A summary of week 2-3 slide presentation

https://uky-gis.github.io/geo109/slides/01

01: Data

Announcements

Thank you for making it to lecture. Make it to class, recitation, and you'll get the grade that you want. Please pay attention to assignments and tasks. Some are extra credit and some have no credit other than telling us about you.

Show private form.

Show pin-your-location on a map. Drop a pin on Null island @ 0,0. It's in the Atlantic Ocean. Mappers call it this because when computer programs encounter invalid coordinates, they often assign 0,0 to the location.

Task 2 will be available next week. It's a tour of the map library and a critique of a map from the collection. Book your time now – it's the only way to have a tour of the collection. When you critique a map, you reflect on what was your first impression, the use of color, typography, symbology, and design.

Thank you for submitting your mental map of campus. Here are a few example submissions. How do they use design to convey their understanding of campus? Do you agree with their observations? This is data.

Data

Data, for us, is simply observations encoded into a usable format. In the 19th Century, the new technologies of flight by balloon and photography created a proliferation of Bird's Eye View maps. Mass printing technologies made these maps very popular. Your home town might have one.

The usable format here is a printed page that one could use to orient themselves in the location shown. Surely the map mapmaker had other sources of data to make this map. E.g., another map showing point locations of prominent buildings and another showing streets. The data was stored on paper.

In the digital age, we have an abundance of formats to which we can save our observations. We can use spreadsheet software to make a table of observations. We download other observations like aerial photography or street centerlines captured by GPS (Global Positioning System). When we learn to use these formats effectively, we can create custom maps that tell a story of place – your argument for what exists and what is important. Will others find your map (i.e., your visually rendered observations) useful?

Finding location

Earth has an imaginary grid, or more precisely a graticule, that locates every location in a coordinate pair. Latitude measures distance from the equator, the north/south distance – the y coordinate. Longitude measures distance from the prime meridian, an arbitrary line that goes through Greenwich, England. It is the east/west and x coordinate.

We'll use the decimal degree format instead of degrees, minute, seconds. We six decimal places, we have enough precision for our maps.

This is our format: 38.037614, -84.501135

The first number is latitude and it's positive, so north of the equator. The second number is longitude and it's negative, so west of the prime meridian.

Paste that into your browser's search bar and see where it takes you.

Data model

So we know that observations are data. We each have our own when we visit places. We can observe what we see, hear, feel, etc. We understand that these observations have a spatial component. We have learned that we can record these observations in space using a coordinates like latitude and longitude. With about 20 characters, we can precisely locate anything on the planet. That's a powerful concept and is the first step in drawing invisible lines on Earth through maps.

We also understand that each person has a unique experience with unique observations. While we might agree on things like the tallest building in town, we might be attracted to completely different things. Because of this, each map that is made will have different observations. There are an infinite number of maps that could be made for any place. We'll soon discover that we have an infinite number of ways that we can symbolize our lines on a page.

Thought experiment

You are fresh out of college and you land a job as an office manager at Southeastern States Diabetes Association. You have been tasked to locate the largest tailgating crowds to hand out information and blood glucose test devices.

Your boss hates sports and asks you compile a list of stadiums. You come back with a Word document. The boss says, "OK, but where are they, which have the largest tailgating crowds? When is the next game?" You need to make observations… you need data. How do you collect information about crowd size? Do you google it, call local authorities, or do you visit with drones taking aerial photography?

You compile the information into another word document. The grumpy IT person says that they can't use this document. They need a attribute table in a specific format. You show a spreadsheet, but it is still not in the correct format. The IT person, says, "Can you give me a CSV file?"

Lightbulb. This digital format can be easily shared as exact copies. What can this format do in other applications like websites and desktop applications? Make an instant map!

Attribute model

This type of data stores observations as a table of rows and columns. Each row, sometimes called a record, is an observation. Observations have attributes, like latitude, longitude, and other descriptions. These values are stored in columns, sometimes called fields.

The CSV file (comma separated values) is a common format. We will make one in our first lab.

Vector model

This type of data stores observations as points, lines, and polygons. It also has the attribute model where each vector feature has a series of columns with information. We'll use mapping software to view this type of data.

Shapefile is common format found online. GeoJSON is popular in the open-source software community.

Digital maps are often composed many vector data layers, stacked in their drawing order. The bottom layer draws first, the next layer above the bottom is drawn, etc. So, we usually manual stack on layers so that polygons are on the bottom, then lines, and finally points.

Let's take a look at layering a map for Pine Mountain SRP.

Vector features are discrete. You are either on (or in) a feature – or you're not. What if you don't know what's outside of a polygon, say your country? During the Age of Discovery, mapmakers put sea and land monsters on the maps. Were they observations made by explorers? Or, were they fanciful illustrations to enhance the visual appeal of their designs?

Often, we look at a map of point, lines, and polygons and think we have some certainty of what exists. However, look between these geometric features. This is blank space the map. Something is there, but what is it? It's ambiguous unless you want to draw between the lines. Map makers have long put fake features, like towns, streets, etc. on the map to identify copiers. They are called trap streets. Another reasons to not entirely trust everything that you see.

Raster model

This type of data stores observations in a matrix of cell values. This model excels at showing subtle variations in observations, like temperature and height above sea level. Raster model also excels in showing change over time because satellites capture raster data everyday. How might this data help with current problems?

Raster types

- Image raster shows reflected and emitted light. Pictures!
- Thematic raster shows difference of type. What is the majority land cover type in the 100x100 ft square that I am standing in the center of.
- Continuous raster shows difference of magnitude. What is the height above sea level in the 5x5 ft square that I am standing in the center of.

Most maps we see use a combination of raster and vector layers.

GeoTIFF is common raster format.

Point cloud model

This type of data stores observations in a cloud of points using x,y,z coordinates. These clouds of points are produced by the scanning technologies like lidar. They can produce the most detailed 3D model of our environment.

The LAZ is a common point cloud format.

Sources of data

Let's explore downloading some data and see if we can understand through the ideas that we have presented so far. Before we start this, let's create a workspace on our computer that we'll organize all of our assets that we use in this class.

What's in a number?

Many of the attributes use numbers. When you see a number, can you guess what it might represent? This describes the level of measurement. We have four levels.

- Nominal: the number is a label, like zip codes.
- Ordinal: the number is a label and rank. First place, second place, etc. But second place is not twice as inferior as first place.
- Interval: the number is a label, rank, and evenly spaced. Temperature is an example. 0° F is not 0° C.
- Ratio: the number is a label, rank, evenly spaced, and zero is the same in any unit. 0 feet = 0 meters.

Demonstrate lab

Let's fire up geoJSON.io and QGIS and start mapping.