Process Book Instructions

TechStream

Arthur Iliescu, Adam Sterling, John Chakkour, Borys Langowicz, Qianren Pan

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Process Book Instructions

Your process book is a living document in which you will track all the progress you make throughout the semester!

The document is organized into tabs, which you should see on the left. Each tab contains the template and instructions for a particular week.

Each group should make a copy of this document (File > Make a copy), which you'll update every week. As a first step, edit the group name and member fields above in your own copy of the process book. When you sign up for groups, you'll be asked to add a link to your group's process book. Your project mentors should be able to access the document to check on your progress.

Submitting

Most weeks, you'll upload a PDF of the relevant milestone on Quercus. When you have a Google Doc tab open and click File>Download>PDF, it will automatically save just the current tab. For grading purposes, we will only be looking at the submitted PDFs, so any updates you make to that tab afterwards will not be considered (but might be helpful for your own documentation, or for TAs to check your process later on).

W4 Proposal and Team Agreement

Jetstream to Datastream

TechStream

Arthur Iliescu, Adam Sterling, John Chakkour, Borys Langowicz, Qianren Pan

Abstract

Our motivation for this project is to analyze flight data to visualize the global human connection. People are spread all over the globe, and transportation is what allows us to connect to one another. Airplanes are the fastest and furthest travelling form of transportation. We want to analyze this data to get a better understanding of the world around us and how it is all connected and intertwined.

We plan to look at global flight tracking data, top destinations, total and average flight times, visualized through the globe. We plan to use open access airline route data, with tracking numbers for flights year round. We can get these from many online data sites similar to flight trackers.

Team Agreement

Communication

We will use Slack as the primary team communication channel. All team members must respond within 24 hours maximum, preferably within 4 hours during business hours (9am-5pm EST). For urgent matters, use @channel or specific @mentions.

Weekly team meetings held every Monday at 5pm via Zoom, with additional meetings 7pm on Fridays as necessary. During meetings each member will present what they have done, what they need to do going further, and anything they need or require assistance with in a status update. Meeting notes stored in a shared Google Doc. Attendance for meetings is mandatory - notify team lead, or message in a notices channel at least 12hrs ahead for absences.

Code Guidelines

Branch naming convention: feature/[ticket-number]-description (e.g., feature/123-login-page)

All complex code requires inline comments explaining the logic. Functions longer than 20 lines must have detailed docstrings. Comment on any workarounds or technical debt. Code which is deemed important to any specific function should be commented appropriately in case of the need to transfer or share work.

Version Control

- Main branch protected - no direct commits
- Create feature branches from latest main
- Merging to or changing the main branch needs to have three separate checks and approvals.
- Subbranches where work is being done alone will not require any checks and approvals.
- Any branches where work is being shared amongst 2 or more team members will require two checks or approvals to make direct branch changes.

Quality Standards

- All code must follow the same agreed upon conventions
- Any updates or decisions made to change code style or quality must be replicated throughout all parts of the project
- No failing tests in main branch

Team

Members: Arthur Iliescu, Adam Sterling, John Chakkour, Borys Langowicz, Qianren Pan
Roles: Team leader: Adam Sterling. Other roles to be determined/finalized based on data set and project size.

Date: September 26, 2025

Signed: Arthur Iliescu, Qianren Pan, John Chakkour, Adam Sterling, Borys Langowicz

Submission
Upload this process book worksheet to Quercus. Make sure to only submit once per team!

W5 Map

Week 5: Map (Project Plan)

John Chakkour, Arthur Iliescu, Borys Langowicz, Adam Sterling, Qianren Pan

Background and Motivation

Our motivation for this project stems from an interest in the ways humans are interconnected across the globe. Originally, our idea was to explore the invisible web of internet connections through digital networks. However, we decided to shift towards something more tangible and human centric with flight data.

Most individuals are only exposed to flight data in their immediate surroundings (friends and family). However the world is a big place with many different cultures and societies. We aim to uncover the connectivity of different peoples and cultures across the globe.

There are many stories and experiences to be told through flight data. What sets flight data apart from conventional data types is that it can be directly used to represent real physical and emotional journeys that connect people, places and cultures.

Related Work

We were inspired by the various online flight trackers and live flight maps that show real world flights happening in live time.

- Inspired by flight trackers online, the maps that are available with in-flight entertainment systems, and maps that show live tracking data
- Maps and visualizations of routes, like those for subways routes and stations shown in class.

Audience and Questions

***Audience*:** Target audience: at the level of the general public + mildly interested hobbyists. They understand basic statistics about flights: flight paths, total number of passengers, most popular flights, airlines used. Extra information for hobbyists can include plane type (777, 747, A380), for example. Possibly some simple efficiency metrics (fuel usage per passenger… etc.) for the ecologically inclined.

The general public and hobbyist audience is driven by curiosity, wants quick answers to simple questions, and is highly motivated by interesting, visually engaging maps and replays that make patterns and anomalies easy to see and share. No need to make the visualizations too technical: colors and shapes (lines, arrows, plane symbols) matter more than raw numbers.

Who are they?

- Casual spotters: Mobile-first, short sessions prompted by nearby aircraft or pickup logistics; success is rapid identification and ETA confirmation.
- Event followers: Traffic spikes during newsworthy events; success is locating the focal flight, understanding deviation causality, and reviewing a reliable replay.
- Enthusiasts: Longer sessions with selective filtering and historical review; a subset contributes receiver data and circulates deep links.

What do they want?

- Immediate clarity and engaging visuals: identify the plane, see its path and ETA, understand anomalies (diversions, holds, unusual routes), and watch/share compelling replays.
- Curated discovery: “Top Tracked Now,” busiest airports/routes, busiest calendar days, live “planes over this region,” and simple before/after weather impacts.
- Simple, reliable outputs: plain-language explanations, readable legends, and links/screenshots that preserve annotations and key metrics.

What do they know?

- Comfortable with flight basics surfaced in consumer trackers: flight number, origin/destination, ETA, route, altitude, speed.
- Conceptual awareness that weather/airspace shape routes and that tracking depends on broadcast signals with varying coverage; limited appetite for technical acronyms or operations jargon.
- Recognition of trending or unusual flights but reliance on short context snippets to avoid misinterpretation.

Their visualization literacy

- Predominantly low-to-moderate: prefer map-first views, simple line/bar charts, and minimal encodings per visualization.
- Comprehension improves with clear legends, consistent color/units, short annotations, and narrative callouts for anomalies.
- Complex multivariate or network diagrams should be optional; provide scaffolding if used (tooltips, stepwise highlights).

Level of detail to present

- Default
    - Simple, map-first view with a few key metrics visible on selection and clear labels; short, plain-language explanation available on tap.
- Visual interest

    - Optional animated replays, side-by-side comparisons to a typical path, simple flow lines between major routes, and calendar or trend snapshots for busy periods.
- Discovery
    - Lightweight modules highlighting what's trending, what's unusual today, and where traffic is concentrated, each opening to a focused visual.
- Advanced
    - Optional filters and overlays for aircraft, weather, and history, plus basic data context and sharing that preserves the current view.
- Guardrails
    - Keep each view focused with minimal encodings, consistent units and colors, brief "how to read" cues, and a short note when estimates or gaps apply.

***Questions*:**

- Which airports are the top global destinations by number of flights?
- What are the most popular flight paths overall/per airline?
- What are the most popular flight paths for each airport?
- What were the most popular airlines?
- Which plane makes/types were the most popular overall/per airline?
- Which airlines have the most flights by region?
- How many planes are currently flying across a specific continent/ocean?
- What are the most fuel-efficient airlines?
- How have flight paths changed over the years?
- What day (in a calendar year) had the most total flights?
- What cities or what countries are the most connected?
- How did global events (e.g., COVID-19) affect flight numbers and durations?

Data

1. Airport data
    - OpenFlights
    - Raw CSV

Attribute	*Description*	*JavaScript data type*
Id	Unique ID	Number (ordinal)
Airport	Airport common came	String (categorical)
City	Airport city	String (categorical)

Attribute	*Description*	*JavaScript data type*
Country	Airport country	String (categorical)
Code	IATA airport code	String (ordinal)
Coordinates	(Latitude, Longitude, Altitude)	(Number, Number, Number) (quantitative)

2. Flight data
    a. Live data
        - Aviationstack
    b. Historical data
        - OpenSky API
        - Bureau of Transportation Statistics

Attribute	*Description*	*JavaScript data type*
Squawk	Unique transponder code	String (ordinal)
Origin	Country name	String (categorical)
Destination	Country name	String (categorical)
Origin airport	IATA airport code	String (categorical)
Destination airport	IATA airport code	String (categorical)
Departure	Departure time	Date (quantitative)
Arrival	Arrival time	Date (quantitative)
Coordinates	(Latitude, Longitude, Altitude)	(Number, Number, Number) (quantitative)
Speed	(Vertical, Horizontal)	(Number, Number) (quantitative)
Model	Specific model	String (categorical)
Airline	Airline name	String (categorical)

3. Tourism data
    - Kaggle

Attribute	*Description*	*JavaScript data type*

Year	~	Date (quantitative)
Country	~	String (categorical)
Inbound	Number of inbound tourists	Number (quantitative)
Expenditure	Average expenditure for visiting tourists	Number (quantitative)

4. City data
    - Simplemaps.com

Attribute	*Description*	*JavaScript data type*
City	City name	String (categorical)
Location	(Latitude, Longitude)	(Number, Number) (quantitative)
Country	Country name	String (categorical)
Population	City population	Number (quantitative)
Density	Average population density	Number (quantitative)
Language	Main language spoken	String (categorical)

5. Aviation accidents
    - Airframes.org

Attribute	*Description*	*JavaScript data type*
Date	Date of accident	Date (quantitative)
Manufacturer	Plane manufacturer	String (categorical)
Model	Plane model	String (categorical)
Age	Plane age in years	Int (ordinal)
Location	Accident location	Int (categorical)
Cause	Cause of accident	String (categorical)

Limitations of our data

Every data set has its own limitations. With the ones we have chosen, we don't have access to specific passenger data such as the number of passengers or their demographics. More company based data such as specific routes flown by carrier, or most common routes for carriers are not available as well. Flight data is also live tracked, and with the amount of flights per day this leads to incredibly large amounts of data in the size of several terabytes per year for even the most basic of data sets. This leads to having to pick and choose specific periods of data instead of being able to use the largest data sets for the most realistic and accurate conclusions. We also cannot take into account all the weather or political events that may skew data when drawing meaning from results.

Summary of data not showed in points:

- Passenger Data
    - Number of passengers
    - Passenger demographics
- Specific routes flown by carrier
    - Only available for commercial api users.
- Simplification of flight route, indication of transactions
- Delayed/canceled flight data
- External events: weather, natural disasters, and political events are not analyzed.
- Airline, airframe, seating charts, and other commercial data like ticket prices

Data Cleanup

Do you expect to do substantial data cleanup?

> Yes. The historical flight data is inconsistently labelled, and the data file sizes are extremely large (100 MB CSV files for each hour of each day in the period covered). We will need to filter this down to manageable levels before analysing.
>
> Data for cities and tourism (at the country level) and air traffic will need to be collated, with attributes like city, country code and location data normalized so it can be visualized together.

What quantities do you plan to derive from your data?

> We plan on extracting key data related to which planes are flying to where at what times. This data will be correlated with information derived from the airport, city and tourism data sets to produce our own statistics for visualization.

How will data processing be implemented?

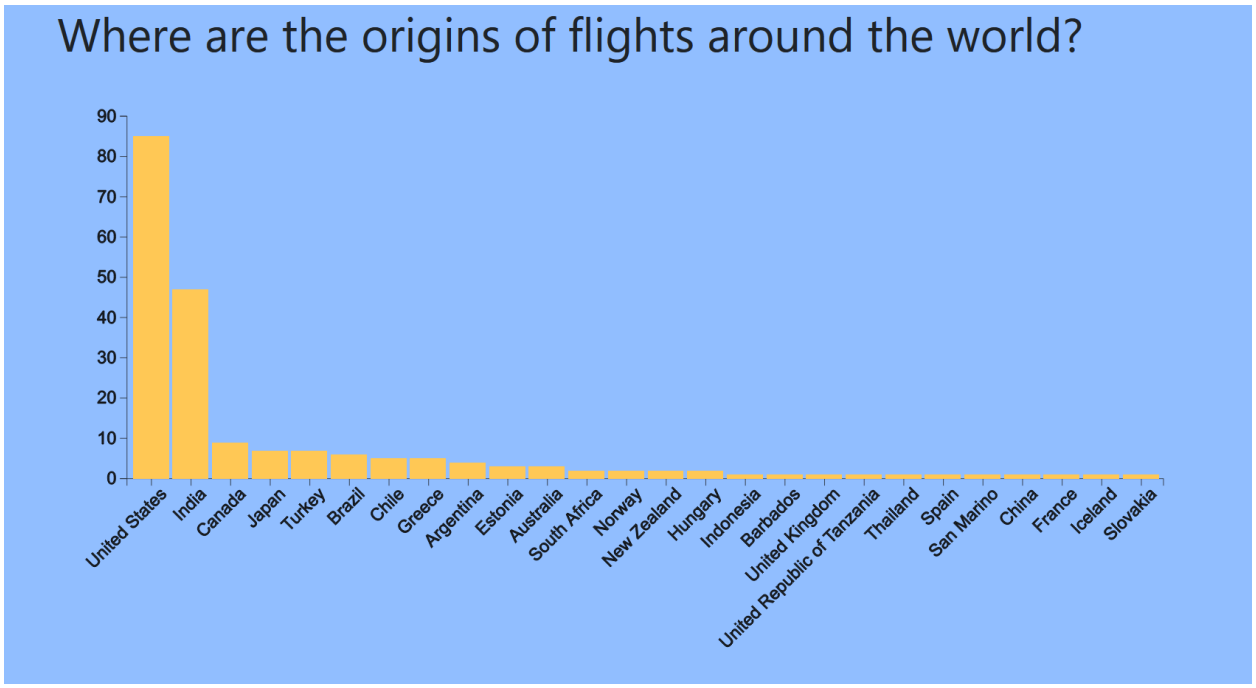
> Python or JS scripts to retrieve and filter CSV files. API access might be mediated through scripts as well to allow some caching and archiving for reliability and offline testing. Data from different datasets will be relabelled with matching attribute names and fields.

