't say for sure that those villages are on fire or that anything has been destroyed. But what we saw subsequently after clouds broke - because it's monsoon season...
MARTIN: Which would make it difficult, but you're saying...
WEIR: It makes it very difficult to see. So far we've only seen two of the 21 different sites that we've detected large fires. And in both of those sites, massive destruction.
MARTIN: And when you say massive destruction, how much detail can you make out from these satellite images?
WEIR: Well, we can see what the town looked like beforehand and the destruction afterwards.
MARTIN: And there are no people in any of these images.
WEIR: Not anymore, no. And in one village, Chein Kar Li, which is a Rohingya village, we saw 99 percent of the town destroyed. That's 700 buildings. In another part, in Maungdaw Township, in northern Rakhine State, we saw 450 buildings destroyed in what is predominantly a Rohingya neighborhood.
MARTIN: You have staff who are trying to follow as best they can the situation from Bangladesh on that side of the border. What are those people telling you about the situation?
WEIR: Right. Well, we haven't been able to get access to northern Rakhine State, and, really, no one can. So we go to Bangladesh. And, unfortunately, the stories that we're hearing now are the same stories that I heard when I was in Bangladesh after the outbreak of violence in October 2016, which is that the security forces are burning down villages, they're shooting people indiscriminately as they enter villages and they're using weapons like mortars and machine guns to fire on villagers.
MARTIN: Myanmar's civilian leader Aung San Suu Kyi, a Nobel Prize winner, has said that there is a campaign of misinformation happening about this situation and the fight against the Rohingya, specifically mentioning fake news photographs. Presumably she's talking about the satellite images that your organization has been reviewing. How do you respond to that?
WEIR: Well, I would say that there has been some misinformation, but that's why we don't take anything at face value. That's why we take testimonies from Bangladesh. That's why we take our satellite imagery. So while the satellite imagery itself doesn't allow us to draw any real conclusions, it's part of a broader picture.

APPLICATION #5. Describe the role data gathering & displaying has played in understanding the Myanmar crisis? What conclusions did the Human Rights Watch make from this data?

STANDARD: Geographers use maps and data to depict relationships between time, space and scale

F. How to Display Space & Data?

About Maps



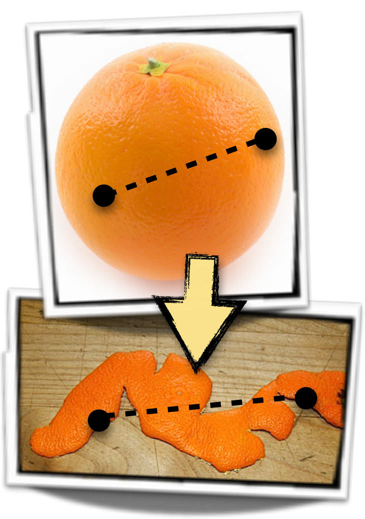
Maps are extremely powerful tools for viewing and understanding the world. If human beings were left to our own bodies to understand the world, they would be bound by the limitations of sight and mental capacity. Due to the curve of the earth, the human eye can only see about 3 miles of the earth's space. Even in the best conditions, the spherical shape of the earth only permits 30 miles of sight. And from a space ship, a human can only see half the earth at once. This means that of earth's 197 million square miles of viewable space, a vast majority is out sight from the average human being. Herein lies the power of maps: their ability to display more of earth's space in one image then can be seen by the human eye under any conditions. Maps have the ability to display data across varying scales of space - from small town road maps with individual houses, to continents, to displaying the entire globe.

Maps have the ability to present enormous amounts of information in a simple, easy to read format and can display layers of information across the spectrum of time: in the past, present or predicted future. This allows maps to unveil the patterns of phenomena, as well as revealing changes over time and space. Maps can be used to identify problems and to create solutions. If a picture is worth a thousand words, then a good map may well be worth a million.

In HuG, it is important to take the time to analyze any maps presented in the text or in the course work using the 4 Level Analysis and the ESPN methods. The maps are used not as space fillers, but as a high density laser beam of critical information that would otherwise take millions of words to attempt to express. They are critical to grasping the concepts and trends presented in the course material that WILL be a part of multiple choice and essay questions.

The Problem With Maps

Maps do have an inherent problem - they deceive. Maps are reflections of the truth, but are incapable of displaying the complete, unaltered truth. Through no fault of their own, maps are a human attempt to take a three dimensional, spherical world with millions of trillions of pieces of information and replicate it onto a two dimensional sheet of paper. There are a two general ways a map can deceive:



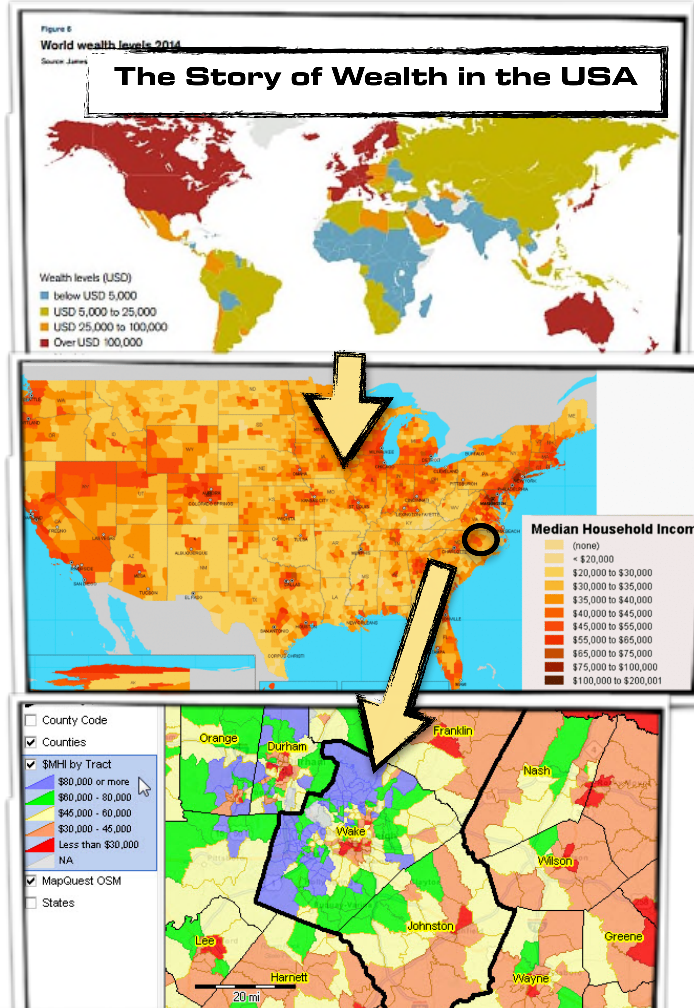
Distortion. As a map transforms the spherical 3D into the rectangular 2D, something has to change or be altered. There are two aspects that change: the accuracy of the shape of the objects being displayed on the map or the accuracy of the distance between points on the map.

