Writeup For Project 1

Link to Github Repository:
https://github.coecis.cornell.edu/ngi2/cs3300_p1/tree/master/Webpage

Final Visualization Image:

Description of Data:

Pre-Processing of the Data:

Used python, jupyter notebooks

For the histogram data:

- Created a new pandas dataframe that only included the countries we wanted in the plot
- Found change in temperature from past to present
    - Past: take average of the decade 1861-71 (earliest point when all these sixteen countries don't have gaps in data)
    - Present: take average of the decade 2003-2013
    - Present minus past
- Append averaged temperatures to a list of temperatures, add their respective countries to a seperate list and dates to another (just year)
- Make a dictionary with those lists
- Create a new dataframe from the dictionary and convert it to a csv

For the scatterplot data:

- Created a new pandas dataframe that only included United States rows
- Calculated average temperature for each year from 1823-2013
- Append values to a list of temperatures, append dates to another list (just year)
- Make a dictionary with those lists
- Create a new dataframe from the dictionary and convert it to a csv

Scatterplot:

The scatterplot data was taken from Kaggle, a file called "Global Land Temperatures by Country"
(https://www.kaggle.com/berkeleyearth/climate-change-earth-surface-temperature-data#GlobalLandTemperaturesByCountry.csv).
A number of decisions were made when designing this scatterplot.

First, the y scales were decided to be from 7 to 10.5. These bounds were chosen because they were approximately .5 less/greater than the minimum/maximum values. This way, the viewer only had to view the needed data with a more precise scale (without the data being to cramped, which would be visually displeasing and difficult to read). For similar reasons, the x scales were decided to be from 1800 to 2020.

Second, the circles were decided to be red and of radius 4. The circles are red because red and blue have historically been used in weather-related visualizations. We chose red since in this visualization, the trend indicates that the weather is getting hotter. Therefore, the color subliminally reinforces the concept that global warming is indeed affecting the United States. In addition, the radius of the circles was 4 to ensure that the circles were small enough to determine the exact location of the point, and large enough to easily see.

Third, there is a small explanation at the bottom of the graph. This decision was made instead of adding a title or axes labels because it is more visually pleasing to have a simple graph (without any clutter). Moreover, with an explanation at the bottom of the visualization it is easier to add a more detailed explanation.

Histogram:

The histogram data was taken from Kaggle, a file called "Global Land Temperatures by Country" (https://www.kaggle.com/berkeleyearth/climate-change-earth-surface-temperature-data#GlobalLandTemperaturesByCountry.csv).

Because we knew we wanted to display the average change in temperature over time for various countries, the variables that we chose to focus on were Average_Temperature, Date, and Country. We processed these variables in the dataset to generate a csv file that had two columns: Temperature Change and Country. The Temperature Change data was calculated for each country as follows:

- First, we had to pick a date in the past to compare to the present. We didn't want to pick just one year, because it could have been an unusually cold or hot year. Rather, we chose a decade, in this case 1861-1871, and found the average temperature in that decade. This eliminated the possibility of "outlier" data. The range 1861-1871 was chosen only because it was the earliest range that had no missing temperature data values for all 16 countries.
- Next, following the same logic as above, we chose to find the average temperature in the range 2003-2013. 2013 was when the data stopped, so we had to stop there (rather than go to the present). Another thing to note is that 2013 data stopped in September.
- After calculating these two averages for each country— average temp from 1861-1871 and average temp from 2003-2013— we subtracted these values from one

another, present minus past. This gave us the change in temperature over this ~130-year span.

As far as design, because the x-axis displays nominal values (countries), we wanted a color scale that didn't give the impression of "high" or "low" values, only colors that would help differentiate the continents the different countries were in. We played around with a color scale generator online (https://coolors.co/686860-ec4e20-ff9505-016fb9-000000) to come up with distinct yet harmonious colors. The colors were chosen because they all distinct hues, which helps viewers distinguish between categories. One possible misconception is the use of the color blue (often means cold) - but we decided this risk was worth it because blue was a very distinct hue and we didn't want to have repetitive colors. We also included a legend beneath my plot so viewers could identify and group the countries into their respective continents.