W6 Data Exploration

Week 6: Data Exploration

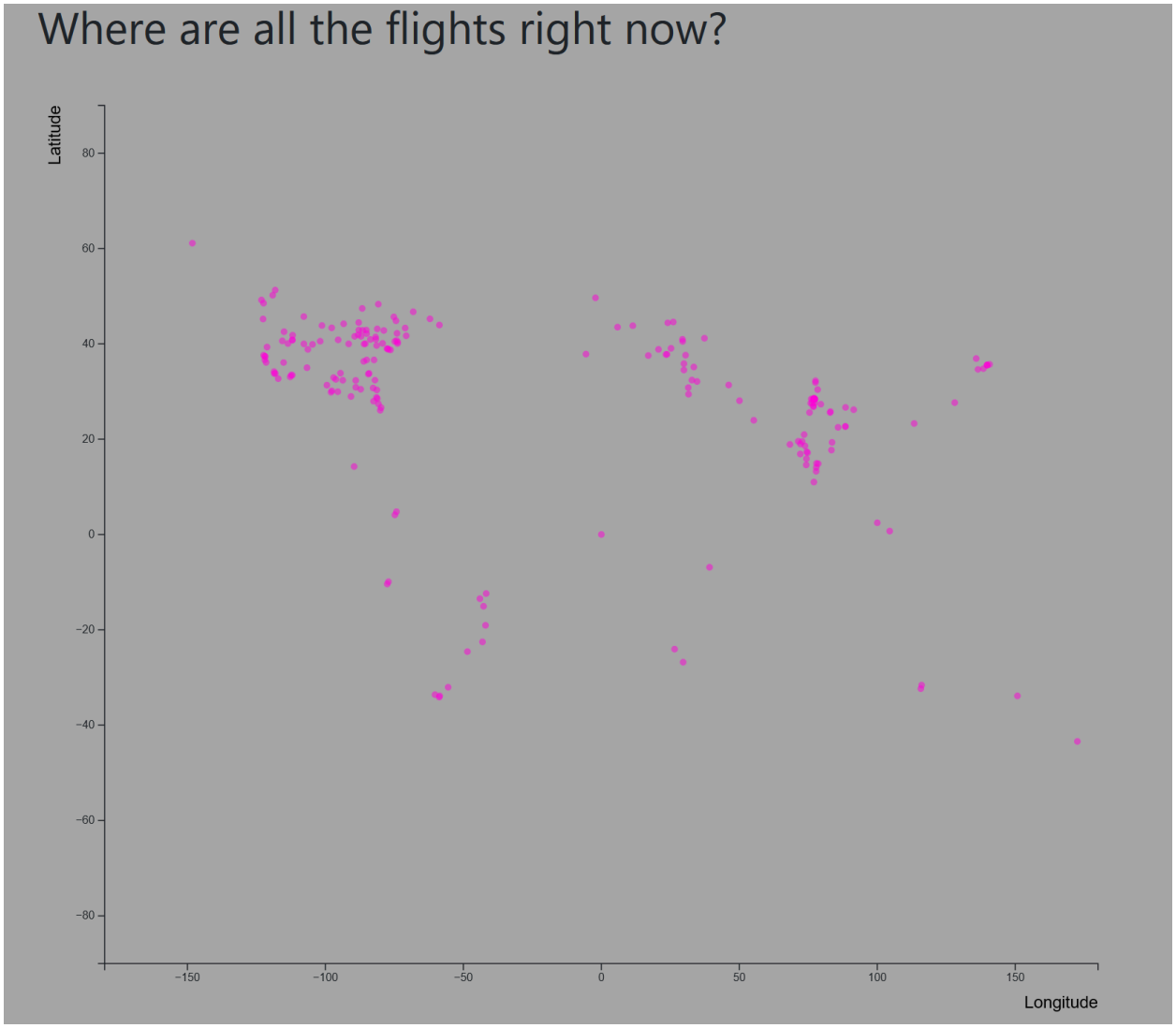
Arthur Iliescu's visualizations

#1 Where are the origins of flights around the world?



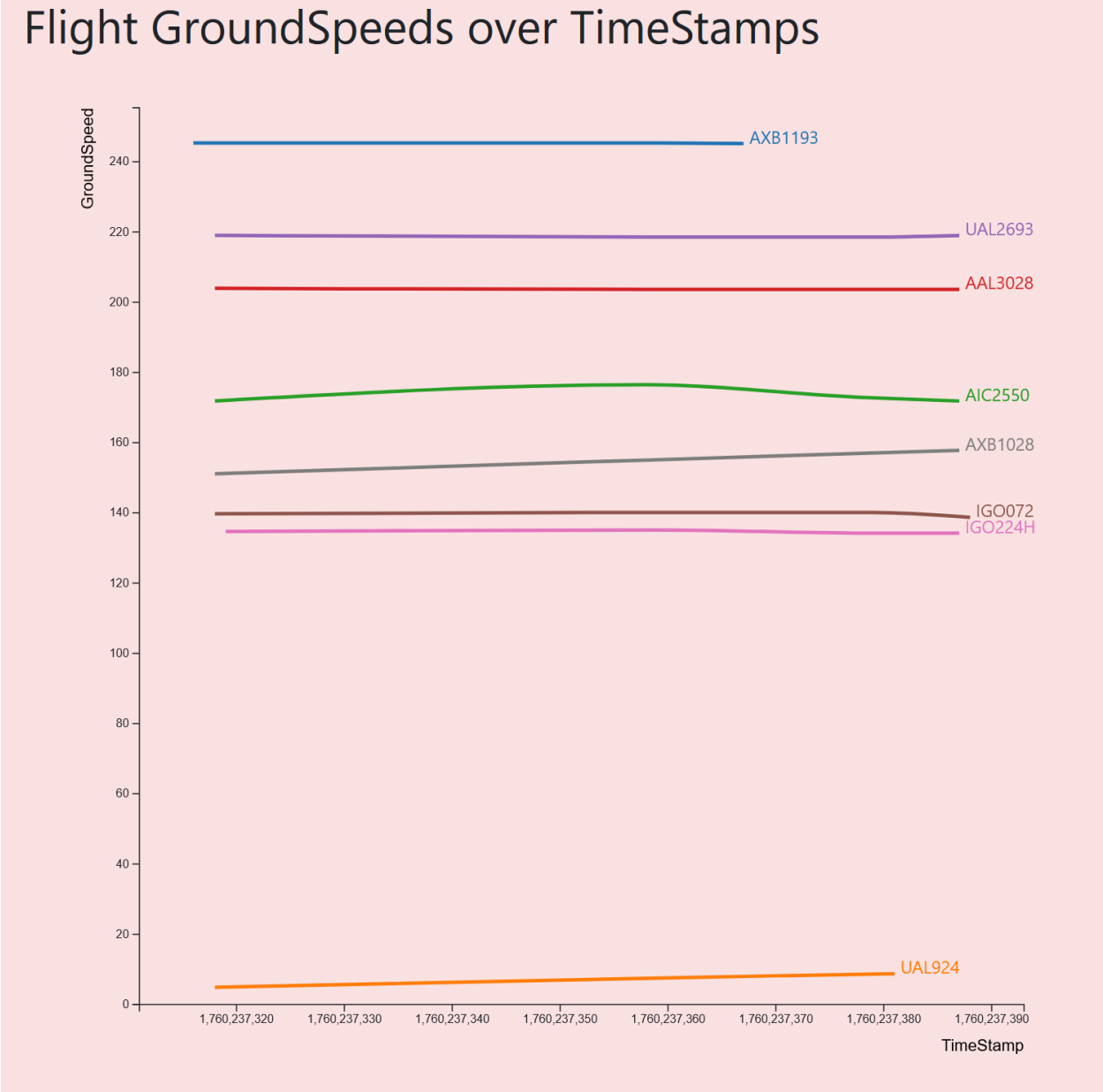
Created with D3 using javascript.

#2 Where are the current coordinates of all the flights?



D3 using javascript.

#3 How do flight speeds change over time?



D3 using Javascript

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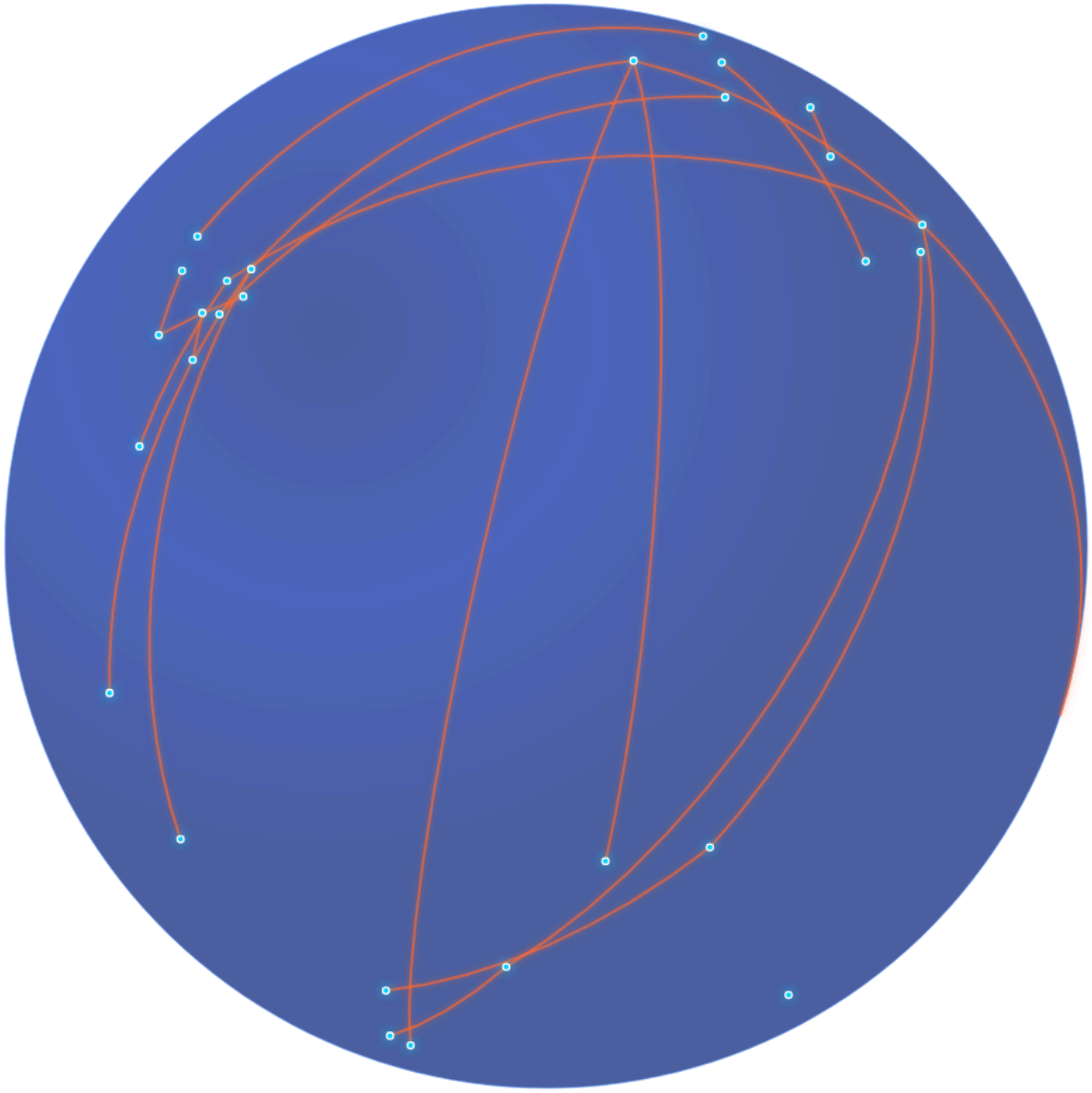
Borys Langowicz's visualizations

I wrote reflections on my work after each visualization

Visualization 1
Create



Using D3.js and this: https://github.com/alexaac/map-challenges/tree/master/points great resource

Reflect

For our flight data, I wasn't sure if a 3D globe would work, but the MapTheClouds proved it was possible. When I looked at the same data in traditional charts, I didn't notice any geographical connections or geographic patterns that the globe format showed. It was much simpler to

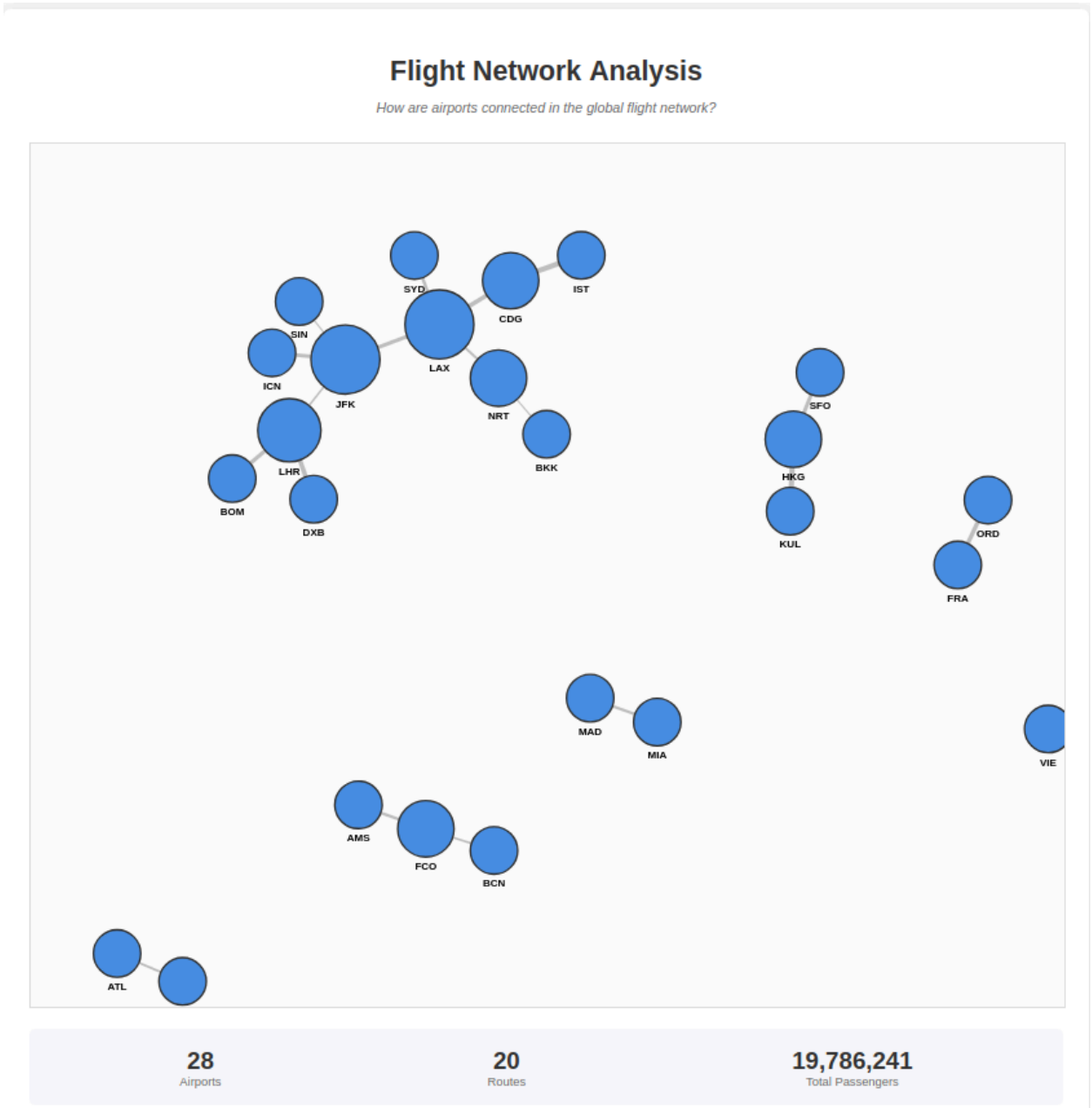
determine which airports are important hubs and how routes cluster in various locations thanks to the ability to zoom and rotate across the world.