- *Shape Distortion.* Imagine taking an orange and trying to lay the peel flat on a table. Is it possible for the peel to keep its original spherical shape while also achieving flatness? Nope. The peel will be bent, torn, and stretched, altering the shape to achieve the goal of becoming flat. So to on a map, the shape of countries change when being displayed in two dimensions. The larger and more global the scale, the greater the potential for distortion.
- *Distance Distortion*. Returning to the original orange, imagine you put two dots on the orange and measure the distance between them. Then, once the orange has been peeled and flattened, you remeasure the distance between the two dots. Would the distance between the two dots be the same? Again, no. In the process of flattening the object, the distance changes along with the shape.
- *Achieving Balance*.Every cartographer (map maker) has to make a decision when creating a 2D map to either prioritize the accuracy of the shape of the countries ***or*** the distance between objects. Sailors want a map that has accurate distances between the objects, with little care about the object's shape. A teacher or TV Weather person wants a map where the objects "look correct" with little care about the distance between objects.

Displaying Data. Maps are frequently used to visually display complex sets of data. However, maps are incapable of displaying the complete truth about their information. Because of the vast quantity of data and the limited amount of space on a map, certain information will receive more emphasis than other. This also means some information will be displayed prominently while other information will be entirely left off the map. Thus the cartographer must decide which "story" the map displays… and what information will be left off. This creates an inherent bias based on the author's interests or intent. This is especially true when considering the influence of scale. The more global the scale, the greater the generalization of the data, the more details that are left off a map. For example, on a map of the world, it is impossible to show the individualized ethnic, political, or shopping tendencies of each individual person within China. However, this more detailed data becomes observable on a small-town map. It is left to the biases and intentions of the cartographer as to which data is displayed and how the data is presented to the viewer.

How the data is displayed has a tremendous impact on the biases of the map, especially when it comes to the choice of whether to display data using percentages or raw numbers. For example: a cartographer is attempting to compare crime rates of the towns and cities in the state of North Carolina. Autryville, NC has a population of 203 people with 2 acts of robbery. Charlotte, NC has a population of 790,000 with 1,500 acts of robbery. If the map used percentages, Autryville has an atrocious .96% robbery rate compared to Charlotte's heavenly .18% crime rate; making Autryville appear significantly more violent on paper than Charlotte. However, if the map was to display solely raw numbers of robbery crimes, Autryville's 2 acts of robbery would appear as almost nonexistent compared to Charlotte's 1,500. *How* the map displays the data determines which location appears to be the safe haven or the home of villains.

A second obstacle is deciding how many categories to display on A map. If the author decides to only show three colors/categories, the data will be more generalized. If the author decides to use eight colors/categories, the data will be displayed with greater detail.

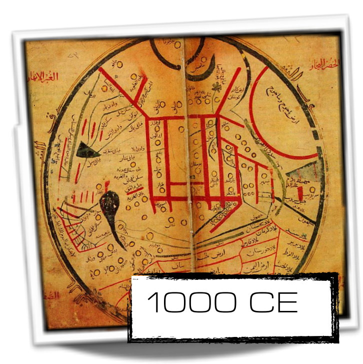


APPLICATION #6 All 3 maps relate to wealth: Global, USA & County Level. How does the story of wealth in the USA change as the map moves from Global, to National to Local scale?

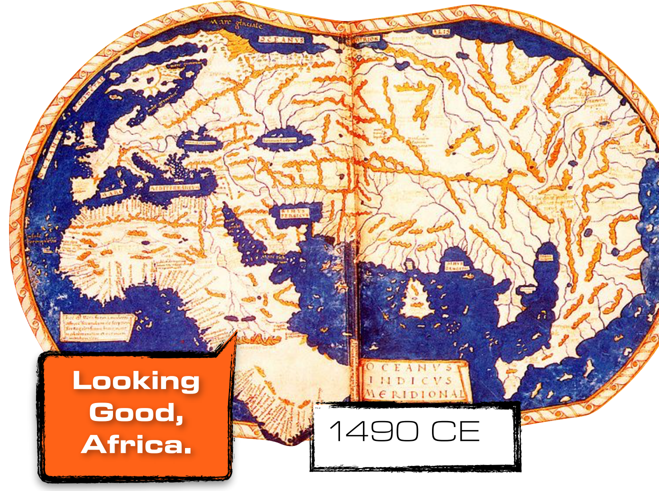
A Brief History of Cartography

600BCE

Before exploring the various types and projections of maps, it is important to understand the process of how humanity came to achieve the beautiful maps that modern society now takes for granted. The stunning maps presented in this book were all developed between 1950-2000 CE by the use of satellite technology and remote imaging. However, before satellites, the process of cartography was understandably difficult. To create a map, a surveyor had to walk or ride a horse across the land; stopping every so often to draw what had been seen. Coast lines were drawn by sailing along shore on a ship. The stone to the left is the earliest known human map from 600 BCE. This map would have been top secret, confidential information; only the King and a select few loyal subjects having access. Maps were power. An accurate map gave locations of key resources, geographic features, and access points to the kingdom. Maps were key to successful business, trade, commerce, and border security. By 1000 CE, much was left to be desired in the realm of cartography. Progress over the previous 1500 years had been slow.



1000 CE



Heading into the 14th and 15th centuries, there was an explosion of human activity. The Indian Ocean Trade routes and the beginning of Portuguese exploration of Africa led to an immense transformation in the mapping of the world. In 1490, this was the best map in the world - developed by Middle Eastern & Chinese sailors - just before Columbus's attempt to sail west for China & India. Europe, Africa and Asia had begun to take shape on paper, but the sizes and shapes were significantly different from what modern societies are now accustomed to viewing. It is with maps like this, along with a chart of star constellations, that brave European explorers set sail with . . . . off the edge of their maps and into the open waters of the unknown.

As the Age of Exploration evolved, so to did maps. Every year brought a wealth of new information. By 1590, dramatic transformations had begun, with the addition of chunks of the Americas. In 1630 the world map finally began to resemble the maps so common today. Every century brought new refinement and more precise detailing. Finally, in the 1960s, the launching of Sputnik by the USSR brought the world into the satellite age. Then with the discovery of radio waves and remote imaging, detailed pictures of the earth brought accuracy to maps the early cartographers could only dream about. Now, maps are so common, every person with a smartphone or a computer can access a perfect, detailed map of any part of the world, on any scale, any time they want to (and even have a satellite guided GIS give them specific directions while they are traveling there).

