

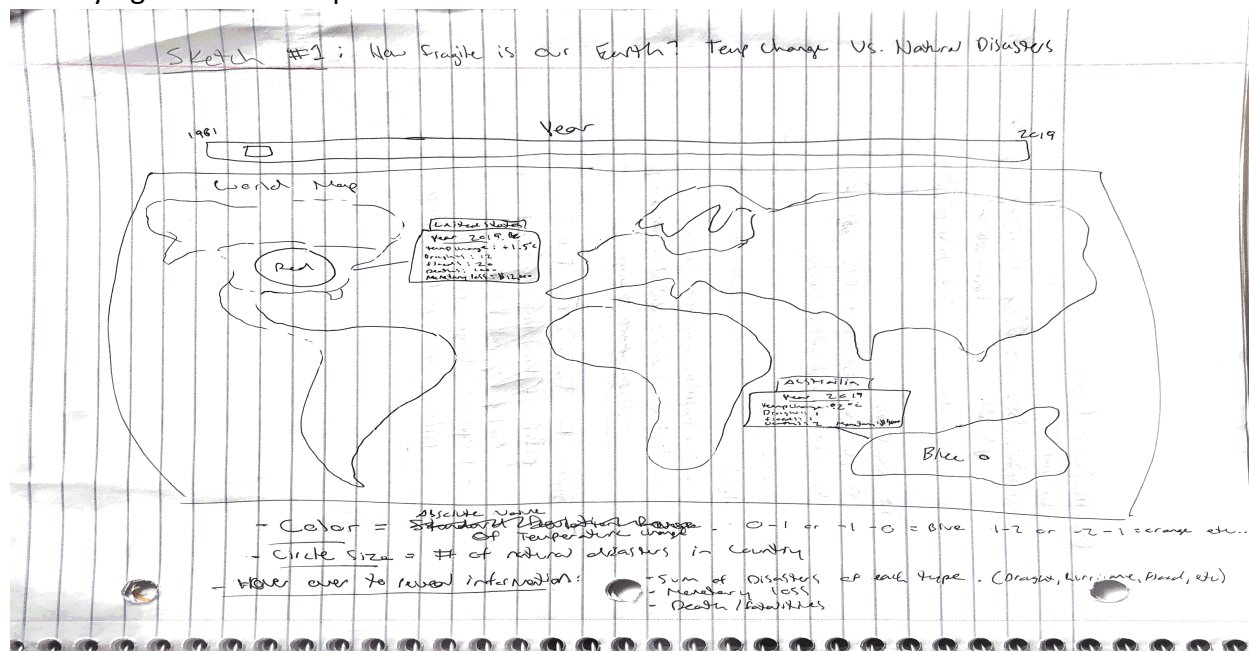
Brendan Puglisi
Professor Field
SARC 5400

Final Reflection

My project is titled "Earth's Fever: Diagnosing the symptoms of environmental fragility and injustice". However, I did not immediately know what I wanted to do when I was presented with a project on fragility, so here is the process I took to get to my final product.