This really made me realize that location matters a lot more than I thought for this kind of data. Regular charts just show you the numbers, but the globe actually shows you why certain routes exist and which airports are the real connection points. I started asking completely different questions about how flights cluster in different regions and what makes certain airports so busy.

It was satisfying to figure out that this whole 3D globe thing actually works and makes the data way more understandable.

Visualization 2

Create



Using d3.js

Reflect

I was able to investigate the connections between airports in the real world with the use of this representation. I could easily tell which airports serve as key hubs - those with a lot of connections - and which routes carry the most traffic by examining the network graph. This network-based representation highlighted the structural connections and patterns of interconnection between airports, in contrast to a standard globe visualization that concentrates on geographic locations. This demonstrated how the global air transport system is structured underneath the surface of geography.

What made this visualization especially effective was how much it showed me at once without feeling overwhelming. The bigger circles instantly told me which airports had the most connections, and the thicker lines showed where the busiest routes were.

Visualization 3

Create

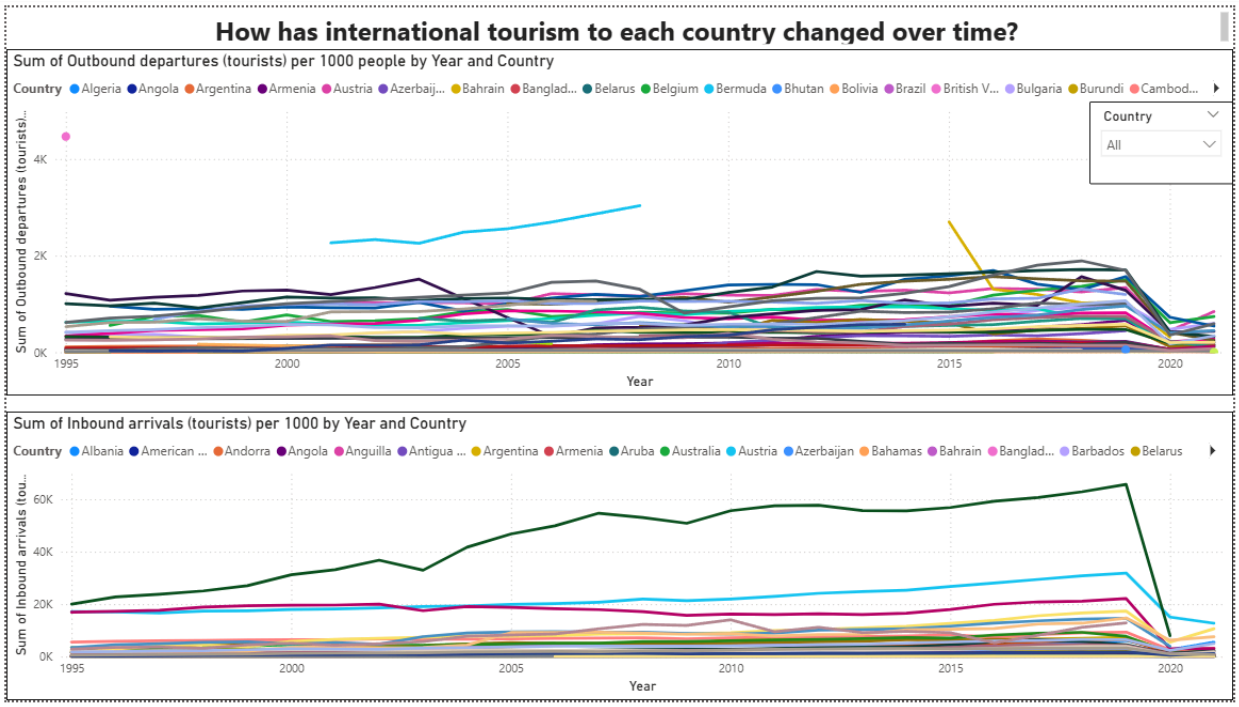
Using d3.js

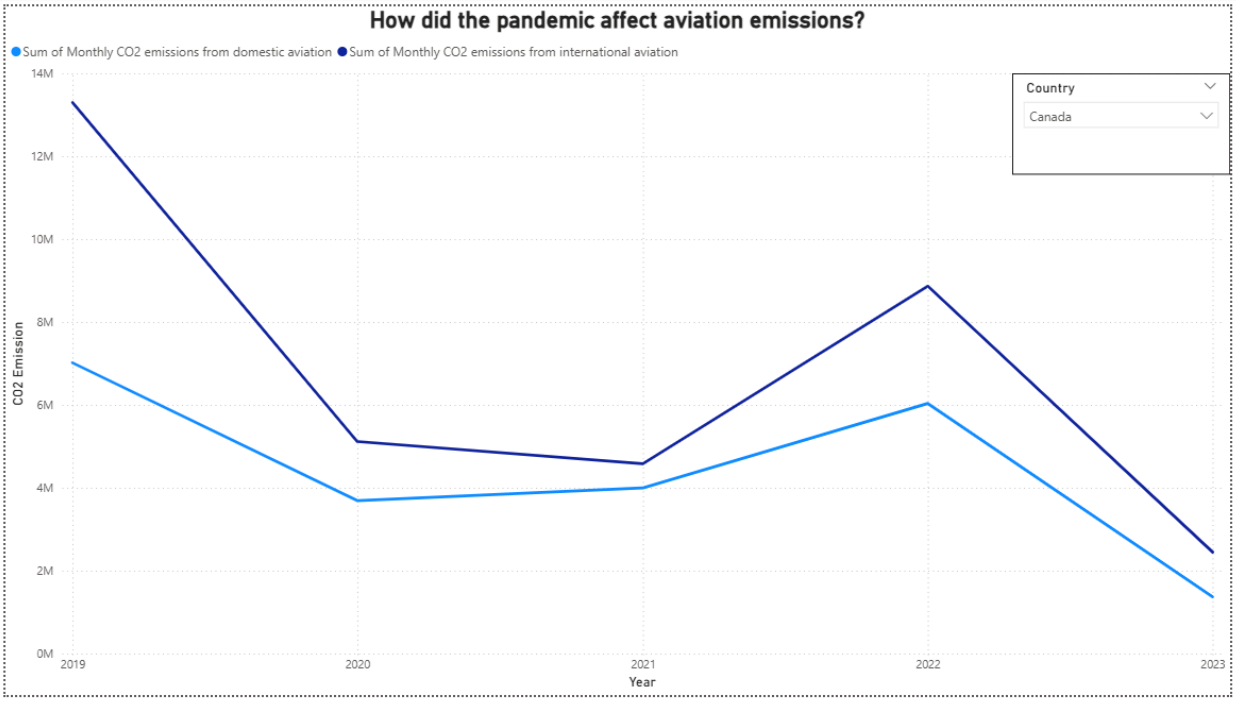
Reflect

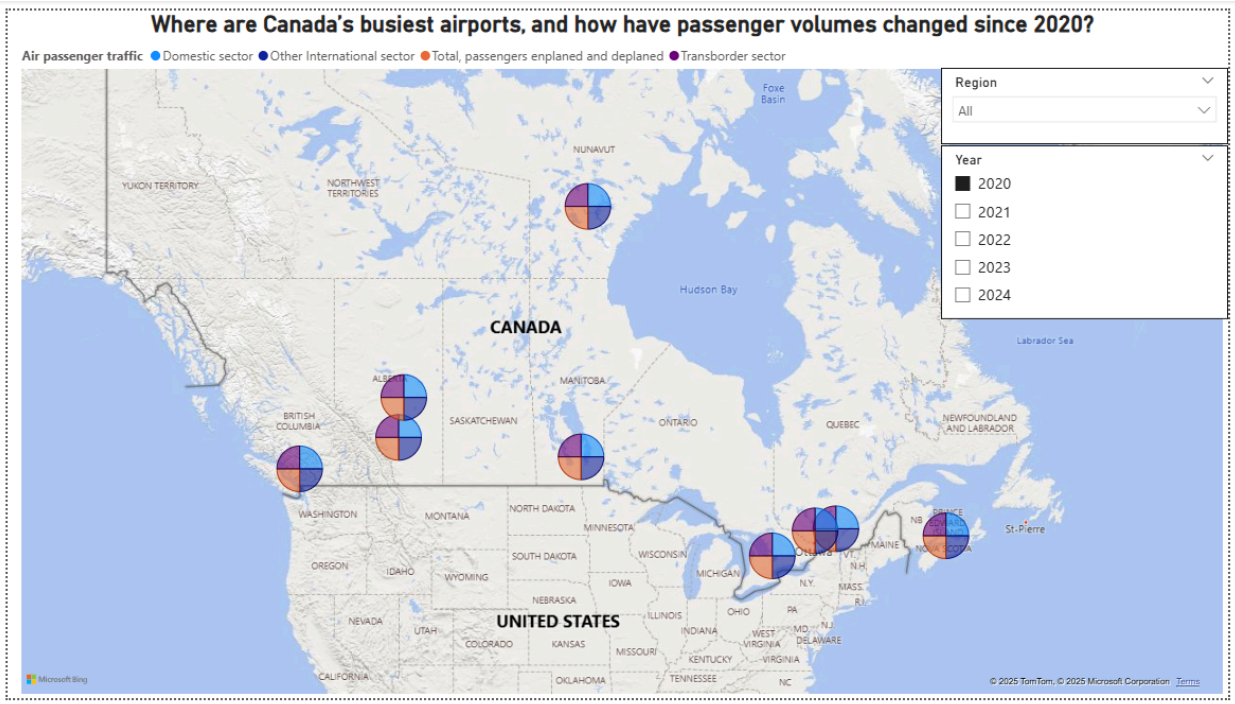
The parallel sets visualization effectively answered the question "How are different airports connected?" by revealing the complex flow patterns between origin airports, and destinations,

through view that made passenger volume relationships immediately visible. This approach proved particularly valuable because it transformed categorical data into a visual flow diagram that highlighted how passenger traffic is distributed across different airport pairs, and the overall structure of the flight network in a way that traditional bar charts or scatter plots could not capture.

Qianren Pan's Visualizations:







Reflect:

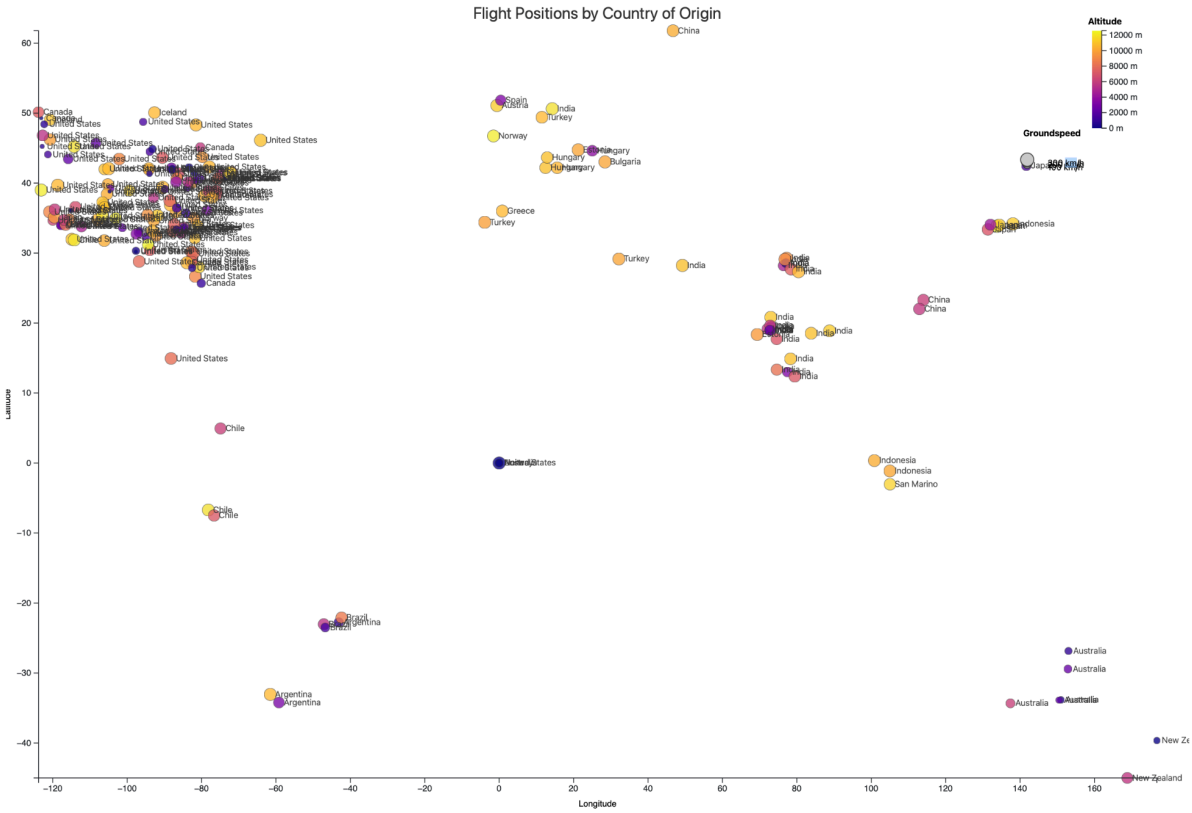
This project used Power BI to visualize trends and locations across three datasets—international tourism, aviation CO_2 emissions, and Canadian airport

traffic—enhancing both temporal and spatial understanding. The tourism visualization revealed how travel demand fluctuated globally over time, while the CO_2 emissions chart highlighted the environmental impact of reduced air travel during the pandemic. The Canadian airport map displayed geographic recovery patterns and regional differences in passenger activity. Together, these visuals transformed raw data into clear insights, demonstrating how Power BI's interactive tools effectively communicate changes in travel trends, environmental outcomes, and spatial distributions in a compelling, data-driven narrative. My approaches also differed from others as I chose to focus more on an overtime comparison, similar to Arthur's groundspeed over time graph, though my overtime comparisons were more about global events and emissions, and locations rather than groundspeed.