Types of Maps

Since maps are tools, there are different types of maps that are useful for different purposes. While each map type has a plethora of nuances to explore, they will be saved for another course. The required knowledge for HuG is to be able to appropriately identify each map type, read and interpret the information being displayed, and then determine the appropriate situations for when that map should be utilized.

Mental Maps

Mental maps were the first type of map developed by humans. National Geographic describes mental maps as "an individual's representation of aspects of the earth's surface." Take a moment and think of your bedroom. What comes to mind is your mental map of your bedroom: the location of your bed, how it is positioned with the door, the place for clothes, etc. What may have also come to mind are the emotions tied to your bedroom: a favorite place to sit, daily routines and habits, or memorable posters or trinkets. Thus, a mental map is a combination of quantitative data (exact locations and numbers of objects) and qualitative data (favorite items, colors, emotions, habits) about a space.

Mental maps, like regular maps, are able to change scales. A person has a mental map of many places: the space where they live, the area surrounding their home, the town/city where they work/shop/play. People who have access to education have developed mental maps of their region, country, as well as the world. Conversely, a person who does not have access to education may only know about the world they have physically seen and experienced. There are tribes in the Brazilian Amazon that have never experienced space outside of the rainforest and cannot comprehend that there are objects that could be more than 3 feet away from their face.

While Americans have come to rely on technology for accessing maps, it is critical to develop a high quality mental map of the world and the different places in it. In an age of mass globalization, being able to mentally place where locations and events are taking place will lead to being a more successful student and global citizen. For example, if the reading discusses increased deforestation in Brazil - the ability to mentally envision the location of Brazil will help you to both understand the situation, as well as answer questions or make connections about the impact to the surrounding regions.

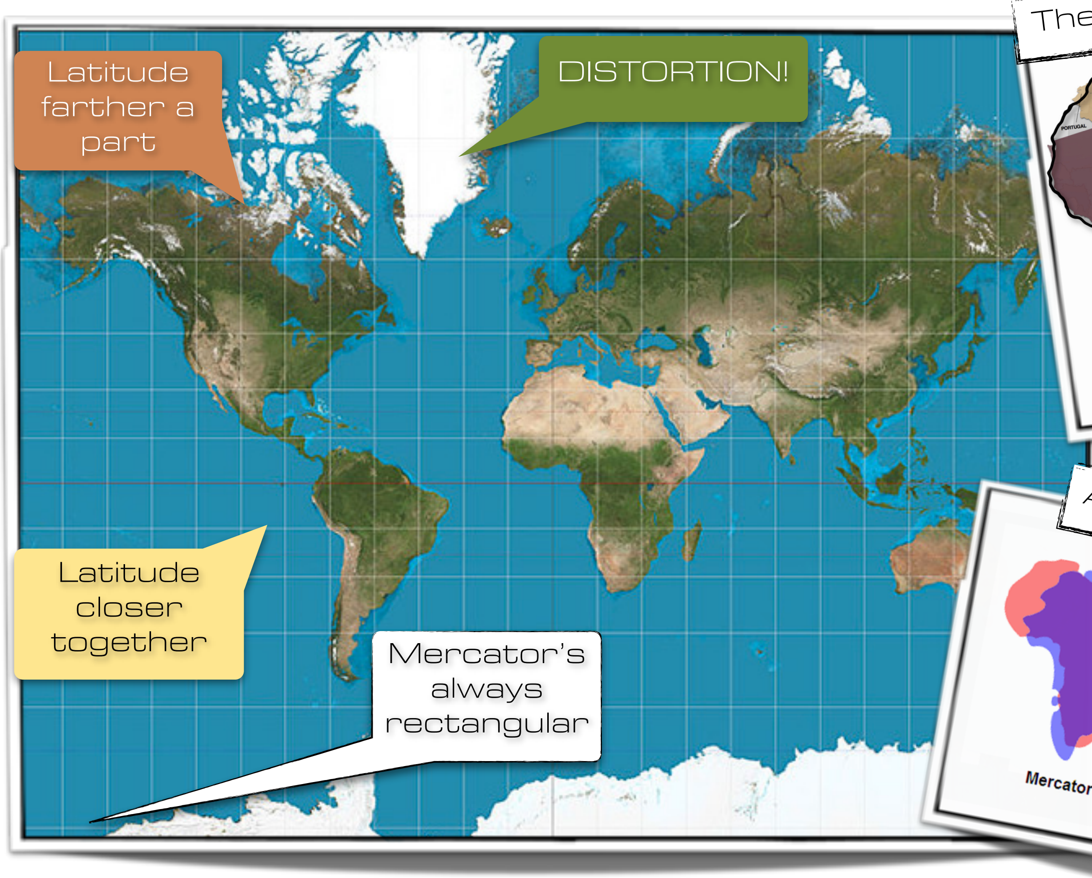
Projections

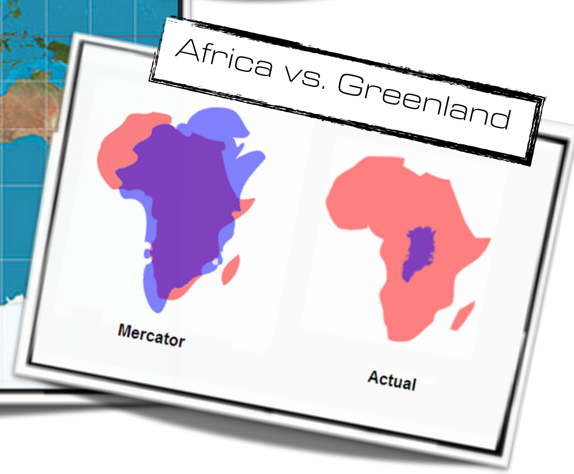
While mental maps are beneficial to individuals, maps in a paper or digital format are critical to sharing information between individuals or groups around the world. The display of the space of Earth as an image is called a projection. There are many different types of projections, each serving a specific purpose:

STANDARD: Identify types of maps & different spatial patterns/ relationships displayed on maps

