The Impact of COVID-19

How COVID-19 has affected various aspects of life.

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ABSTRACT

This paper details our project titled “The Impact of COVID-19” that was produced for the Spring 2020 offering of Interactive Data Visualization, 6.894.

For our project, we wanted to explore how COVID-19 has affected various aspects of life as we know it, by focusing on visualizing trends in mobility, schooling and social activities among other topics. We gathered data pertaining to these topics from multiple sources and wrangled it to produce visualizations focused on interactivity, while also exposing key insights we identified in the data exploration process.

Our aim is to weave these contextually different visualizations into a single storyline that walks the viewer through the key insights we highlight in our custom visualizations.

The tools used to wrangle the data were pandas, python and some Javascript. For visualizing the data, we used D3.js as well as D3plus. A deployed version of our final project can be found on github pages here.

With this final project, we hope to encourage readers to reflect on the different ways COVID-19 has affected their daily lives and to remind them that we're all in this together!

RELATED WORK

We drew our inspiration by viewing interesting tools built for COVID-19 but also one particularly compelling visualization showing the changes in air pollution levels in China observed during lockdown. These are linked here:

• COVID-19 Dashboard by the Center for Systems Science and Engineering (CSSE) at Johns Hopkins University (JHU) available here.

• Pollution made COVID-19 worse. Now, lockdowns are clearing the air available here.

KEYWORDS

COVID-19; Interactive Data Visualization;

INTRODUCTION

We are currently heavily affected by the ongoing COVID-19 pandemic. In the recent months, we have been seeing multiple visualizations both online and in the media about the progression of the disease, the death tolls by country, the infection rate and various other metrics pertaining to the pandemic.

The spread of the disease has been extensively visualized, but other impacts of the various governmental policies, for example lockdowns, shelter in place policies, travel restrictions, etc. have not been visualized as much. To address this, our team decided to focus on these micro and macro aspects that people have felt on a personal level, both worldwide and in the US.

The end product of our work is a narrative visualization that walks the user through our findings and allows the user to interact with data that is currently siloed in scattered locations, and as such, is not readily available in a single space for interactive viewing. We lay the narrative out on a single page to linearly show our insights in a more compelling manner.

METHODS

The most time consuming steps for this project were finding reliable and up to date data, and wrangling the data into a format suitable for visualization. Our wrangling scripts are located within each visualizations’s respective subfolder in the data folder.

Given that the pandemic is still ongoing, finding COVID-19 specific data for our topic areas was challenging, and so for many of these topics, we

found other datasets tracking information about our target topics, in near real time, and drew our own conclusions from them.

Some of the data sources we explored are traffic data reported by Los Angeles county, Google mobility data, flight statistics data provided by flight analysis third parties, Kaggle datasets and UNESCO datasets.

These datasets came in various formats and sizes and we wrangled each into a JSON format suitable for each individual visualization. For some larger, time series datasets, we made use of D3 Nest to rearrange the JSON data for a more snappy interaction. When dealing with large and time stamped data we aimed to show changes over time. To this end, many of our visualizations make use of a slider with automatic playing ability to visually show an overview of the large scale impacts per topic area. These large datasets are read in and nested by date using D3 Nest before being fed into our visualizing code.

Since the pandemic is ongoing, on some occasions, we came across better datasets late in the development process that we used to replace the ones we were already using.

RESULTS

For our narrative visualization, we have built multiple visualizations while paying particular attention to consistency throughout, for example we standardized the time sliders and their aesthetic throughout. In order to make our storyline compelling and to make each visualization have more impact we experimented with a few techniques, such as:

1. showing time series data such that the “cliff” generated due to some policies are clearly identifiable.
2. showing geographical impact data, where applicable, on maps while gradually filling up the map with more data to emphasize their scale.

Our visualizations span various topics as detailed in the following subsections.

TRANSPORTATION

In the recent weeks, there has been some buzz about how the airline industry has been impacted by travel restrictions. To visualize this, we used worldwide airline data[1] as shown in Figure 1 to accentuate the “cliff” in air travel volume.