We ended up making two scales for the data: a scale for temperatures, the y-axis, and one for creating 16 even ticks on the x-axis. For the x-axis labels, we had to rotate them to make sure the country names would fit under the ticks. We also decided to color the "United States" label red so it would pop out to viewers, considering the rest of the plots relate to the US.

The y-axis goes from the range 0-2.5. The maximum value is 2.32, but we wanted to make sure the 2.5 tick was included for reference. There are also only grid lines coming out from the y-axis, not from the x-axis: we thought it would be used to have horizontal gridlines so viewers could visually match the bars (the height of the bars corresponds to the change in temperature) to their respective y-values, but vertical gridlines would overcomplicate things (and make the graph uglier).

Map:

I found the dataset from a Kaggle site https://www.kaggle.com/berkeleyearth/climate-change-earth-surface-temperature-data#GlobalLandTemperaturesByCountry.csv. I used the Global Land Temperature by State dataset. In this dataset, I chose two decades that are a hundred years apart.

The first data selection criteria was that I wanted to make sure the average temperature was comprehensive of a long period of time to reduce error in our calculations. Therefore, we calculated the average temperature of 1912-1922 and 2002-2012. Then, we used the difference of these two decades as the input value to the color scale.

Second, these two decades had to be far enough apart. There are 100 years between the two decades, which meant there was enough time passed to make a valid comparison for climate change.

With respect to design decisions, the heat map was an ideal choice for displaying the varying trend and how much they varied in continuous area. The color of states varied from blue to red since they are historically been used in weather-related visualizations. The more the temperature

increased, the redder the states became. This conveyed to the viewers a strong urgency that the US is indeed being impacted by climate change. The color channel is a divergent channel which means it has a "middle" point to denote that there is no change in this state.
Next, the US has states like Alaska and Hawaii which are far from the mainland. Albers projection helped relocate them to make the map look more compact. The map is placed at the center of the SVG canvas with a projection scale of 1000 to make sure it is clear for viewers to know the temperature changes of all states.
Additionally, a table of color legends was added to help viewers to understand the temperature change more precisely.
Website that I got the US map shape file and referred:
https://gist.github.com/michellechandra/0b2ce4923dc9b5809922

Story:

When our group met for the first time, we discovered that we all had a passion for climate change activism. This shared interest drove our interest for this project from start to finish. Our ultimate goal for this project was to motivate viewers to take action. Our "story" begins with the histogram displaying the change in temperature across 16 countries (from a diverse geographic range) during the past few centuries. The second visualization focused in on the United States and created a scatterplot displaying the increasing trend in temperature over the past few centuries. The reason why we chose to isolate the United States dataset was because our intended audience was for people living in the United States. The US is one of the top producers of waste and overall contributors to climate change. The third visualization became even narrower with a map plot displaying the change in temperature in a heat map. We felt this visualization was important to include since it gave American viewers a sense of connection to the visualization. For instance, if they saw that their state was particularly red or blue, then they would be more inclined to take action.
Aesthetically speaking, we chose a red and orange color scheme for our website. This is because we wanted to convey that our data is showing an overall increase in average temperature. In addition, the red was also chosen because it traditionally is a color of "danger" - so we were subtly communicating to our audience that global warming is imminent and dangerous.
Finally, we concluded the visualization by recommending sites viewers could visit if they were interested in taking action. We believe that this gave our visualizations a real impact rather than just feeding viewers with more information they most likely have seen before.