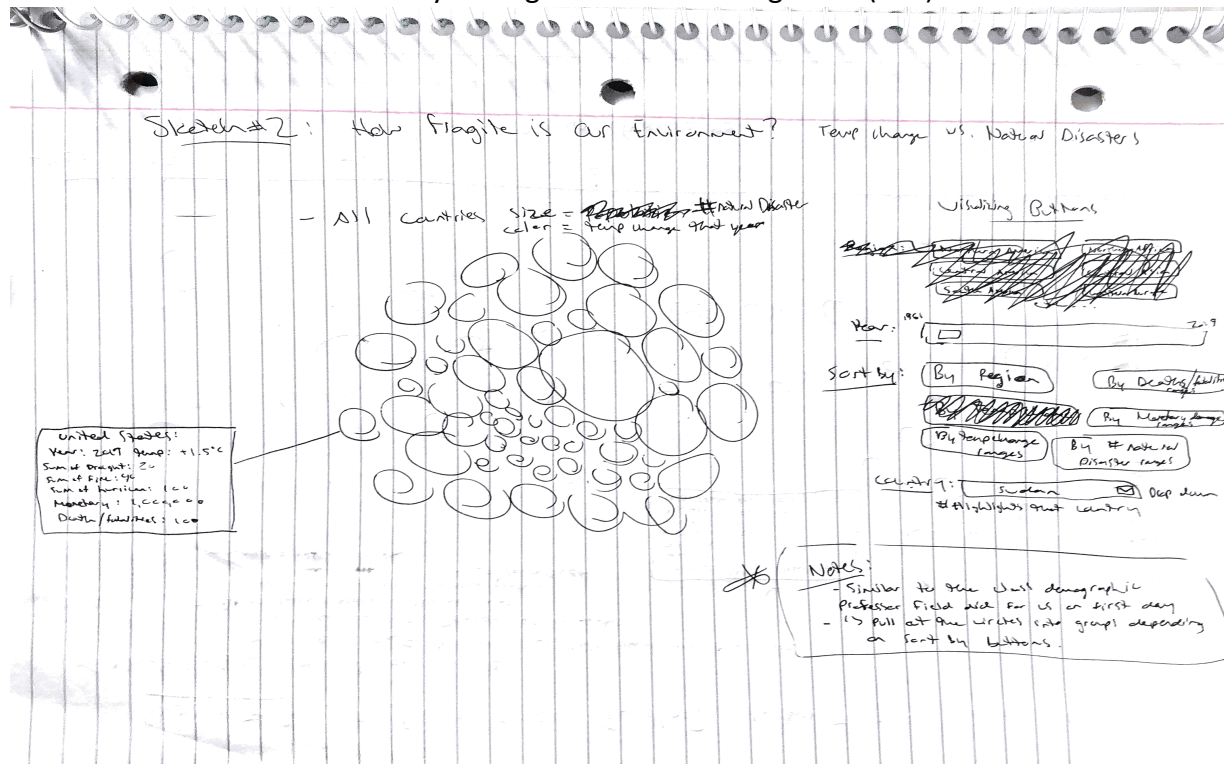
As a global sustainability major, I immediately knew that I intended for this project to highlight some form of fragility in our environment. Although originally starting with the idea of biodiversity loss, I began to think more towards the realm of natural disasters. I struggled with finding data and found a great data set going incredibly in depth into landslide occurrences throughout the World. I had information on when, where, and how much damage and deaths it incurred. As a result of an office hours conversation, I began questioning the upstream causes of these events. As a result, my question developed into how is Earth's increasing temperature and resulting climate change affecting occurrence and intensity of certain types of natural disasters? After searching for hours and discovering how difficult it truly is to find good data sets, I was finally able to obtain data on global natural disasters and global temperature change.

Before I started visualizing, I began with several sketches in my notebook and I was super set on doing a map visual, especially because we just went over how to do so in class. I then created a prototype of my visuals in tableau and began exploring the data more, identifying variables and points of interest.



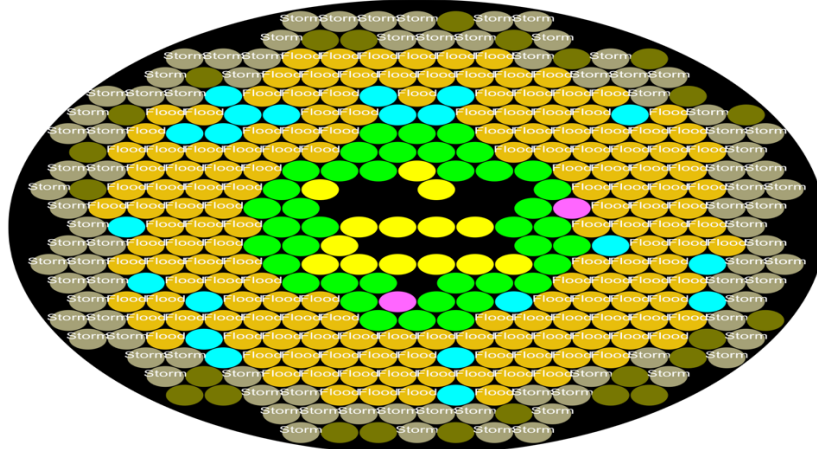
After presenting my work and overall project ideas in class and receiving incredible insight from peers I began to wonder whether my question truly was geo-spatial. After consideration, I realized that political boundaries like countries did not matter in terms of this