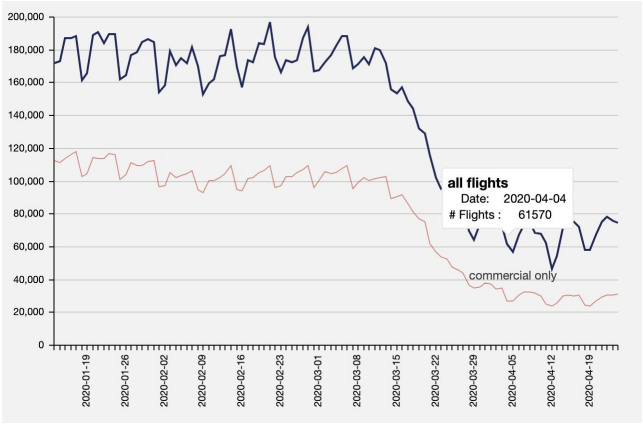

Figure 1: Worldwide air traffic volume data, with interactive line bolding and tooltips.

Another aspect of transportation affected has been car traffic, but in perhaps a more positive manner. Fewer cars on the road have also resulted in fewer traffic collisions, as we found out by visualizing LA county collision data[2]. To more effectively show this data, we used disappearing dots on a map coupled with a live graph as shown in Figure 2.

Figure 2: LA County traffic collision visualizations featuring a map with blinking spots and a synced line graph.

Schooling

As the epidemic progressed, multiple governmental bodies have seeked to “flatten the curve” by limiting crowds. One such measure has been school closings which have been gradually implemented worldwide[3] (Figure 3) and within the US[4] (Figure 4). To visualize this data, we use the second technique defined above to gradually fill up the respective choropleth maps. Interestingly, in Figure 3, the school closings seem to trace out the geographical spread of the disease.

To allow the user more flexibility to interact, we opted to expose a play functionality to automatically step through the data and also exposed a slider to allow the user more flexibility.

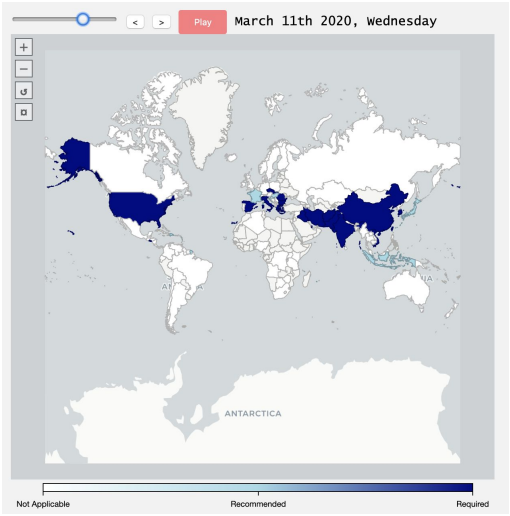

Figure 3: Worldwide school closures. Users can also step forward or backwards by date. and use tooltips for country names.

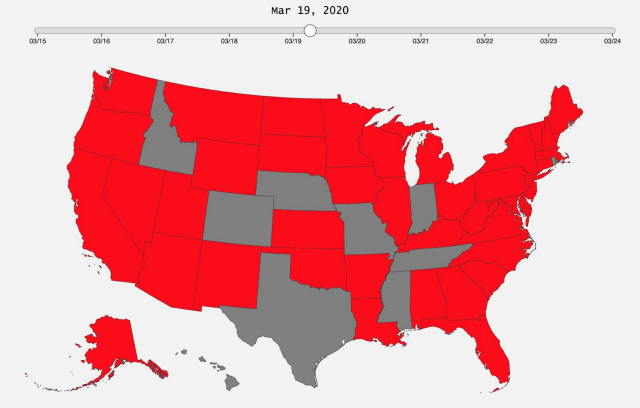

Figure 4: US school closures in the US by state.

Restaurant Traffic

Another measure to further decrease the spread of COVID-19 has been to reduce social gatherings. The restaurant industry has been heavily impacted, with states mandating closures as can be seen in Figure 5. The baseline value used for these percentage data[5] is the corresponding date in 2019.