Adam Sterling's Visualizations:

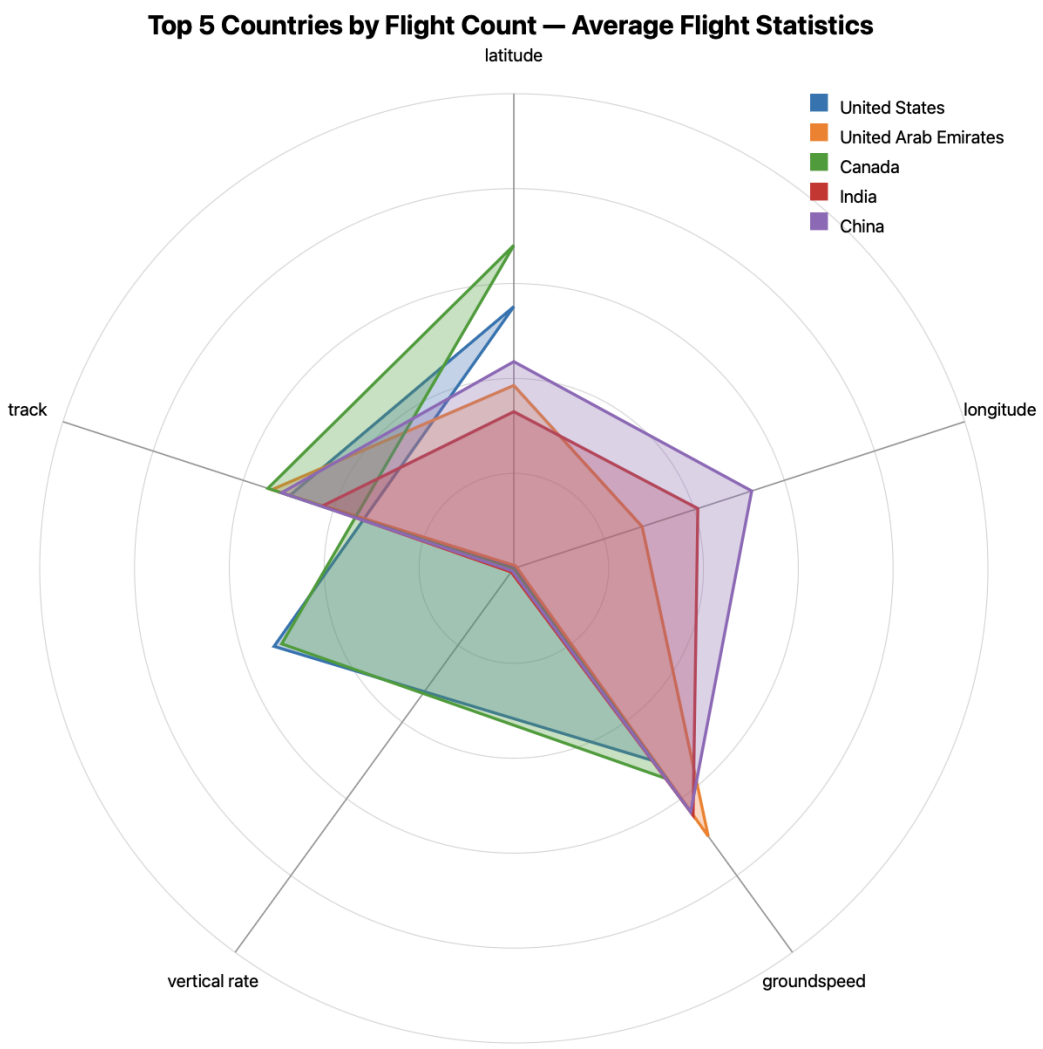
Reflection:

This design is inspired by a pilot's flight instrumentation. Data from a selection of real-time flights is shown, incorporating key position and direction information in the same way in might be seen by a pilot in flight. This visualization focus on showing position and location data in an easy to comprehend format, helping to answer where a selection of plane is located and headed at a given time, without relying on map based visualization. It functions on its own to help answer questions about This was designed to help visualize the answer to specific questions about which planes are travelling to where at a given time, functioning as its own graph or as a component of a larger visualization. It was designed in d3.



Reflection:

This visualization is a scatterplot based on the dimensions of a world map. It uses size and color to express the speed and altitude of various flights. This visualization can be used to determine where flights are currently concentrated, and when tied to data over time, to visualize high traffic routes and the connections between geographic locations. This is designed in d3.



Reflection:

The radar graph above uses the same real-time flight data, but visualizes the average data for the countries with the highest current flight count. A radar plot fits with the visual theme of aviation, while providing an easy to examine signature, when viewed over a period of time, that shows changes in overall trends of traffic from various countries (or airlines, or even between specific countries or airports). This helps build a visual flight profile that can show major changes in time and between different classification groups, and as a response to specific global events. This helps answer questions about how trends change over time, and in response to outside factors. This was also designed in d3.

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Reflection

Borys Langowicz's reflection after comparing with others

When I compare my visualizations to the rest of the team's, I can see that the questions I explored ended up being pretty different from what we focused on during the Map step. At first, as a group, we were mostly interested in seeing where flights were happening around the world and how they moved geographically. But once I started experimenting with D3.js, I became more curious about the connections between airports - how they're linked, which ones act as major hubs, and how passengers move through the system. The 3D globe helped me realize how geography shapes these patterns, while the network and parallel sets visualizations showed the structure underneath the surface. Instead of just showing locations, I wanted to understand the relationships that make the global flight network work.

Everyone on the team approached the data a bit differently, which made things more interesting. Arthur and Adam both focused on real - time flight locations and movement, using D3 to show where planes were and how they were traveling at that moment. Their visualizations felt very dynamic and map-based. Others work was different - using Power BI to combine aviation, tourism, and emissions data, which told a broader story about trends and impacts over time. My work focused more on exploring structure and connections.
Seeing other's visualizations made me understand how the same data can be looked at from many angles, and how combining these views gives a more complete picture.

Arthur Iliescu reflection:

Overall reflection:

I tried to take more of an analytical focused approach on all my graphs.

For the first graph, I went with a comparison approach. I focused solely on what the flights were at the current time of October 10th, 10pm EST and then explored what their origin countries were. If I were to replicate this chart over a large data set I could also figure out which countries fly the most planes for each hour in the day.

For the second graph, I decided on a relationship approach with a scatter plot. I used real world flight locations of October 10th, 10pm EST and mapped them to an accurate longitude and latitude scale of the globe. I wanted to add flight id's but many would overlap and it would be illegible. One thing I would do moving forward is to plot the flights over a world map, while maintaining the axes for accuracy.

For the third graph, I went with a change over time representation. First, I tracked the ground speed changes over time for four flights roughly 10 seconds apart, and combined the data for each time into one larger data set, mapping the change in speed over time. It would be interesting to see the results if I were to map flights over periods of hours to see the ascent and descent speeds.

The questions I explored were more specific than the group questions on the map step. Though some were still similar, the second map is similar to the question how many planes are currently flying across a specific continent or ocean, but I would have needed to add a real world map in the background to identify this. Additionally, if I had tracked the path of the locations instead, I could have also answered the question: “How have flight paths changed over the years (or over time)?”. This map idea was similar to Adam’s second, and Borys’s first visualizations in relation to the topics of space and location, though Borys represented the actual path over a globe, and Adam went into further detail with origin and altitude. My third graph was also similar to the first two of Qianren’s visualizations as they focus on change over time.

Overall, I felt that if I could use my second scatter plot graph with the additional data in Adam’s scatter plot graph, mapping it over a picture of the world map, then it would be close to a flight simulator. The final touch would be adding the paths over time. I think going forward this would be a good approach to answer many different questions in the week 5 part, and we could create menus for selecting certain aspects, such as country connectivity, fastest and slowest planes, most popular airports. If we mapped data over time around covid, we could also answer the question about global events. Additionally, we could add an option dropdown to select a flat map, or a globe that a user could interact with similar to Borys’s first visualization except in a dynamic approach. I think we could also reshape the original questions to better fit this format of a visualization.

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Data submission summary

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Screenshots/discussions/other notes (if applicable)

…

Instructions

This week, you’ll dive deeper into your dataset by creating quick exploratory visualizations to better understand what you’re working with.

Step 1. Create

- Use any tool you like (Excel, Google Sheets, Datawrapper, Tableau, Python, ChatGPT, etc.) If you want to see some options, check the resources page on the course website: https://hivelabuoft.github.io/CSC316/resources.html
- Each team member should generate at least **three different visualizations** that ask different questions about the data.
- Give each chart a question-style title based on what it answers. (e.g., "How is income distributed in Toronto?").
- Export each chart as an image and add them to your process book. Label each chart with who made it and what tool they used.

When exploring your data, try to go as wide as possible in terms of different approaches. Follow your curiosity and keep asking questions. You don't have to coordinate as a group—individually explore whatever you find interesting. Here are just a few angles you might want to consider looking at, but don't limit yourselves to these:

- Distributions (histogram, boxplot)
- Comparisons (bar charts, rankings, small multiples)
- Relationships (scatter, heatmap)
- Change over time (line or area chart)
- Data quality checks (missing values, outliers, duplicates)

Step 2. Reflect
At the end, write a reflection that answers the following questions:

- How did the questions you explored differ from your team's original questions from the Map step?
- Did people take similar or different approaches to each other?
- Which charts felt most useful, and why?
- How will this shape your approach going forward? (e.g. if you will change the questions you answer, focus on a specific angle, etc.)

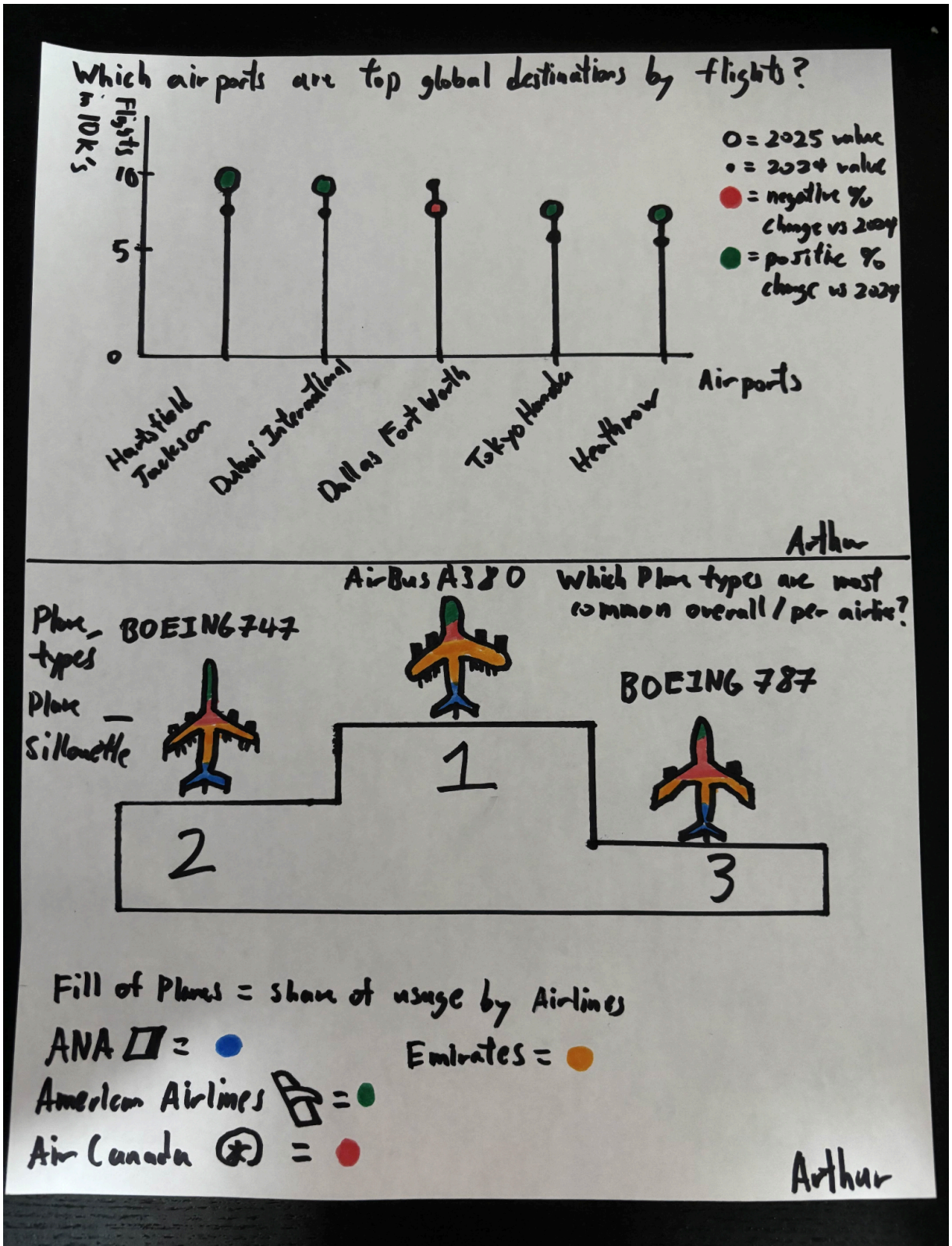
Submission
Upload this process book worksheet containing visualizations, labeled by team member, followed by your reflection. If you used ChatGPT or other LLM tools, include the prompts you used in an appendix.

W7 Sketch, Decide, Storyboard

Week 7: Sketch, Decide, & Storyboard

Arthur Iliescu's sketches

Sketches in image 1 then image 2 from top to bottom, ID 1 to 4



What day had the most flights?

- Emirates
- Delta
- American
- United

top airlines

= 10 million people
% of person is like scale out of 10 mil

= 100,000 flights
% of plane out of 100,000 flights

August 1st

December 25th

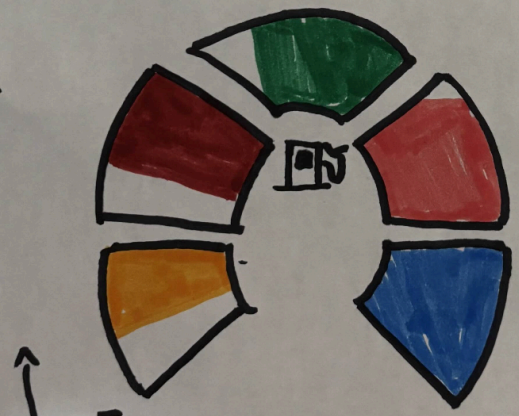
January 1st

size proportional to airline share of flights on that day.