global question, but climate region and other factors of region did. As a result, I decided to go forward with representing this project through a packed bubbles or clusters diagram to display occurrence as count and intensity through deaths or damage cost (size) in these visuals.



After plugging my data into some of Professor Field's pre-built functions I decided that clusters would be best for my project as I was going to change the bubbles' spatial locations based on categories, so I wanted them to move on screen instead of creating new ones like packed bubbles did.

Pack Circles



Then after going to office hours and receiving help on the coding process I was finally able to filter my data by year so my computer could better run the visual instead of visualizing

11,000+ lines of data at once and sounding like an airplane. In this meeting professor Field also made me wonder if there was a better 'so what?' to find in my question than just deaths and damage. As a result, I began focusing on the environmental injustice side of things. So, another part to my question was added, who is getting hit the most/hardest by the increase in disasters and how much are they responsible for climate change?

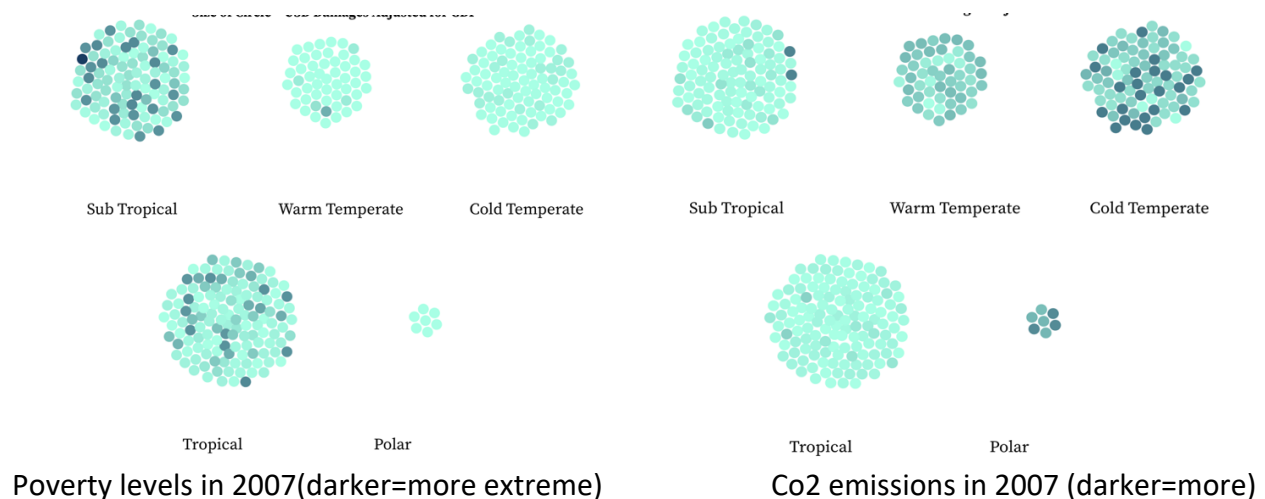
As a result, I began the process of searching for more data, this time it was for poverty levels, co2 production levels, GDP, and climate regions across countries. I then combined all this data using R, based on year and country ISO.