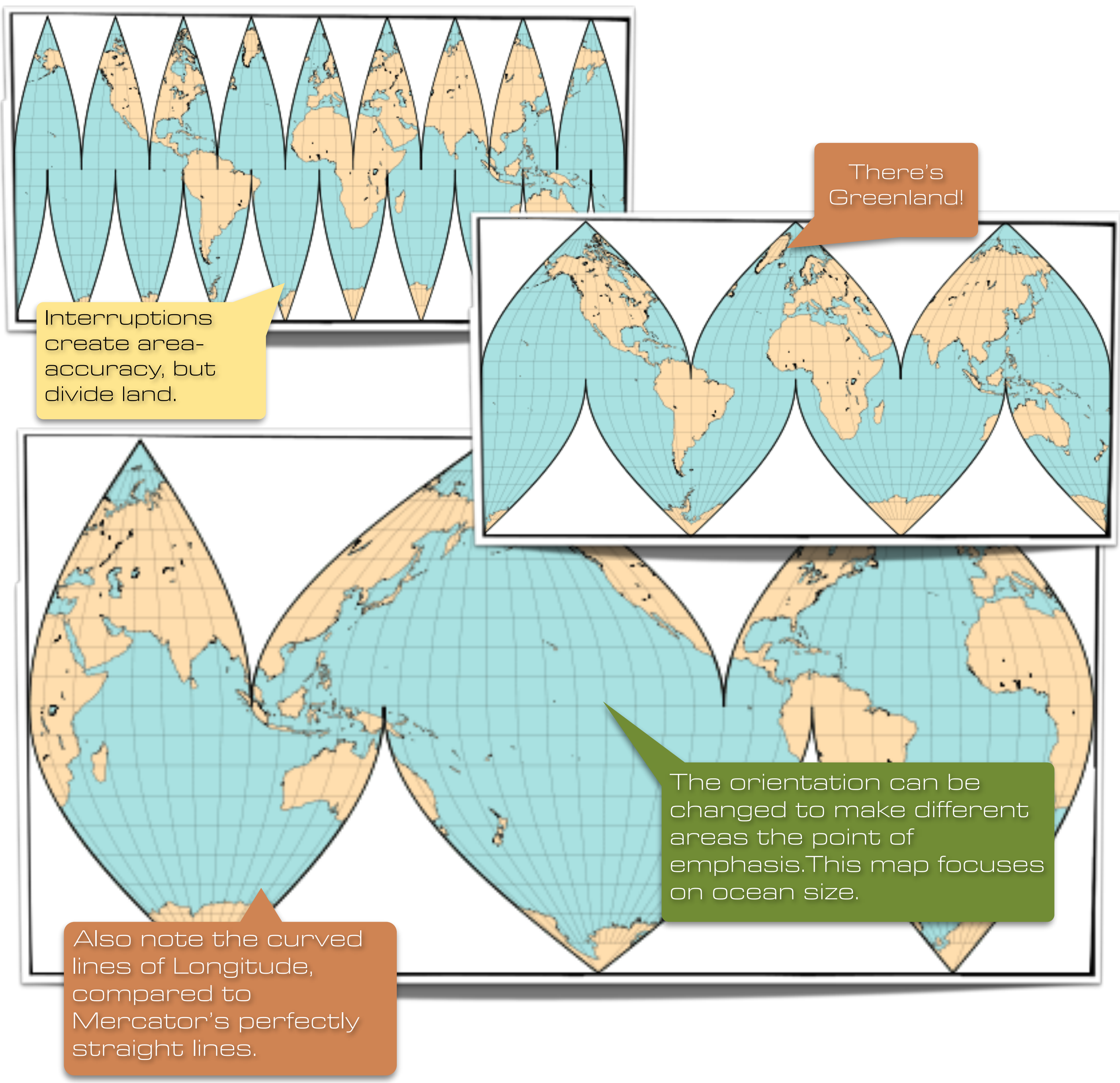
Mercator Projection. The Mercator projection is a map for the purpose of travel, in particular a map for sailors. When the Mercator projection was invented in the 1500s, it was aimed at keeping the angles of the land forms “correct” so that the distances between objects would stay "true" to the Captain’s compass. Using the Mercator projection, a ship's captain can use the perfectly straight lines of latitude and longitude on the two dimensional map, along with their compass, to know where in the world the ship was at any give time.

However, to achieve this mathematical feat, the Mercator Projection creates an immense shape distortion. The lines of latitude near the equator were moved closer together, while the lines of latitude closer the North and South poles are farther apart. This kept the distances correct between objects according to a compass, but caused some land masses to be overly stretched or shrunk. The result is a size and shape distortion that is most apparent when looking at Africa and Greenland. In reality, Africa is *massive;* more than 14 times larger than Greenland! The land area of China, USA, India, Mexico, Peru, France, Spain, Japan, Germany, Norway, Italy, New Zealand, UK, Nepal, Bangladesh and Greece can all fit onto the continent of Africa with room to spare. However, due to the shape distortion on the Mercator projections, Greenland looks massive and Africa looks tiny. While the Mercator projection is a wonderful map for sailors and for understanding the accurate distances between countries, it should be avoided for displaying data and for political or cultural analysis.