Arthur

What are the most fuel-efficient airlines

Airlines
- ANA
- Air Canada
- Delta
- American
- Emirates



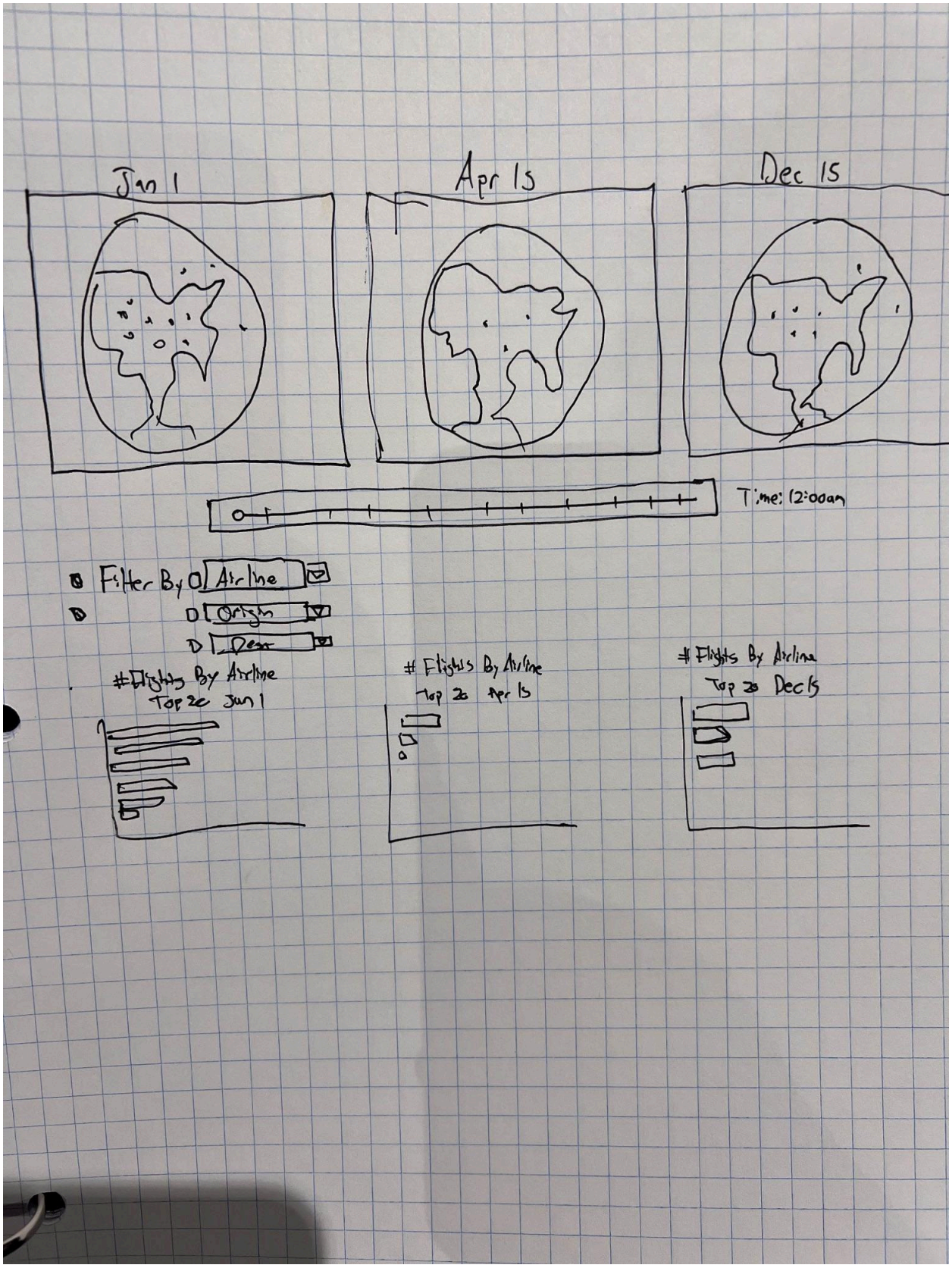
Fill = proportionality of fuel efficiency of airline compared to leader.

E (worst)

F (Best)

Arthur

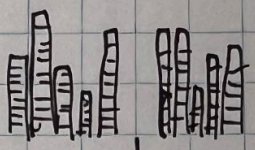
Adam Sketches


Jan 1
Apr 15
Dec 15
Time: 12:00am
Filter By
Airline
Origin
Dest
Flights By Airline
Top 20 Jan 1
Flights By Airline
Top 20 Apr 15
Flights By Airline
Top 20 Dec 15

Flights ~~to/Dest~~ (over 24 Hours' Period)

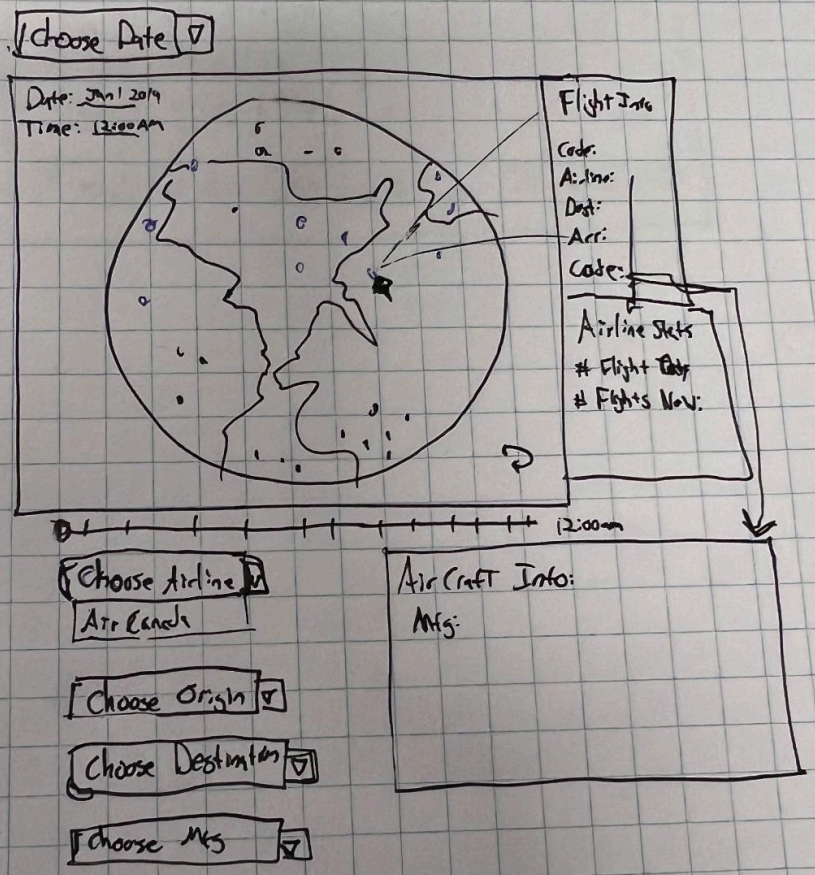
Before, During and After Start of COVID LOs.

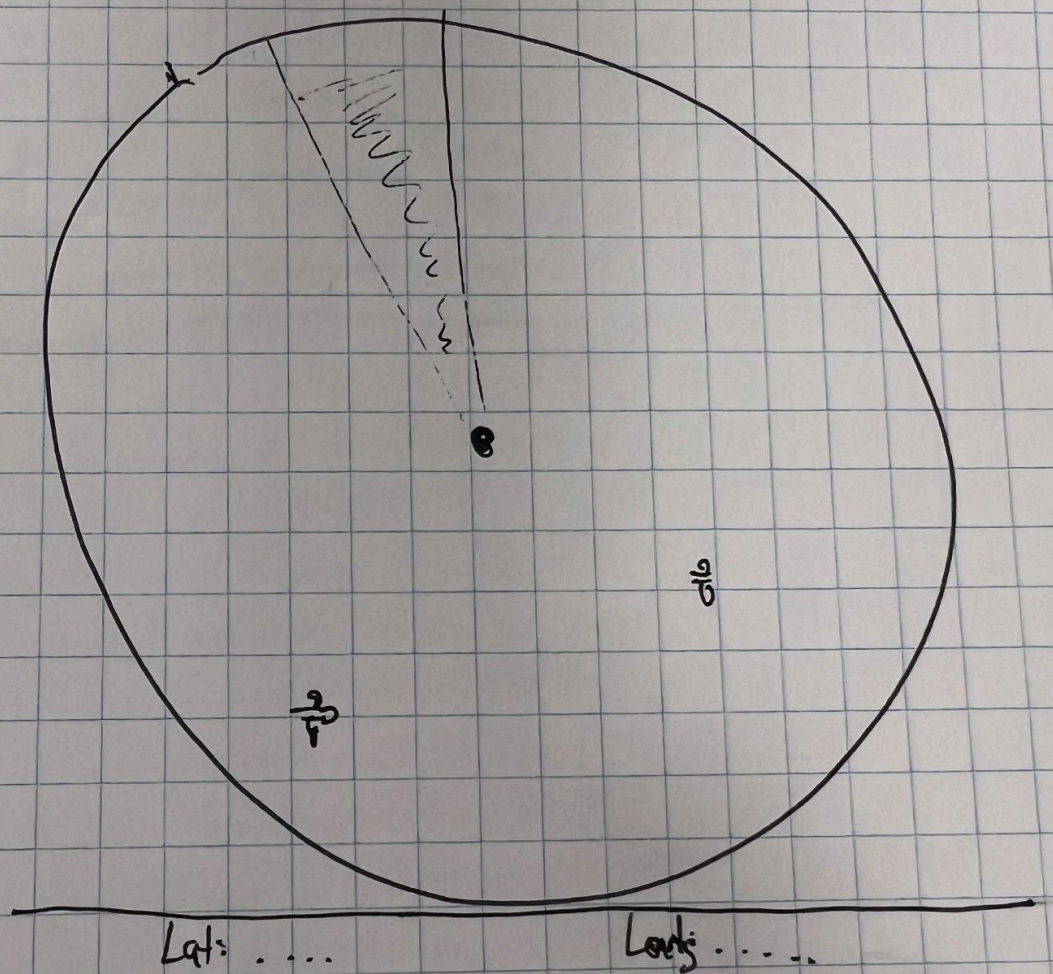
Stacked By Hour



~~Dest~~ | YYC | YUL | . . .

Top * By Most Active [Arr/Dest ▽] on [Choose Date ▽]

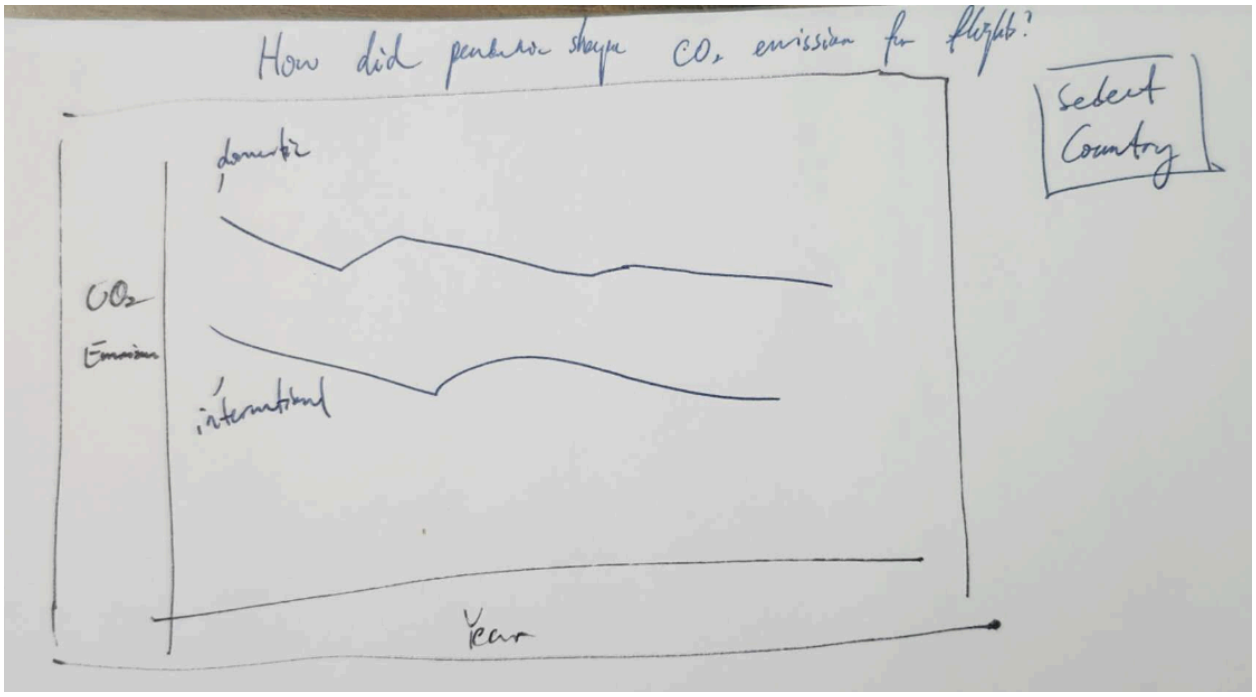

Choose Date
Date: Jan 1 2019
Time: 12:00 AM
Flight Info
Code:
Airline:
Dest:
Acr:
Code:
Airline Stats
Flight
Flights Now:
12:00 am
Choose Airline
Air Canada
Choose Origin
Choose Destination
Choose Mfg
Air Craft Info:
Mfg:



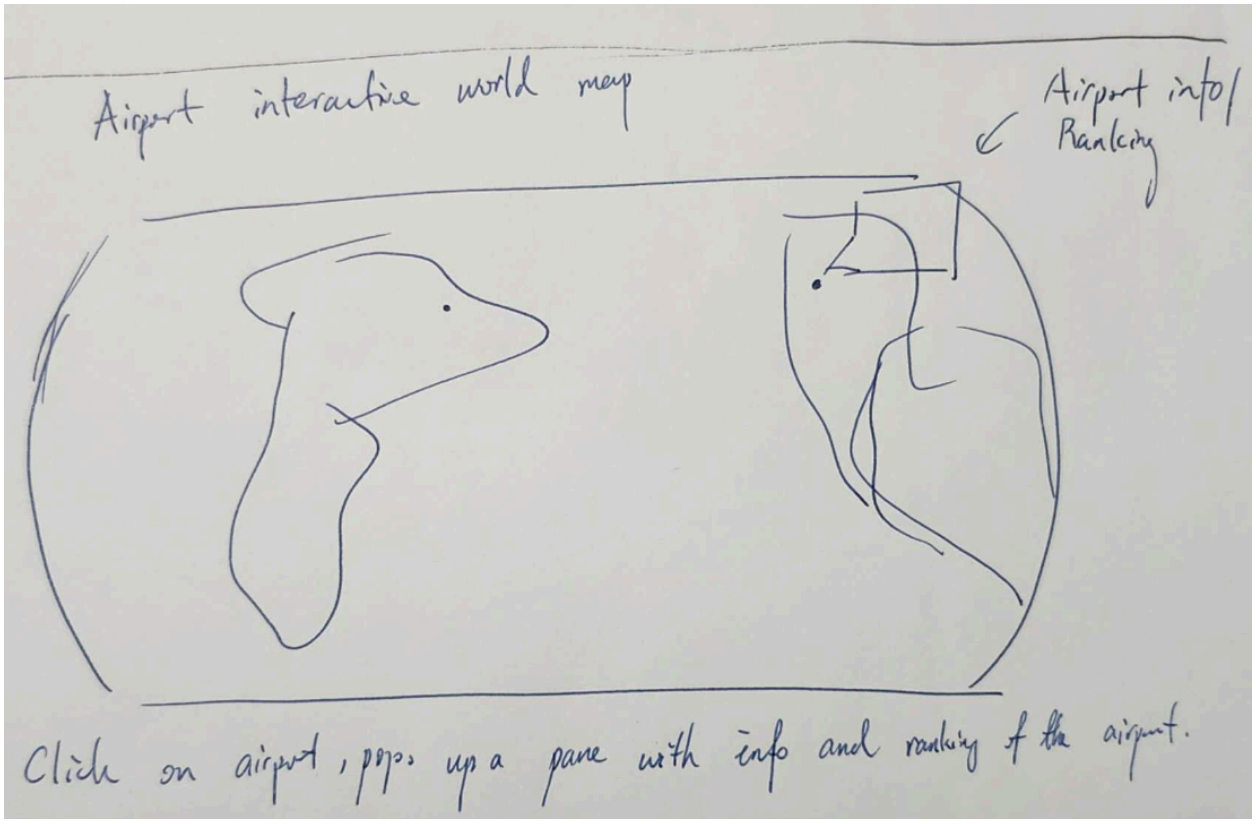
in proximity: ____

in Radar Cone: ____

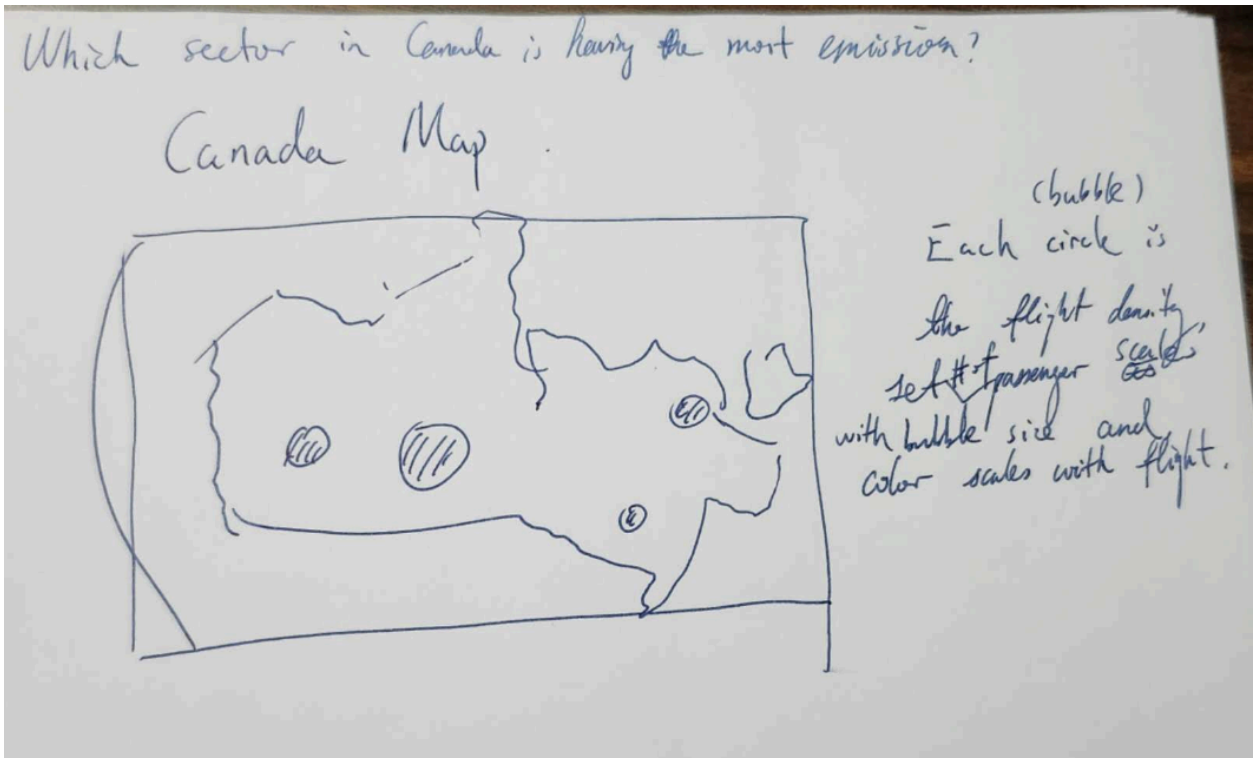
Qianren's sketch:
Sketch 9



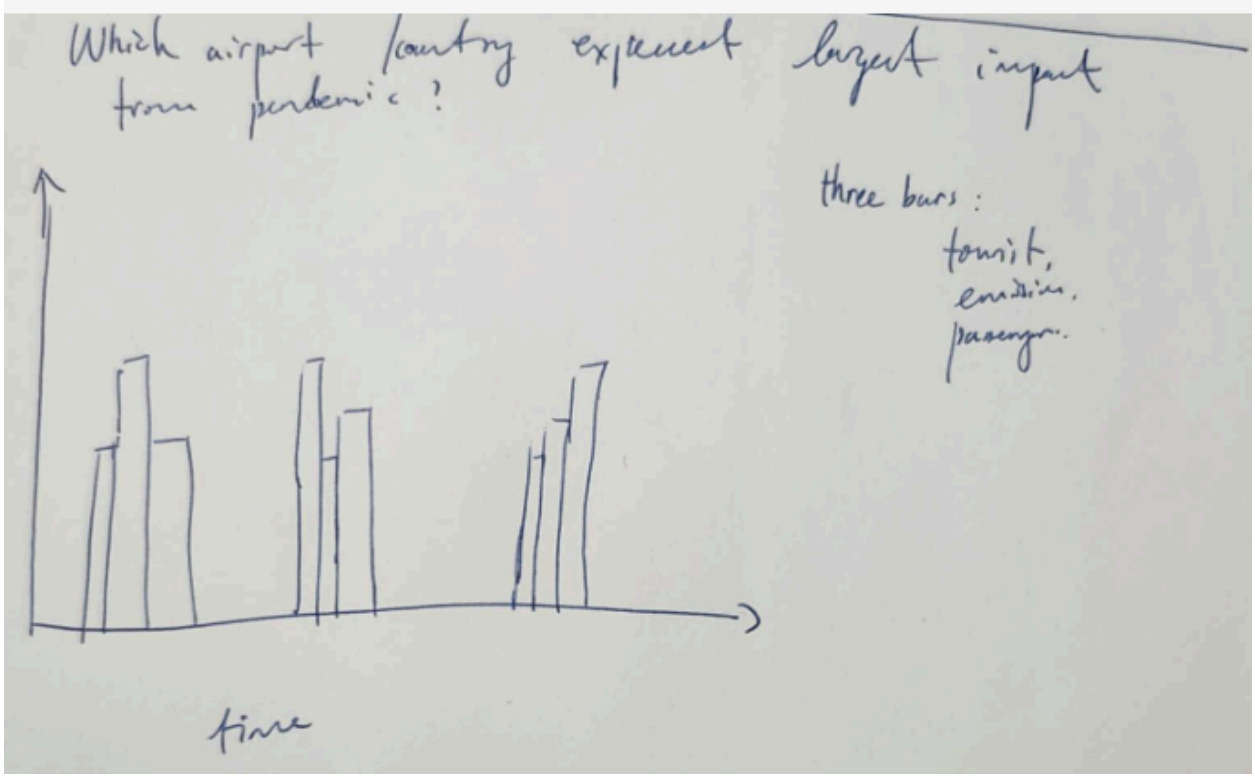
Sketch 10



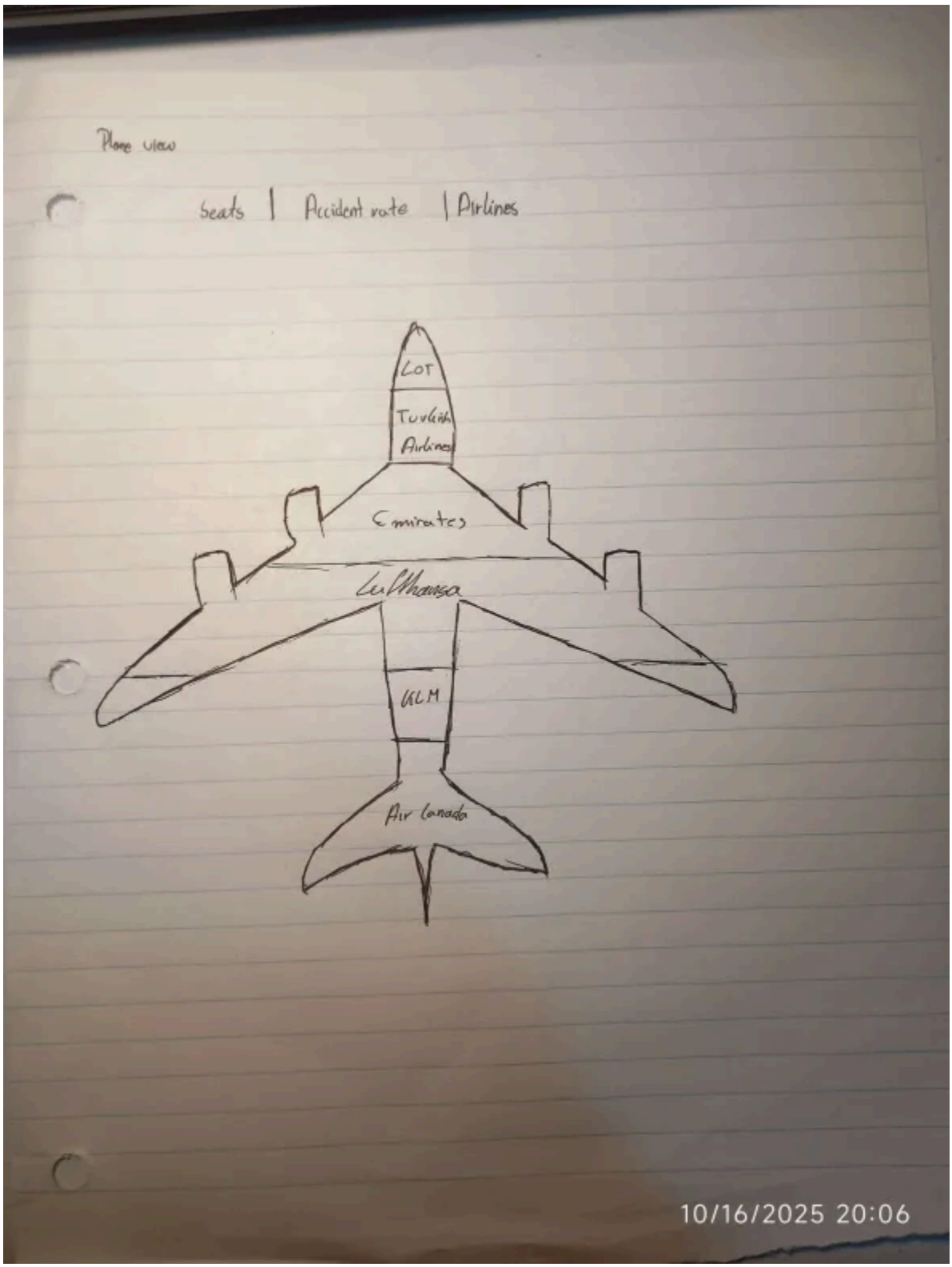
Sketch 11


Which sector in Canada is having the most emission?
Canada Map
(bubble)
Each circle is
the flight density,
set # of passenger scales
with bubble size and
color scales with flight.

Sketch 12


Which airport / country experience largest impact
from pandemic?
three bars:
tourist,
emission,
passenger.
time

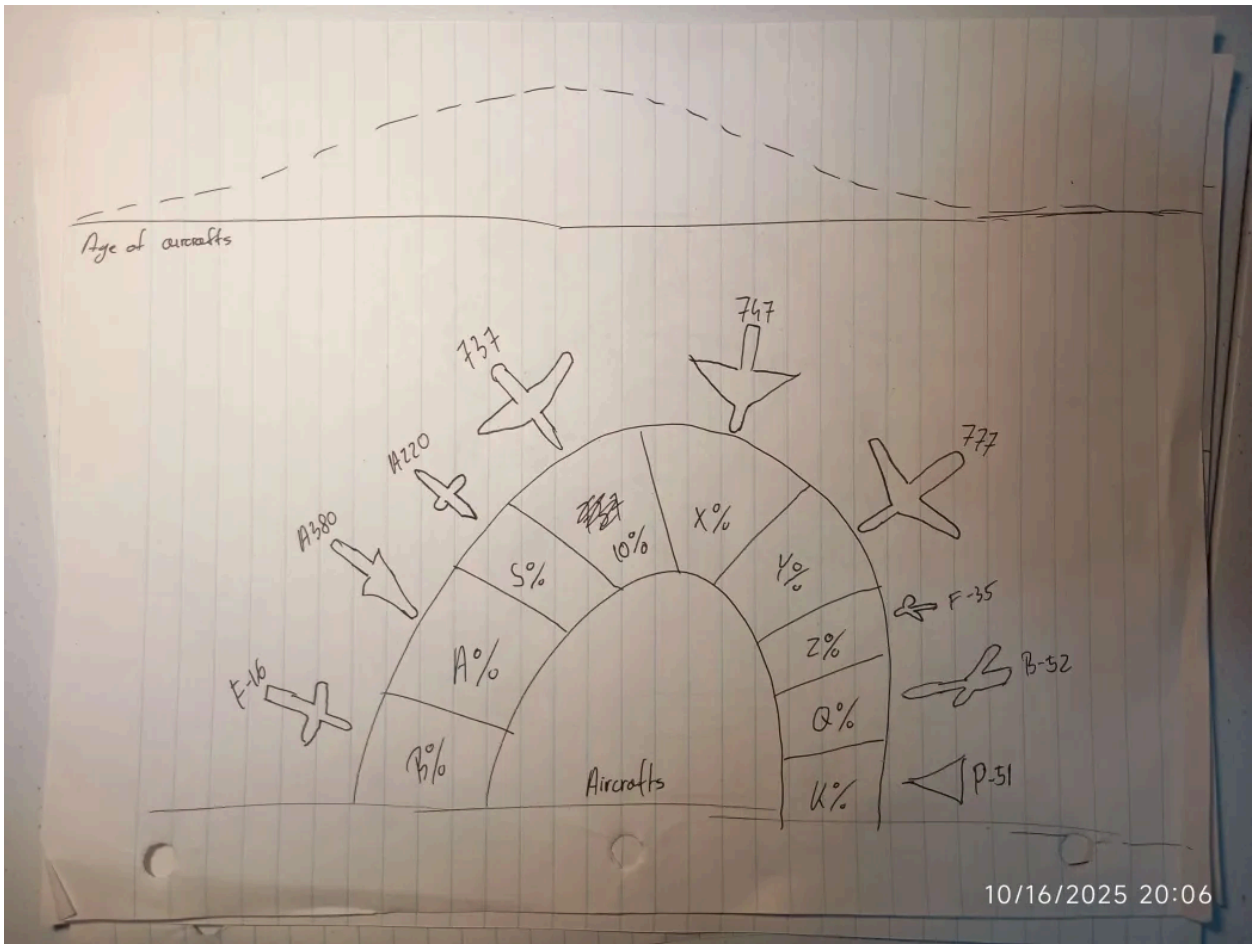
Borys Langowicz’s sketches
Sketch 13:



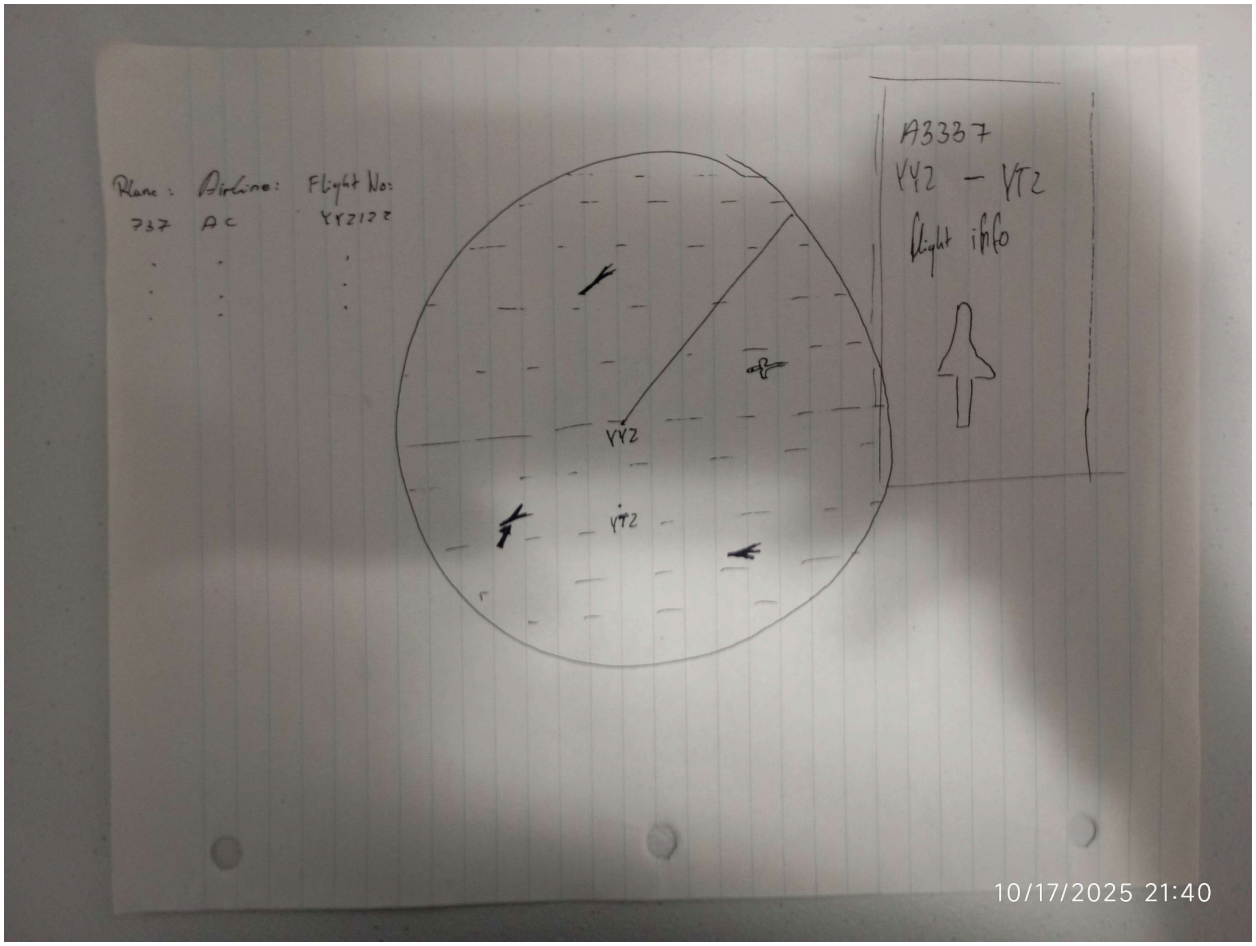
Sketch 14:


Flight ABC -> DEF
Airline
From: Airport 1
To: Airport 2
Location
Time of Flight
Plane Name
Plane Age
18:00
19:50
10/16/2025 20:06

Sketch 15:

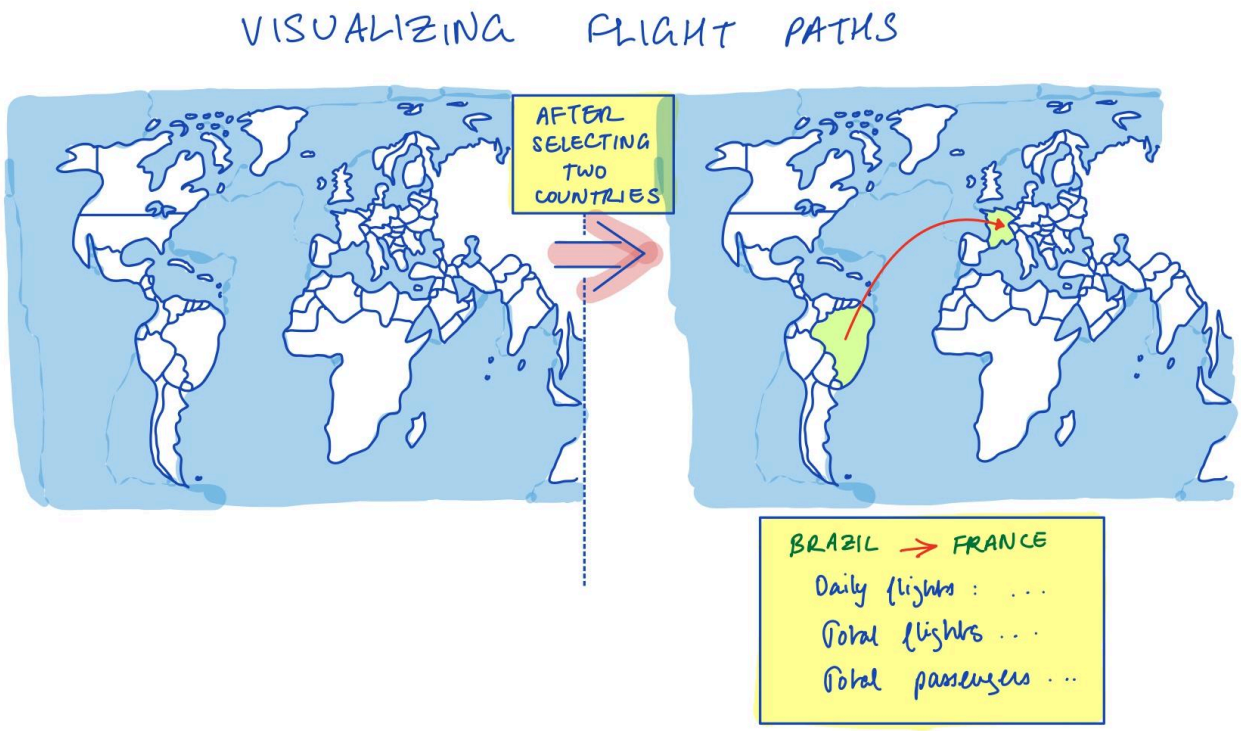


Sketch 16:

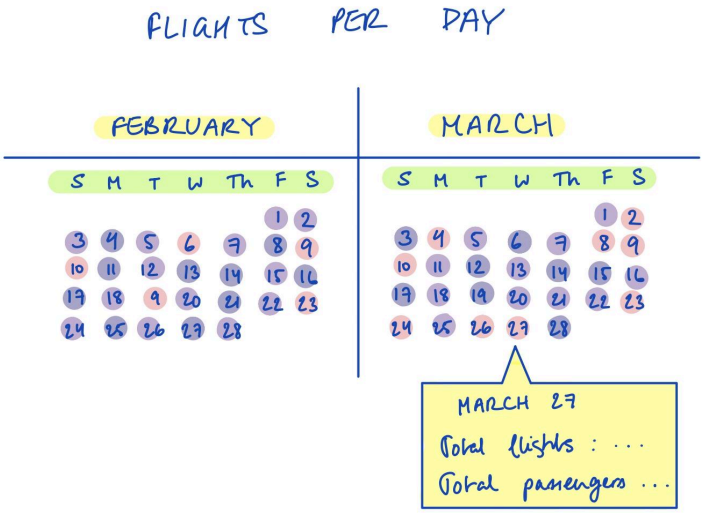

Plane: Airline: Flight No:
737 AC YYZ122
A3337
YYZ - YTZ
flight info
YYZ
YTZ
10/17/2025 21:40

John Chakkour sketches

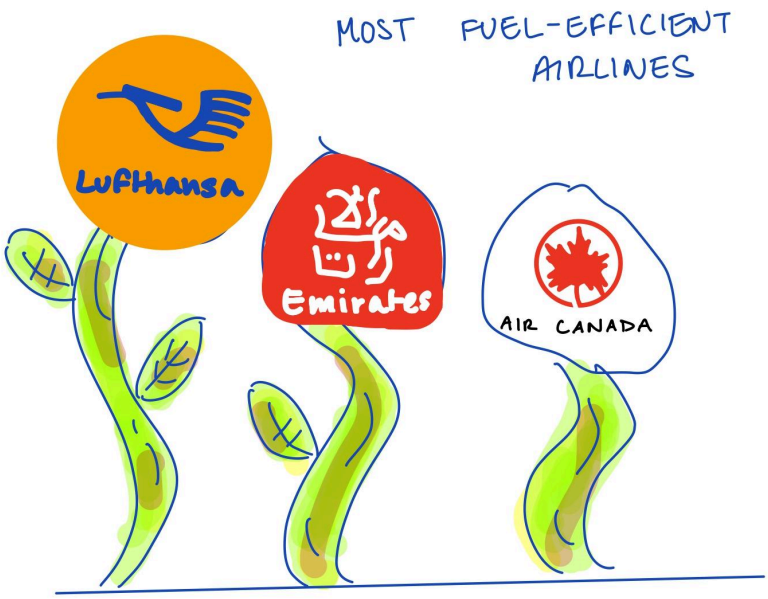
Sketch 17: flights between countries



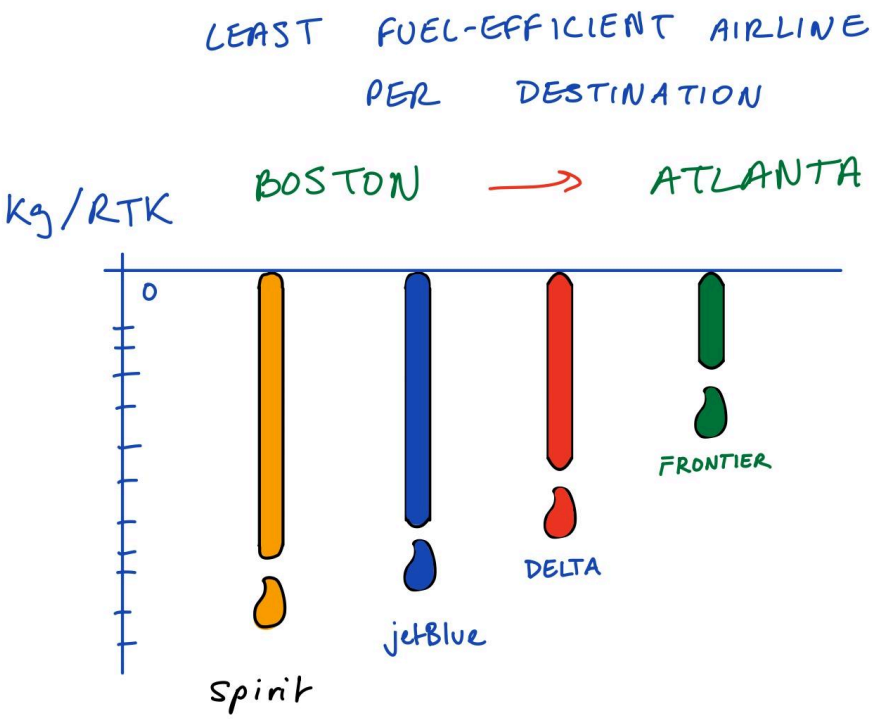
Sketch 18: how busy each day is



Sketch 19: most fuel-efficient airlines



Sketch 20: fuel efficiency per airline for a particular route



…

Voting process and explanation

1. Which airports are the top global destinations by number of flights?
2. What are the most popular flight paths overall/per airline?
3. What are the most popular flight paths for each airport?
4. What were the most popular airlines?
5. Which plane makes/types were the most popular overall/per airline?
6. Which airlines have the most flights by region?
7. How many planes are currently flying across a specific continent/ocean?
8. What are the most fuel-efficient airlines?
9. How have flight paths changed over the years?
10. What day (in a calendar year) had the most total flights?
11. What cities or what countries are the most connected?
12. How did global events (e.g., COVID-19) affect flight numbers and durations?
13. Flights by proximity to airport or airplane

Sketch IDs:

- Arthur: 1–4, Adam 5–8, Qianren 9–12, Borys 13–15, John 17–20

Sketch ID	Question ID	Author	Arthur's Votes	Adam's Votes	Qianren's Votes	Borys's Votes	John's Votes
1	1	Arthur					
2	5	Arthur	x	x	x		
3	10	Arthur					
4	8	Arthur					x
5	1-7, 9-12 (emphasis on 12)	Adam	x	x	x		
6	1, 12	Adam		x			

7	1-7, 9, 10, 11	Adam					
8	6, 13	Adam					
9		Qianren					
10		Qianren					
11		Qianren		x			
12		Qianren					
13	4	Borys	x	x	x		
14	7	Borys				2	x
15	5	Borys					x
16	13	Borys					
17	2, 3	John		x	x	x	x
18	10	John	2			x	
19	8	John				x	
20	2 (related), 8	John					

Chosen sketch results by relevancy ordered descending:

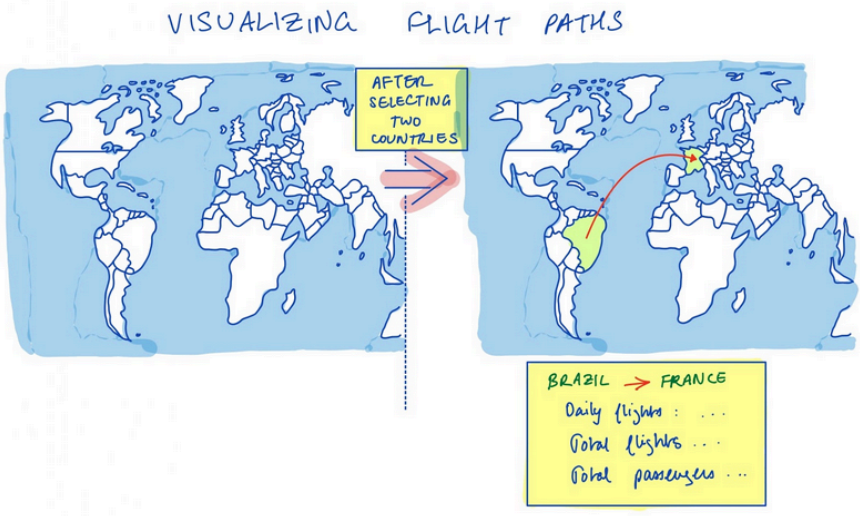
Rational for choosing these sketches:

The first sketch of the globalized visualization of flight paths, allows for a good entry point into the project, showing a broad range of data befitting the original main message of connectivity we seek to show. The second sketch chosen also expressed similar global data but with more filtered analytical data to provide quick understandings of top flights using easier to read graphs containing quantitative data. The third and fourth visualizations provide deeper insights into the airline specific data, separate from airport and flights. These data visualizations focus more on the plane models and flight companies themselves, giving different ways of understanding the same data. Some audience members may associate themselves more towards flight paths or certain origins and destinations, but others may associate more closely with familiar airliners or plane models. The final visualization provides date specific data allowing for comparisons through global events, throughout or within years such as data over specific events or the best