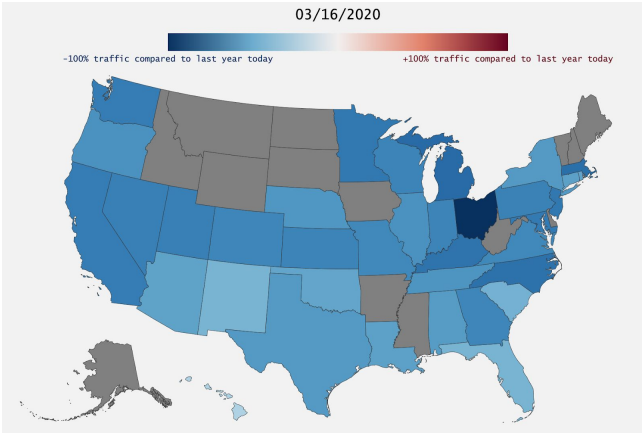

Figure 5: Restaurant reservations data, with grey states indicating states for which no data is available.

Google Mobility

While visualizing these large scale effects was indicative of lifestyle changes in response to COVID-19, we wanted some more specific insights at a more personal level. Therefore we used the google mobility dataset[7] to find out how people from the top 5 countries have changed their daily patterns, and the amount of time they spend in particular locations.

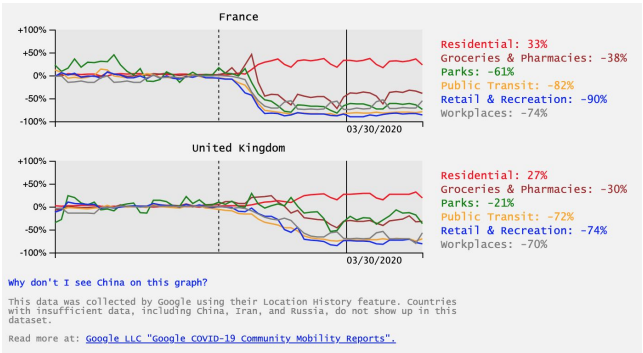

Figure 6: Mobility data across top 5 affected countries (only 2 pictured here).

The tooltips on these graphs are synched such that hovering over one moves the vertical line across all graphs and updates the value labels on the side. We also experimented with adding a question label that toggles the visibility of an explanatory blob as shown in Figure 6.

DISCUSSION

This project has enabled us to dabble in data storytelling, as well as developing a better understanding of javascript and D3. Throughout, we have tried experimenting with different interaction techniques that we had not explored in A4: timestamped data, interactive line graphs, interactive multi graph visualizations and synchronized drawing of multiple graphs based on the same dataset.

Hopefully, while viewing our project, a user would have a better understanding of aspects of life that have changed due to the pandemic that they had not been exposed to via the mainstream media. Through the worldwide school closure data, we hope to have demonstrated that tracking the extent to which the virus has spread could also be done by monitoring indirect side effects such as government policies considering schooling. Where possible, for example for the google mobility data, we have annotated the data with interesting insights about the data or about interesting facts about the data.

We also hope that the various interaction techniques we explored would be a decent source of ideas for future projects.

FUTURE WORK

In order to improve on this project, we would have liked to explore a larger breadth of topics. Some areas we could not explore, either due to a lack of datasets or due to a lack of sufficient time, but that would make nice additions to this project include: air pollution data in busy cities around the world, groceries and other consumables customer habit changes, the movement of specific stock prices for goods specifically useful during COVID-19 among others.

We would also have liked to explore some more visualization types such as area tree graphs and explored a bit of modelling to be able to answer predictive questions such as: How is the mobility data/ mortality rate affected if restaurants were reopened but not other businesses.

Given the situation is still unfolding, it would also have been great if we could hook up to live data sources and have our visualizations update as the situation continues to unfold or goes back to normal.

ACKNOWLEDGMENTS

We enjoyed the content of this class and thank the staff for making this class interesting and teaching us how to exercise a healthy dose of skepticism while assessing visualizations.

REFERENCES & DATA SOURCES

[1] Worldwide flight data statistics, https://www.flightradar24.com/.
[2] LA city traffic collision data, https://data.lacity.org/A-Safe-City/Traffic-Collision-Data-from-2010-to-Present/d5tf-ez2w
[3] Worldwide School Closure data, https://en.unesco.org/covid19/educationresponse
[4] US School closure dates, https://www.edweek.org/ew/section/multimedia/map-coronavirus-and-school-closures.html
[5] Restaurant Traffic data, https://www.kaggle.com/roche-data-science-coalition/uncover#restaurant-performance.csv
[6] Google COVID-19 Community Mobility Reports, https://www.google.com/covid19/mobility/