Natalie's contribution:

- Contributed equally to the checkpoint requirements
- Coded the scatterplot section of the webpage
- Contributed equally to the writeup

Lily's contribution:

- Contributed equally to the checkpoint requirements
- Pre-processed the data
- CSS formatting of the web page
- Coded the histogram section of the webpage
- Contributed equally to the writeup

Xu's contribution:

- Contributed equally to the checkpoint requirements
- Coded the map section of the webpage
- Contributed equally to the writeup

We spent approximately 3 hours total creating the check point requirements, 2 hours per visualization, and then 3 hours completing the writeup.

Screenshots:

image source: TheConversation.com

Why does it Matter?

"The Intergovernmental Panel on Climate Change (IPCC), which includes more than 1,300 scientists from the United States and other countries, forecasts a temperature rise of 2.5 to 10 degrees Fahrenheit over the next century".[1]

The warming of the earth is extremely likely (>95% probability) caused by the result of human activity since the mid–20th century.[2]

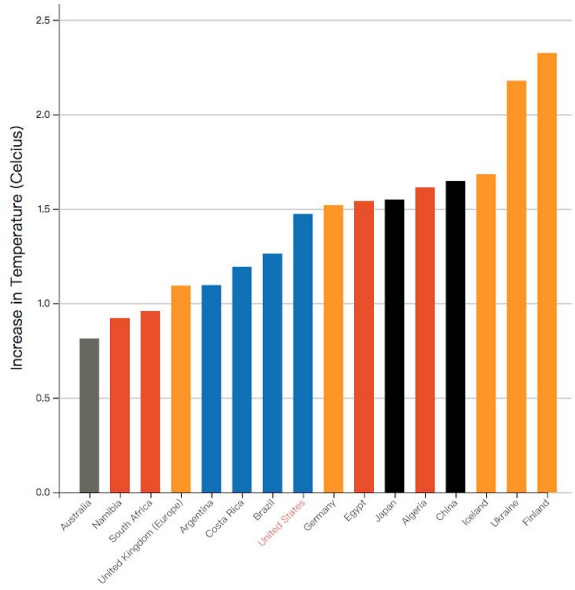
"Climate change encompasses not only rising average temperatures but also extreme weather events, shifting wildlife populations and habitats, rising seas, and a range of other impacts".[3]