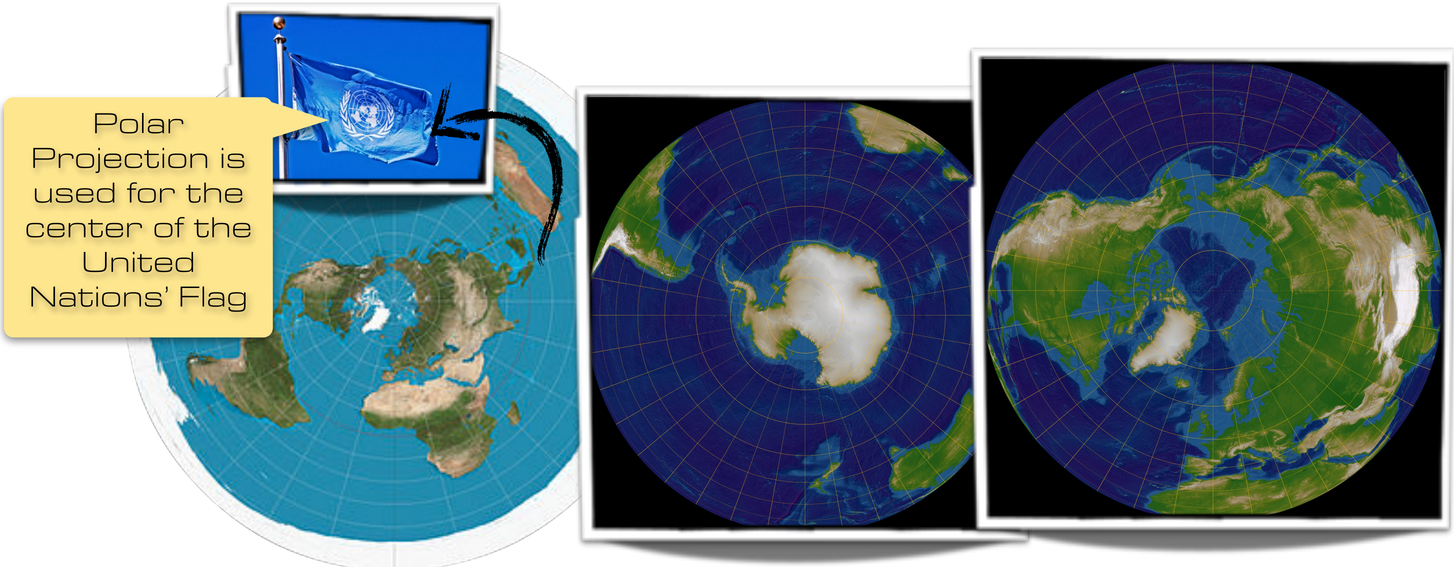




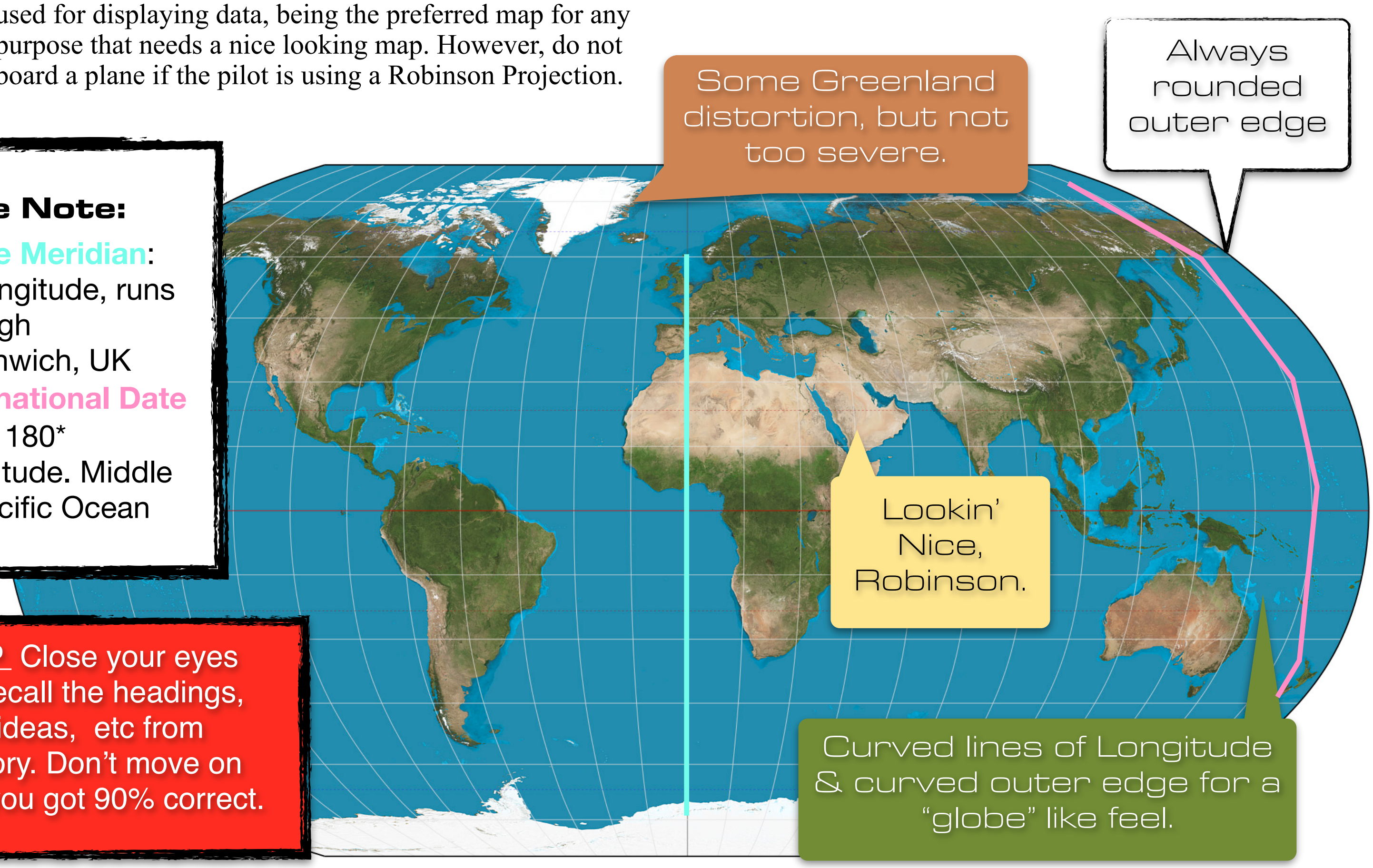
Interrupted Projection. The Interrupted (Homolosine) projection seeks to keep the shape of the objects on the map accurate, being willing to sacrifice the distance between objects. Much like the orange peel on the previous page, interrupted maps display the tears or breaks in the image necessary to keep the validity of the shape. The more “interruptions” or breaks that appear in the map, the more accurate the shape. Notice Greenland and Africa. Greenland becomes the tiny speck of land near the North Pole, while Africa shows its comparative size to the rest of the world. These maps are used for functions that need accurate land shape for displaying spatial distribution of objects or phenomenas. However, from a functional perspective, the more breaks that appear, the more difficult the map is to read - limiting its usefulness. Certainly, no one would want their pilots using these maps to fly or sail… or for predicting weather.



Polar Projection. In the spirit of Mercator, the Polar Projection attempts to show accurate distances between countries. All distance are accurate from the center pole on the map to any object shown. The Polar Projection is used by the airline industry, the radio industry for tower placement, to track nuclear missile flight patterns, and for tracing seismic activity with earthquakes.



Robinson Projection. The Robinson Projection is the projection of compromise. Dr. Robinson desired a map that was visually appealing. Throwing math and formulas to wind, the Robinson map distorts both shape and distance to create the ideal "look"; showing appropriate amounts of land above and below the equator. This projection has the now-classic rounded outside edges, with slight distortion near the poles. The Robinson projection is used for displaying data, being the preferred map for any purpose that needs a nice looking map. However, do not board a plane if the pilot is using a Robinson Projection.



Side Note:

Prime Meridian: 0* Longitude, runs through Greenwich, UK

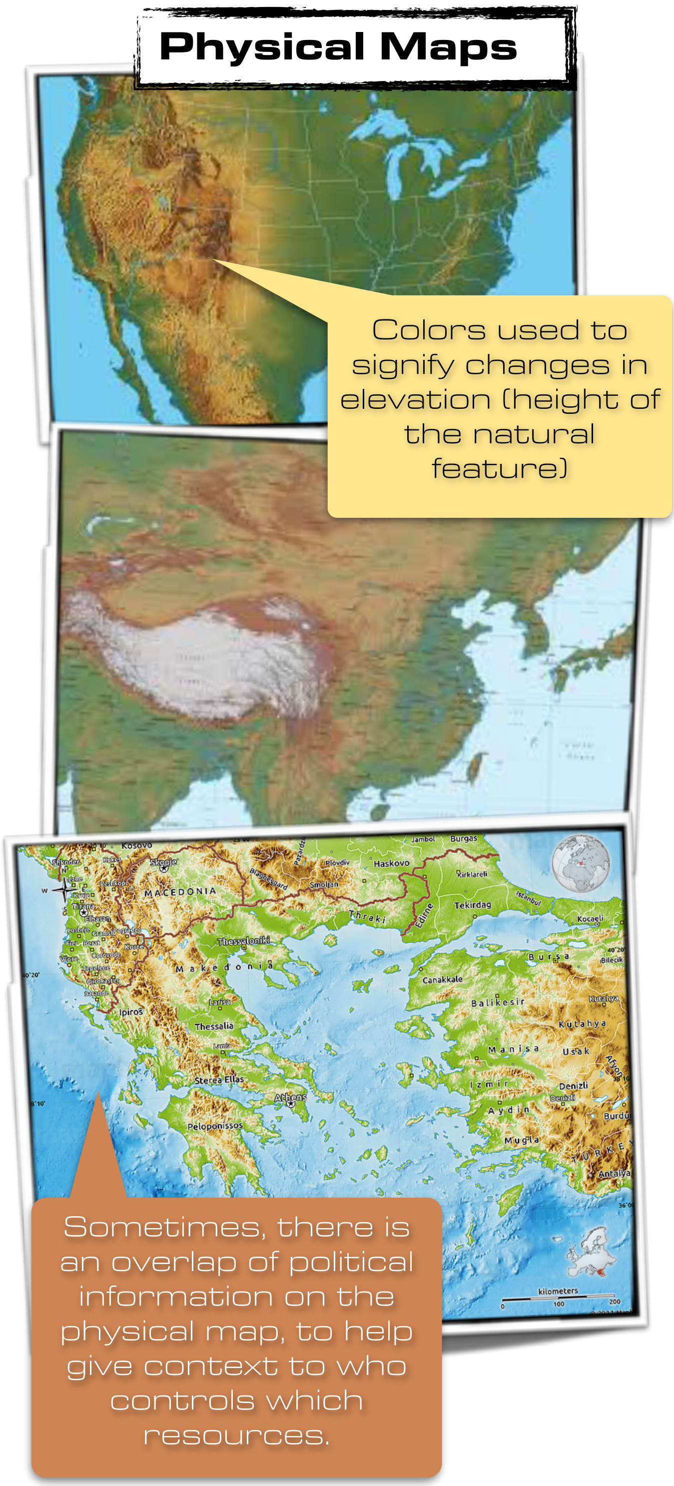
International Date Line: 180* Longitude. Middle of Pacific Ocean

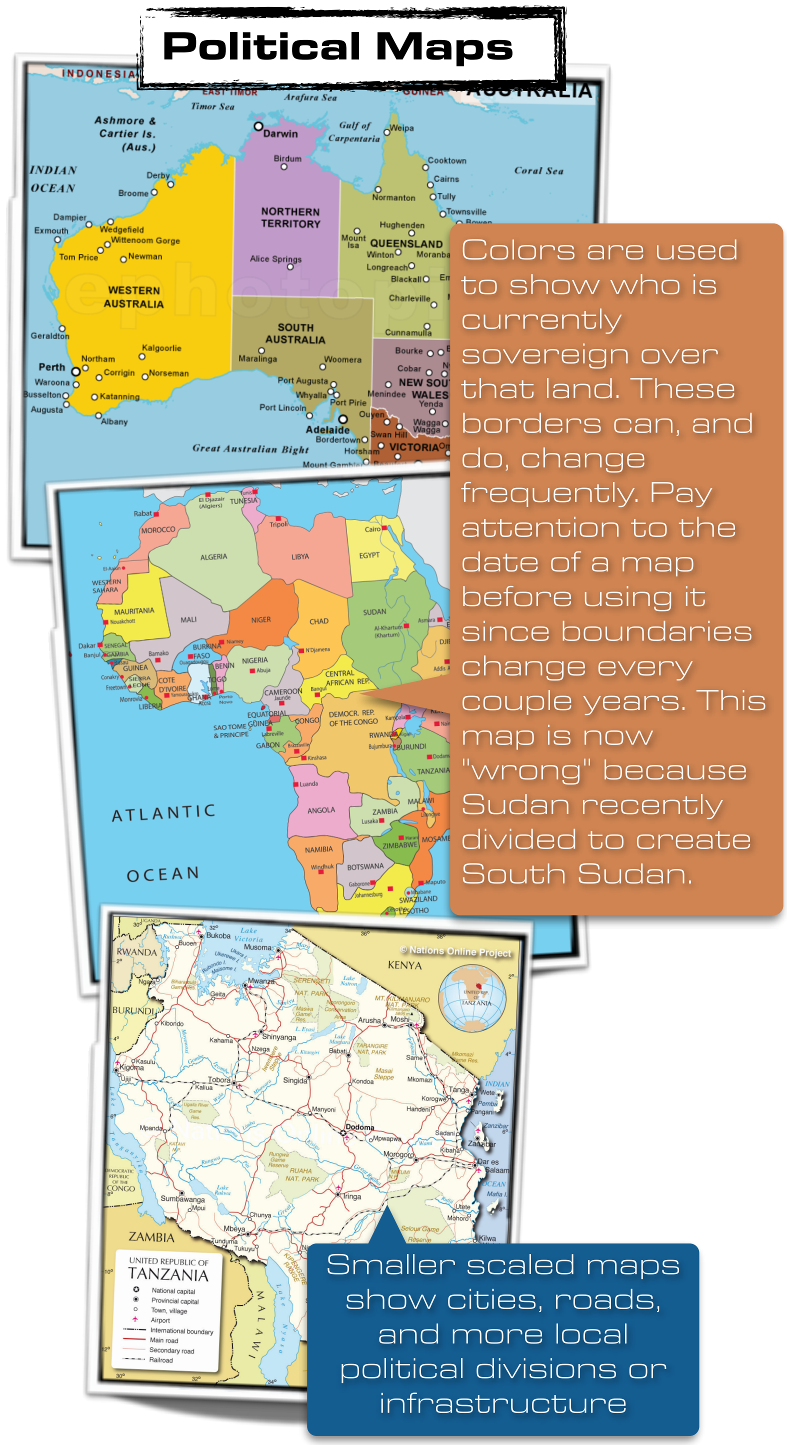
STOP Close your eyes and recall the headings, main ideas, etc from memory. Don't move on until you got 90% correct.

Data on Display

Different projections of maps are used to display data in various ways. These collections are not an exhaustive list, but discuss the most commonly used methods for displaying space and data in APHuG.