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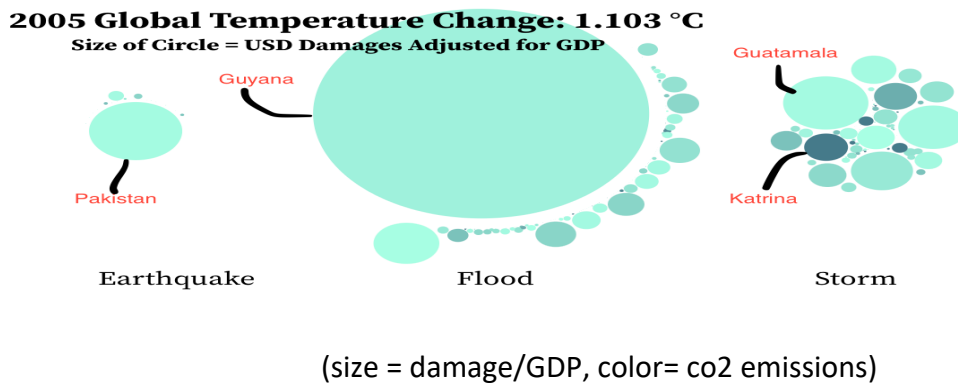
22 total<- merge(total, co2percap, by=c("ISO","Year"))
23 total
24
25 gdp<- read.csv("~/Desktop/datavizfinal/GDP_annual_growth.csv")
26 gdp
27
28 library(tidyr)
29 data_long <- gather(gdp, Year, GDP, X1961:X2020, factor_key=TRUE)
30 data_long
31 data_long[is.na(data_long)] = 0
32 data_long
33
34 data_long$Year<-gsub("X","",as.character(data_long$Year))
35 data_long
36
37
38 total<-merge(total, data_long, by=c("ISO","Year"))
39 total
40
41 total$Damage.pergdp <- total$Total.Damage..adjusted./total$GDP
42
43 total
44
45 library(dplyr)
46
47 total<-total %>%
48   select(ISO, Year, Country,Classification,Disaster.Type,Disaster.Subgroup,Region,Continent>Total.Deaths..adjusted.,Total.Damage..adjusted.,CPI,X.1.90.per.day...p
49
50 total
51
52 write.csv(total,"~/Desktop/datavizfinal/alldataextmaybe?.csv", row.names = FALSE)
53
54

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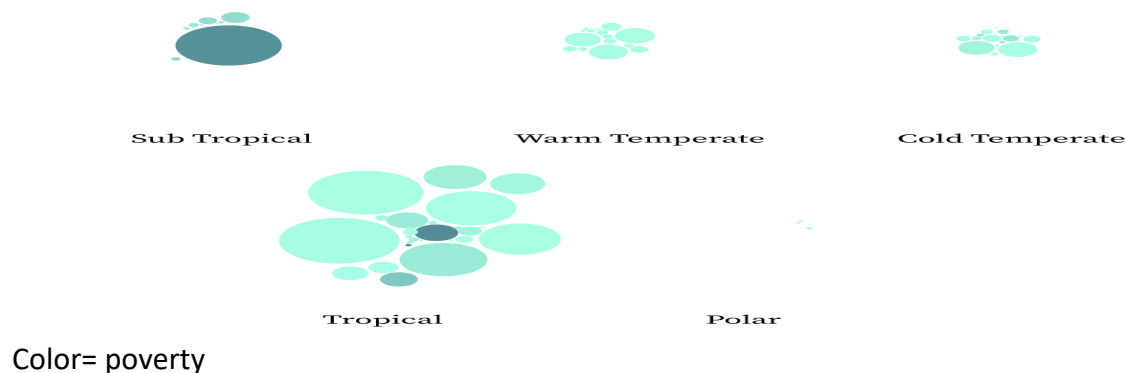
I hoped to display poverty levels and co2 production as a color gradient on my circles as they were continuous variables so sectioning them spatially based on high/medium/low poverty and co2 would have given me hard cut offs for minuscule differences in numbers, and I wanted to avoid this. This eventually served to my benefit as it was soon very apparent that extreme poverty and co2 production are almost always inverse characteristics of specific countries. Demonstrating how nations who will be hit the hardest by natural disasters, like ones with high levels of extreme poverty due to a lack of infrastructure and resources, are also the least responsible for climate change because they produce the least co2.