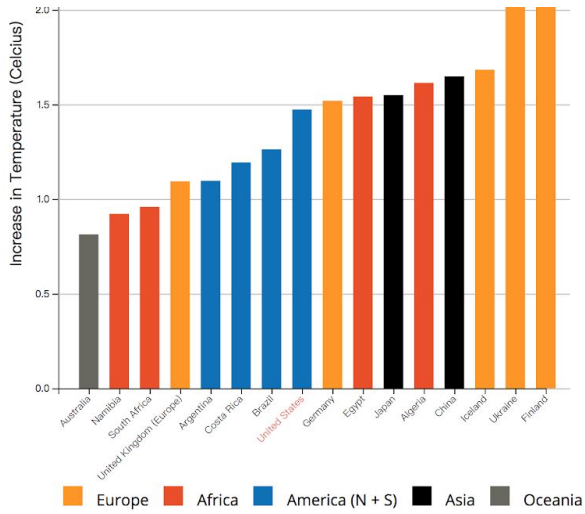
Average Temperature Change by Country

from 1861-1871 to 2003-2013

Average Temperature Change by Country

from 1861-1871 to 2003-2013

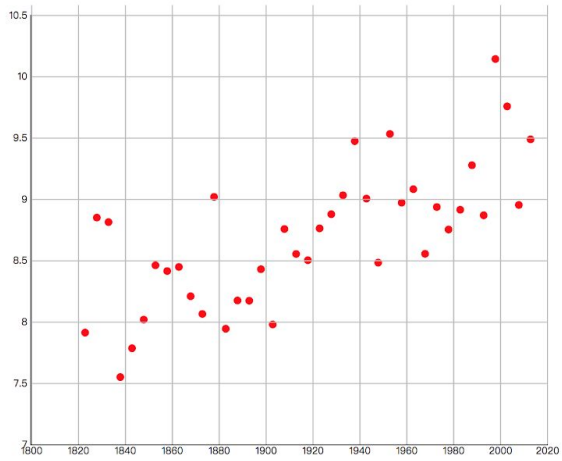


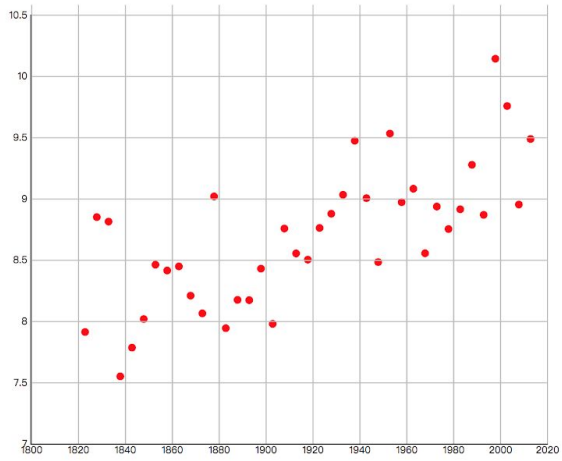


This bar chart, displaying data from countries from 5 continents, was made by first calculating (for each of the 16 countries) the total average temperature from 1861-1871 and from 2003-2013. The differences of these averages (present minus past) are shown in the y-axis.

Average Change in Temperature in the United States

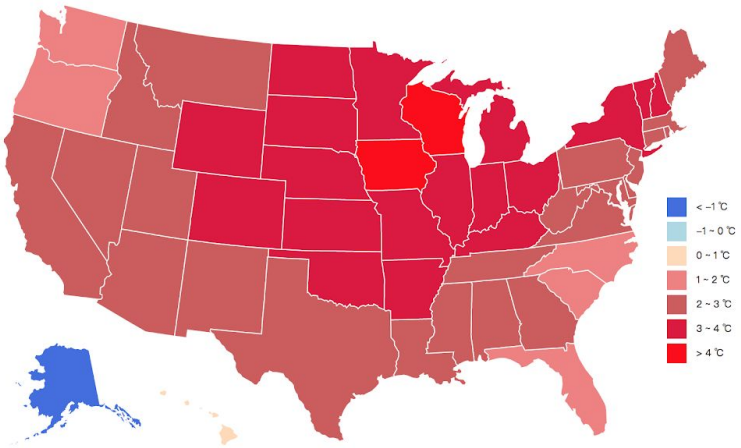
from 1823-2013

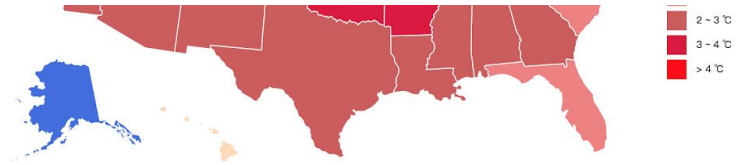




The graph above represents the trend of average temperatures in the United States. Data has been selected from a sample of approximately 200 years (at 5 year increments). The average temperature has been measured in degrees Celcius.

US Average Temperature Changes From 1912 To 2012





The heatmap above shows the US average temperature changes of 1912 and 2012. The overall trend of the climate change is 50 states are getting hotter but Alaska is getting colder. As mentioned above, "Climate change not only rising average temperatures but also extreme weather events."[3]

Footnotes

[1] https://climate.nasa.gov/effects/

[2] https://climate.nasa.gov/evidence/

[3] https://www.nationalgeographic.com/environment/global-warming/global-warming-overview/

[4] Data Source: https://www.kaggle.com/berkeleyearth/climate-change-earth-surface-temperature-data#GlobalLandTemperaturesByCountry.csv

To learn more, visit: https://climate.nasa.gov/

To take action, visit: https://citizensclimatelobby.org/volunteer-for-climate-change/