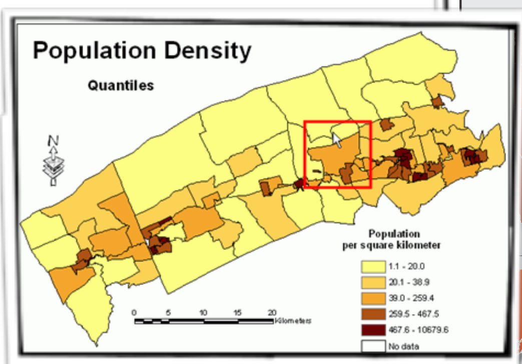
Reference Maps. Reference Maps display natural land features and political organizations, and are useful to answer the "Where" questions. Physical maps address locations of the geological features of the earth: mountains, rivers, deserts, plains, oceans, etc. Political maps illustrate the boundaries and borders of states and nations.

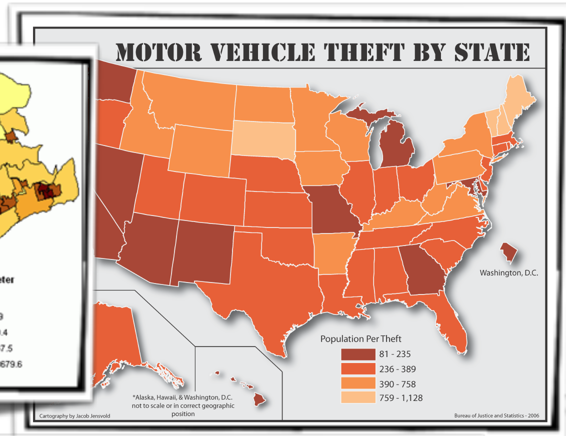


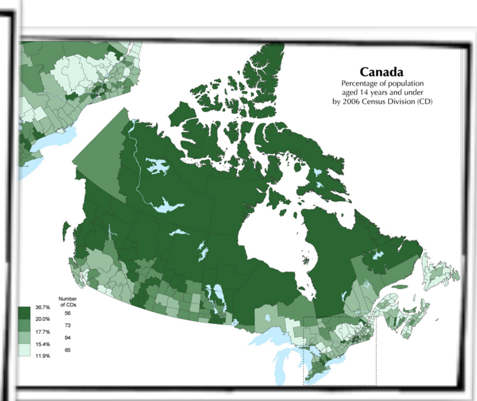


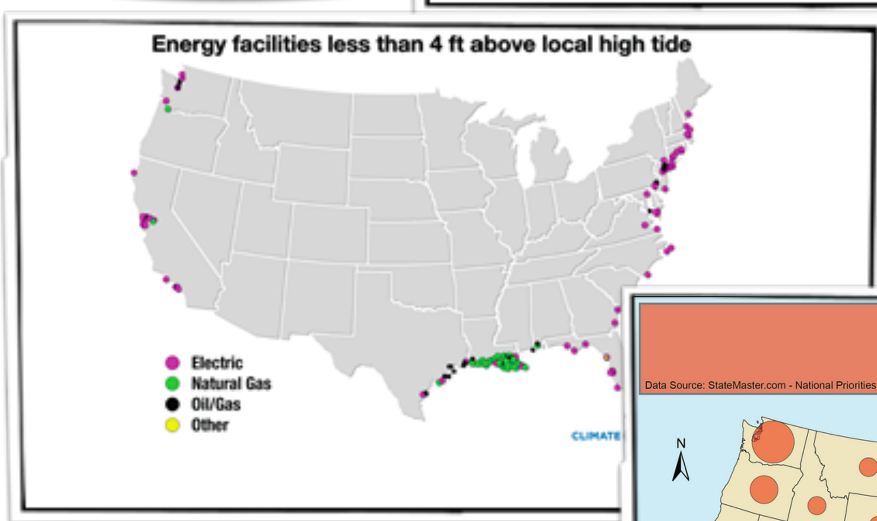
Thematic Maps. Thematic maps are used to display the spacial distribution of data about a particular topic or set of information. The options for the type of information that can be displayed on thematic maps is nearly endless: population density, age distribution, favorite sports teams, police brutality incidents, ways of preparing hotdogs… When analyzing these maps, it is important to pay attention to the scale of the map, the title, and the key to ensure you know exactly which data are being displayed. The following are common variations or subtypes of thematic maps:

- **Choropleth Maps.** Choropleth maps display data by using shades of color; typically one set of data per map. The key will display the amount of data represented by each color. Choropleth maps tend to utilize 3 to 7 shades of a single color to display the pattern; occasionally two colors will be used to accentuate differences.