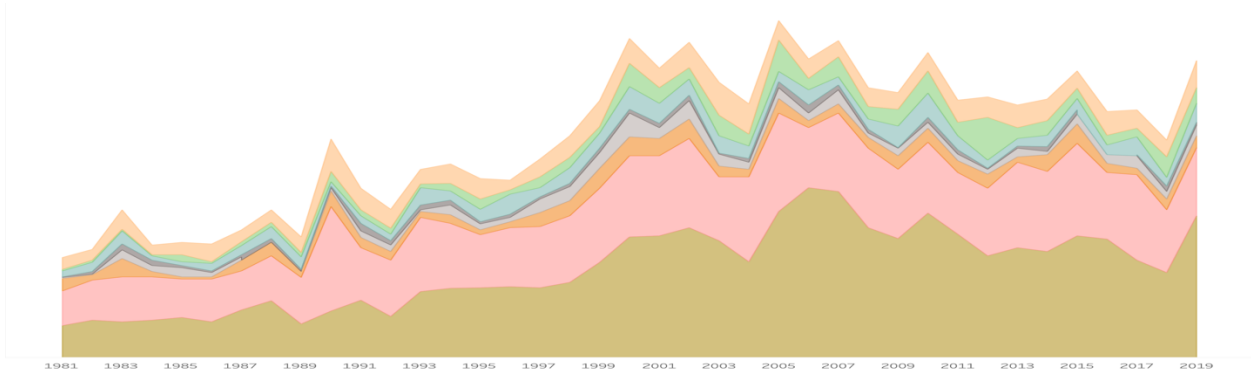
Another way I wished to incorporate this discovery is to take the damage costs of disasters and divide it by country GDP to account for how much of an impact the disaster truly had on the population it effected. I made this variable (damage costs adjusted for GDP) the size of my circles and immediately I was able to see elements of environmental injustice. Although not perfect because I was not able to section the adjusted damage/GDP variable for regions, so the entire U.S was bulked into one for example, it was good enough. As well, natural disasters happening in the U.S will still receive U.S aid no matter how impoverished the area is, so it essentially is valid. This allowed me to display how severe natural disasters relatively equivalent to Katrina are happening every year in countries all around the World. Even in 2005, Katrina was just an average sized bubble on my visual while other countries like Pakistan experienced an Earthquake that led to almost double the damages in relative dollars to GDP. The same earthquake causing over 40x the deaths of Katrina but it is never talked about. Or Guatemala in 2005 who experienced a storm causing similar deaths and almost 3x the amount of damages in relative GDP dollars. Or Guyana who experienced a severe flood costing an astronomical amount more to their economy then Katrina did to the U.S.



I then wanted to display where this was happening in the World, so I sectioned them off by climate regions based on temperature (typically representing latitudes) and displayed each. This ultimately allowed me to see that the disasters that incurred the most damage were typically floods, storms, and earthquakes, in tropical regions that experience extreme poverty and produce relatively minimal amounts of co2. Essentially supporting the idea that the Global North is most responsible for climate change through their production of greenhouse gases but face the least relative consequences.



