For Spacious Skies: A Scrolly-telling Narrative about US Domestic flights during COVID-19

Evan Denmark
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Introduction

Many people search Google Flights when they are actually going somewhere. Not me. Poking around Google Flights is what I do for fun so digging around flight data is something that fascinates me.

Pre-COVID, I had booked a flight from Boston, MA to Austin, TX for late April. About a month before the flight, I got a notification from Delta saying that my nonstop flight had been rerouted through Detroit. It got me thinking: why did they decide to do so? In the midst of a crisis, how does an airline decide which flights to cancel and which flights to keep? Furthermore, how does an airline effectively reroute its customers all while balancing their social responsibility to not spread a pandemic with their desire to stay financially afloat.

Fortunately, there are other data scientists out there with the same desire to poke around flight data. The OpenSky Network [1] is a non-profit community-based receiver network that has been collecting air traffic surveillance since 2013. In particular, they have recently released a dataset [2] of all global flights in 2020, specifically for COVID-19 analysis.

Therefore, I set out to answer a few questions:

1. How have airports been impacted by COVID? Are some airports impacted more than others?
2. How are flight routes impacted?
3. How are different airlines coping with the pandemic?

Related Work

There have been plenty of visualizations to accompany COVID-19 and, similarly, plenty of online articles from a variety of sources talking about the affects of COVID-19 on the airline industry, but none have effectively portrayed a visual story to what is going on.

There do exist some visualizations on the subject, like FlightRadar24 [3], but they do not really give us an idea of what is actually happening. FlightRadar24's visualization only shows the number of planes in the sky at two points in time during the pandemic, however, this fails to show where the planes are going, what airlines they are, and how airports are impacted.

VisualCaptialist [4] also released a visualization on March 18 but it only shows the passenger capacity of the flights, nothing about the number of flights.

Cesium [5] put out an interesting visualization showing the flights out of given global cities, but it was published on March 13 and thus is outdated and is very limited in the number of cities.

As a visual storyteller and active New York Times consumer, I gravitated towards producing a scrolly-telling guided story because it is the type of story that allows for the public to consume the information most easily. Therefore, the visualizations produced were designed to be visually aesthetic as well as informative.

Methods

The biggest data design choice I made was how to accurately group flights to compose a cohesive story. I chose to group flights by week because there is a large fluctuation of the number of flights depending on the day of the week. Additionally, because April ended on a Thursday, each week goes from Friday to Thursday. This way, each week can be compared equally with no bias. Well, almost. No two weeks can ever be compared exactly because there are temporally varying events (like spring break) that will affect the number of flights. Therefore, in this project, I define the "normal operation" as the 2020 maximum weekly operation. Pre-COVID, weekly flight patterns for airports and airlines did not fluctuate by more than a few percentage points.

Inspired by the New York Times "See How the Death Toll Grew Across the US" [7] visualization, I decided to plot the different airport traffic on a map as a bar chart. I took inspiration from the NYT to put the total number of flights on the top of the bar.

In order to represent the traffic of a given flight route, I vary the opacity and weight of the route. Because I wasn't concerned with how well each route could be perceived, I felt opacity was appropriate. This way the routes could be interpreted in aggregate.

I decided to represent airline operating percentage as a single line graph as opposed to small multiples because it was easier to directly compare their relative behavior. Also, putting across the entire page was something that I found aesthetic.

Results

There were three major areas in which I found intriguing results: airports, routes, and airlines.

Airports

It was interesting to see that many of the largest airports drastically reduced their flights in mid-March to somewhere around 20%. Most were in the range of 15-25% of their normal weekly traffic. Some airports – like New York LaGuardia (LGA) – dropped as low as 4.6% of their normal traffic. Others, like Louisville (SDF) only dropped to 71% of its normal capacity. Indianapolis actually *increased* by about 400%. I initially thought this was an error in the data, but later found out that FedEx rerouted many flights to Indianapolis for some reason. I reached out to FedEx but they didn't respond.

Routes

Because of the drastic reduction of passengers in the last weeks, airlines no longer need to service the same number of flights for a given route. However, depending on how many flights normally operate on that route, the reduction of the number of routes was different. Most of the highest volume routes pre-COVID were reduced to 10-15% of their normal weekly amount. Other more "niche" flights, like Anchorage (ANC) to Chicago (ORD) were hardly reduced at all.

Airlines

Depending on the status of an airline, the flight reduction behavior varied. Major airlines, like Southwest, Delta, United, and American, reduced their operations by 69-85%. In contrast, budget airlines – Frontier, Spirit, Allegiant, and Sun Country – reduced their operations in much higher percentages (90-99%). The airlines that are not a budget airlines but are also not a national carrier like JetBlue, fell in between the full service and budget airlines. In particular, Frontier Airlines has nearly stopped operation, going from approximately 1250 weekly flights in

February to 11 flights in the last 7 days of April.

The timing in which airlines started decreasing their flights is peculiar. Spirit Airlines did not significantly decrease their arsenal until two weeks after other major airlines did.

It is also interesting to note that cargo delivery airlines FedEx and UPS have remained relatively constant throughout the pandemic.

Future Work

There are many way in which to improve upon this project.

Interactivity

Because this is meant to guide a user, I would love to add an interactive component at the bottom of the scrolly-telling once the user has been taught the different elements of the story (airports, routes, and airlines).

External Data

The TSA recently published data about the number of passengers it has seen each day. It would be useful to add in external datasets like this in order to understand if flights are operating at capacity.

Additionally, it could be interesting to incorporated publicly available COVID data for different cities and see if they correspond to flight data in any way.

Global Integration

For the scope of this final project, only US flight data was used, but OpenSky Network has the data for every airport in the world publicly available. It would be really useful and exciting to do similar analyses for the global data.

References

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