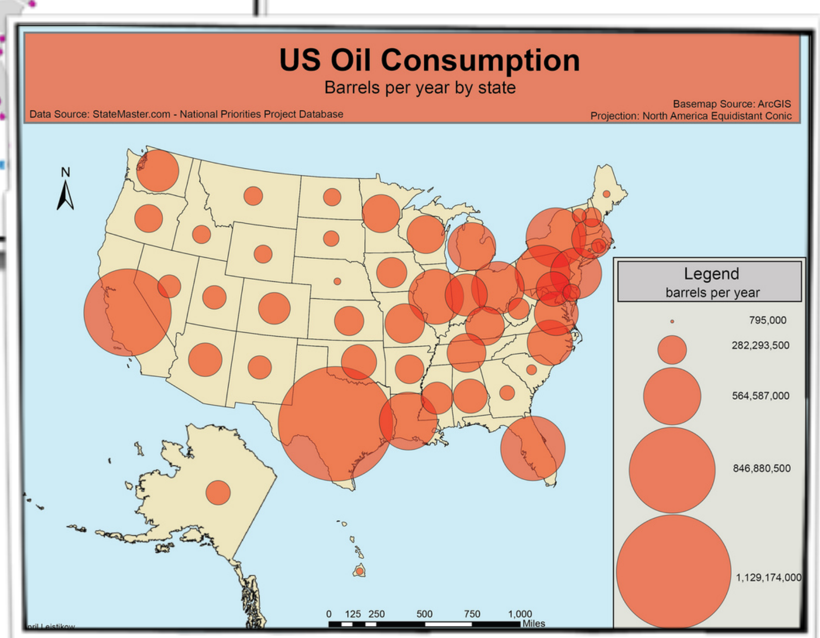




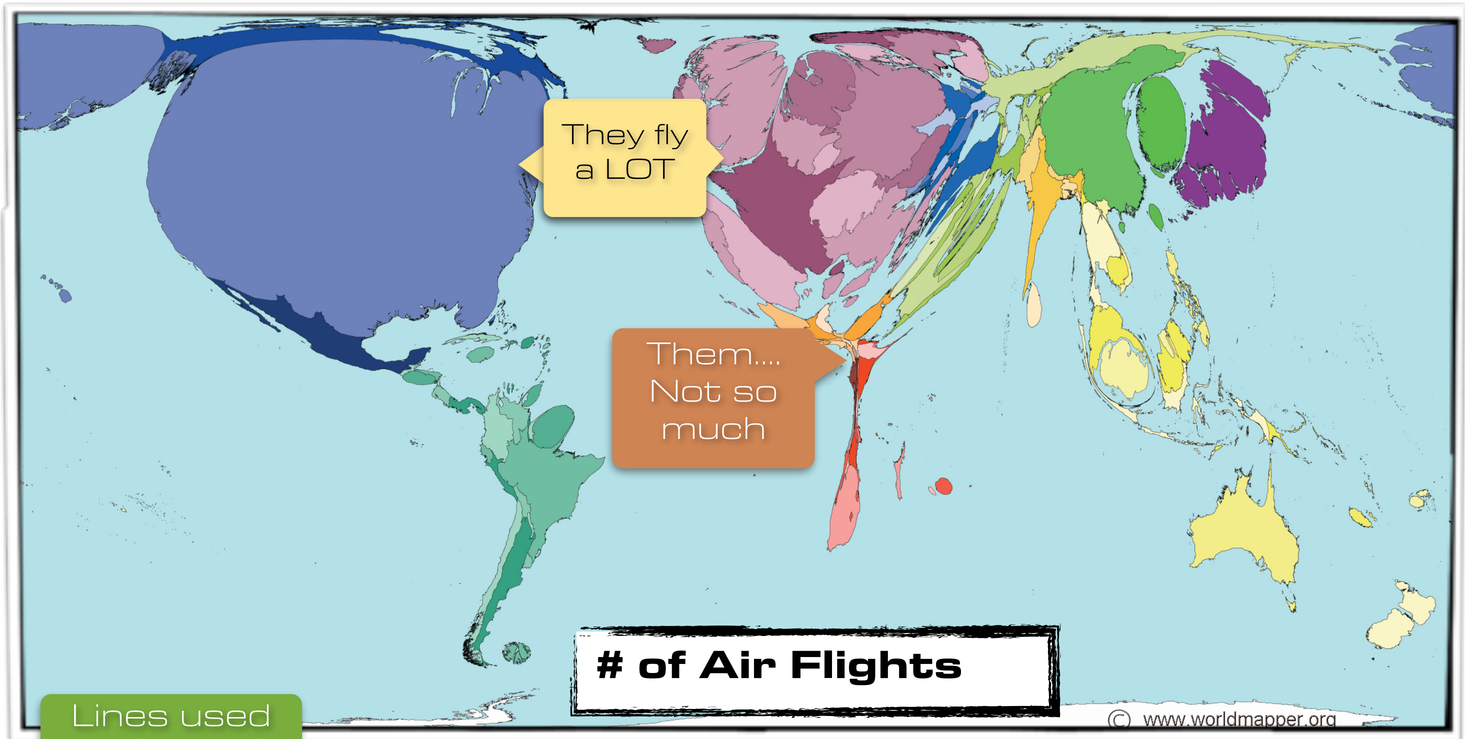


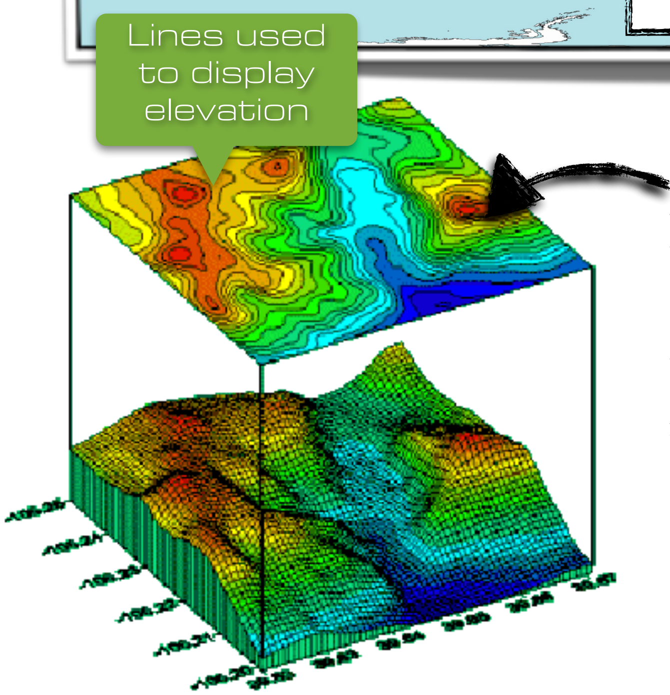
- **Dot Maps.** Dot maps display data using small dots. Each dot represents an instance or an occasion of the phenomena. While all dots are the same size, some maps will use different colored dots, depending on the data-set.

- **Graduated or Proportional Symbol.** In contrast to the dot map, proportional symbol maps use *different sized dots* to display the data. The larger the circle, the greater the value of the data being displayed; the smaller the circle, the lower the value.



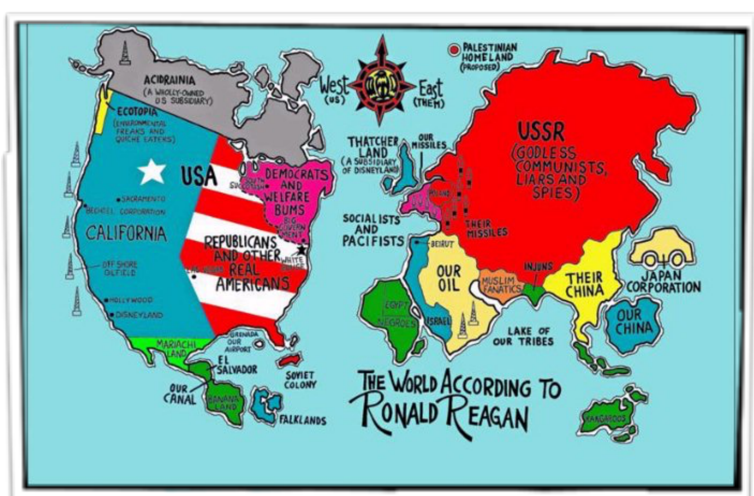
- **Cartogram Maps.** Cartograms change the size of the country or region to represent an amount of data. The bigger the country is displayed, the greater the value of the data. The smaller the country is displayed, the smaller the value of the data. This can be disorienting at first, because the shapes do not match your mental map. However, cartograms can serve as a powerful tool for portraying information.





Isoline Maps. Isoline maps use lines (and occasionally colors) to display information. These are commonly used to show changes in temperature, weather, or elevation. Lines connect areas of equal value, with each line representing a new value. For example, on a temperature map, each line represent where the average temperature changes.

•**Propaganda/Sales Maps.** While all maps deceive, there are maps that represent space and data in a way never intended to be accurate. These maps attempt to convey a point of bias or opinion and should not be used as a reliable source of information.



Stop Close your eyes and mentally review the big ideas from this section. Check your notes to see if your recall was successful. Repeat until you successfully recall 80-90% of the big ideas, with an example from memory.