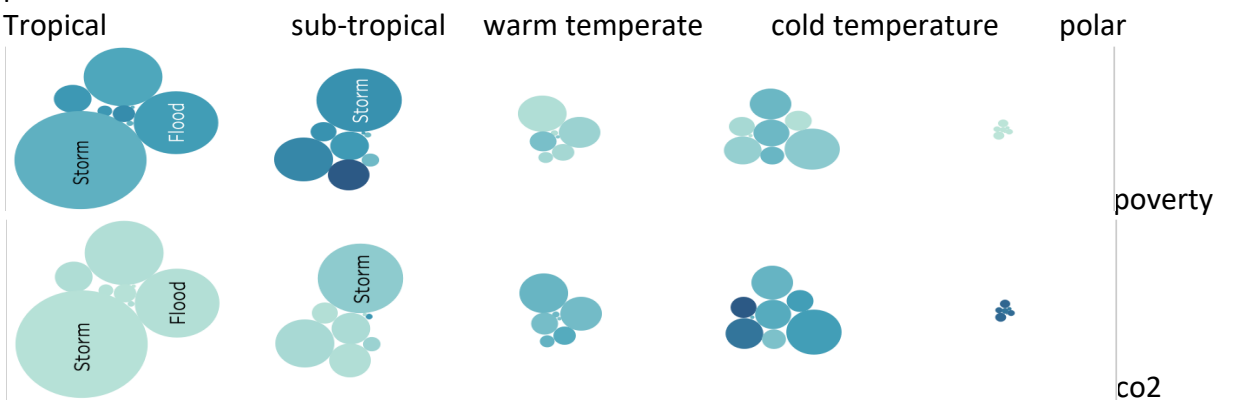
In my static visual I struggled with finding another way to display my data because I simply did not just want to do screenshots of my interactive. As a result, I decided to split my question of how temperature change is increasing natural disasters and environmental injustice into several parts to analyze each within a portion of the static. I also added a few statements throughout the piece to guide the thinking. So, in the first portion I did an area graph to show the increasing number of each natural disasters from 1981 to 2019.



I then did a bubble sequence below to show temperature rise by color across the years, and average disaster damage by size in each year. I first I had this as total damage, but then realized this could just be showing an increase in frequency of natural disasters. Instead, average damage is showing that the severity of disasters is increasing.



Then in my third portion I represented the injustice portion with packed bubbles. Each circle being a disaster type, their size being disaster damage cost/GDP and color being poverty on one side and co2 emissions on the other. Then splitting them by climate regions you can easily see that across all the years, tropical and sub-tropical nations that experience the most poverty are experiencing the most monetary consequences from natural disasters. Despite being the least responsible for their increased occurrence and severity due to being the least producers of CO2.



Overall, I struggled the most with the coding portions of d3. Having some coding experience but none with javascript and barely any with html, it was a challenge to even conceptualize how to put these objects on screen let alone do it. Professor Field helped tremendously with this process and through his templates and office hours I began to understand how to manipulate the objects and visual myself as well. The whole process was also a struggle in attempting to visual something in the best way possible to give the most insight behind it. This was alleviated by looking through previous years' work, sharing my ideas with peers, looking on online communities, and continually asking myself what my question was. What was it that I was trying to give a medium to find an answer to and convey something? Keeping this question in mind throughout the process helped me organize and display everything to truly tell a story.

Sources:

Natural Disaster Data: <https://www.kaggle.com/datasets/jnegrini/emdat19002021>

Global Temperature Data: <https://www.kaggle.com/datasets/sevgisarac/temperature-change>

CO2 Emissions Data: <https://www.kaggle.com/datasets/danielrpdias/co2-and-greenhouse-gas-emissions>

GDP Data: <https://www.kaggle.com/datasets/zackerym/gdp-annual-growth-for-each-country-1960-2020>

Poverty Data: https://ourworldindata.org/grapher/distribution-of-population-between-different-poverty-thresholds-stack-bar?country=OWID_WRL~Europe+and+Central+Asia~Sub-Saharan+Africa~Middle+East+and+North+Africa~South+Asia~East+Asia+and+Pacific~Latin+America+and+the+Caribbean~Other+high+Income+%28World+Bank%29

Climate region classifications:

<https://www.sciencedirect.com/science/article/pii/S2351989419307231?via%3Dihub#sec2>