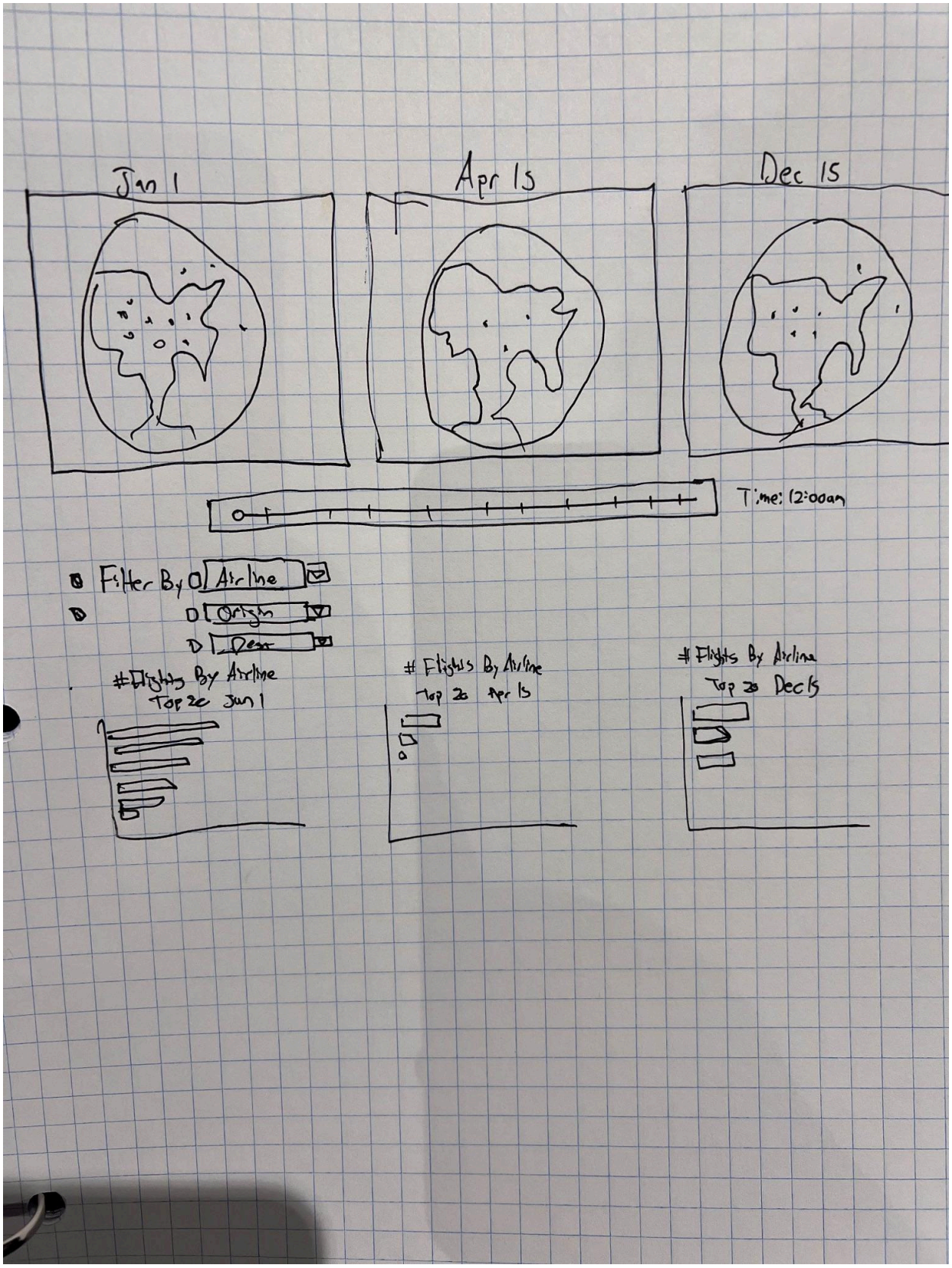
and worst days in a calendar year for flight travel. Together, these different visualizations fully encompass the many different parts of the datasets, and allow for different perspectives and angles on what our data is trying to represent: global connectivity, through an interpersonal lens.

1)

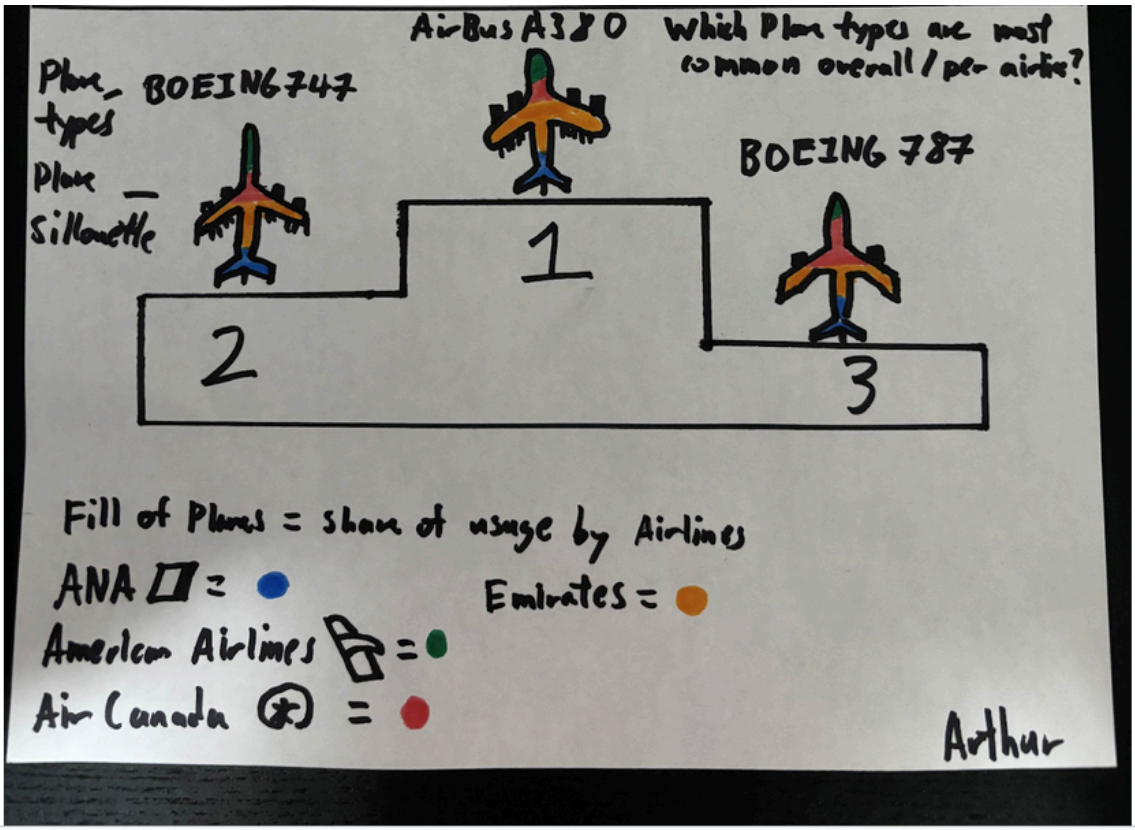
Sketch 17: flights between countries



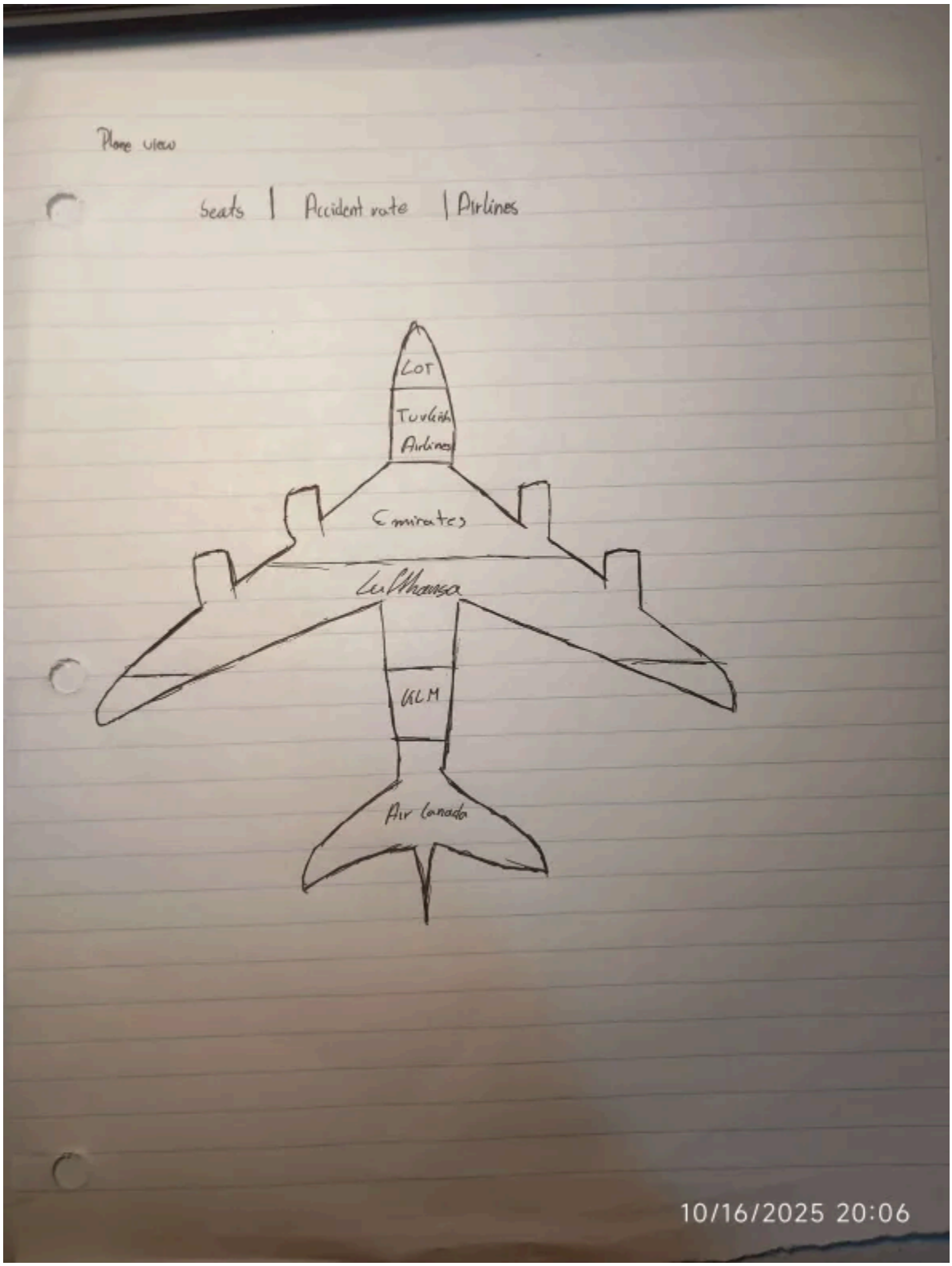
2)


Jan 1
Apr 15
Dec 15
Time: 12:00am
Filter By
Airline
Origin
Dest
Flights By Airline
Top 20 Jan 1
Flights By Airline
Top 20 Apr 15
Flights By Airline
Top 20 Dec 15

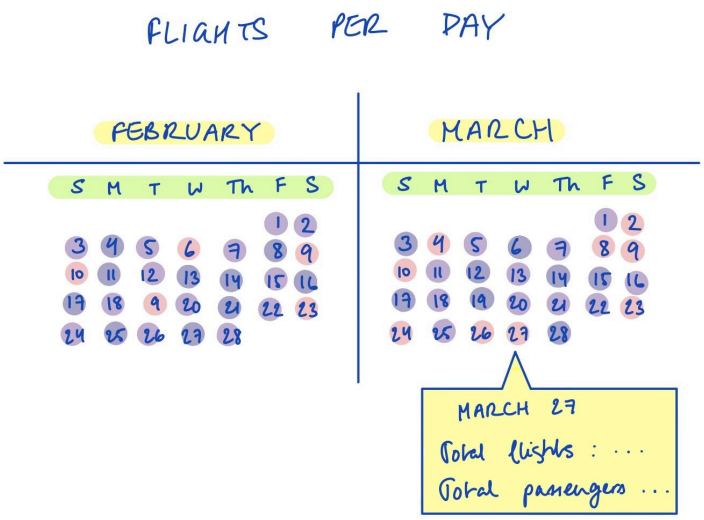
3)


Which Plane types are most common overall / per airline?
Plane types
Plane Silhouette
BOEING 6747
AirBus A380
BOEING 787
1
2
3
Fill of Planes = share of usage by Airlines
ANA =
Emirates =
American Airlines =
Air Canada =
Arthur

4)


Plane view
Seats | Accident rate | Airlines
LOT
Turkish Airlines
Emirates
Lufthansa
KLM
Air Canada
10/16/2025 20:06

5)



…

Insights and main message

Arthur:

1.) Analyzing global connections. From airport to airport, city to city, or country to country, this is one of the main things that tell a story about flight connectivity and travel. This can be represented using the general data of the data set mapped to a globe.
2.) Localizing through plane/airport perspective data. The datasets itself contain a bulk of information about airplanes and airports, this data can be localized to create a more personal feel encompassing a smaller area than the broader scope. The insight can be visualized through a sonar-like graph, only containing information around a certain point.
3.) Timing. Since this data set provides time dated results, we can compare and contrast through various historical, or global events. With this, we can uncover new patterns and ways to understand how global events shape and affect the world of air travel.

Adam

1) Concentration of data. Fight data tends to be concentrated around certain countries or areas with large global influence or population. This data could be ordered and analyzed on a per popular location basis.
2) Mapping paths through time. The data set records live locations at certain points in time. Thus flight paths can be mapped through utilizing time data over time and forming paths based on interval locations.
3) Geographic mappings. Flight data contains altitude as well as ground speeding. Through this geographic mappings and comparisons can be drawn. E.g. flight data over areas of large elevation v.s areas of lower elevations, or flat areas vs mountainous areas.

Qianren

Borys
I really liked the idea of an animated 3d globe that shows the geographic mappings in an easy to understand way, that is universal to all cultures and ages. The visuals produced are appealing, while also providing information that can be missed while only looking at the destination and starting airport.
Another aspect I am really keen on visualizing is the importance of time in the visualization, and how the time can be used to filter out data to be observed and visualized. It allows to see current flights and also how flight coverage in specific period of time looked like

John

The map is the fundamental visual object for visualizing patches and routes. This can be done in two ways: as a flat map or a 3D globe (hence my choice of sketches 14 and 17). The choice of a fuel gauge as a pie chart is particularly inventive for visualizing fuel efficiency and related metrics, hence my choice of sketch 4. Finally, I am personally interested in seeing which plane makes are most common, and so showing all the different models as in sketch 15 is appealing.

Group:

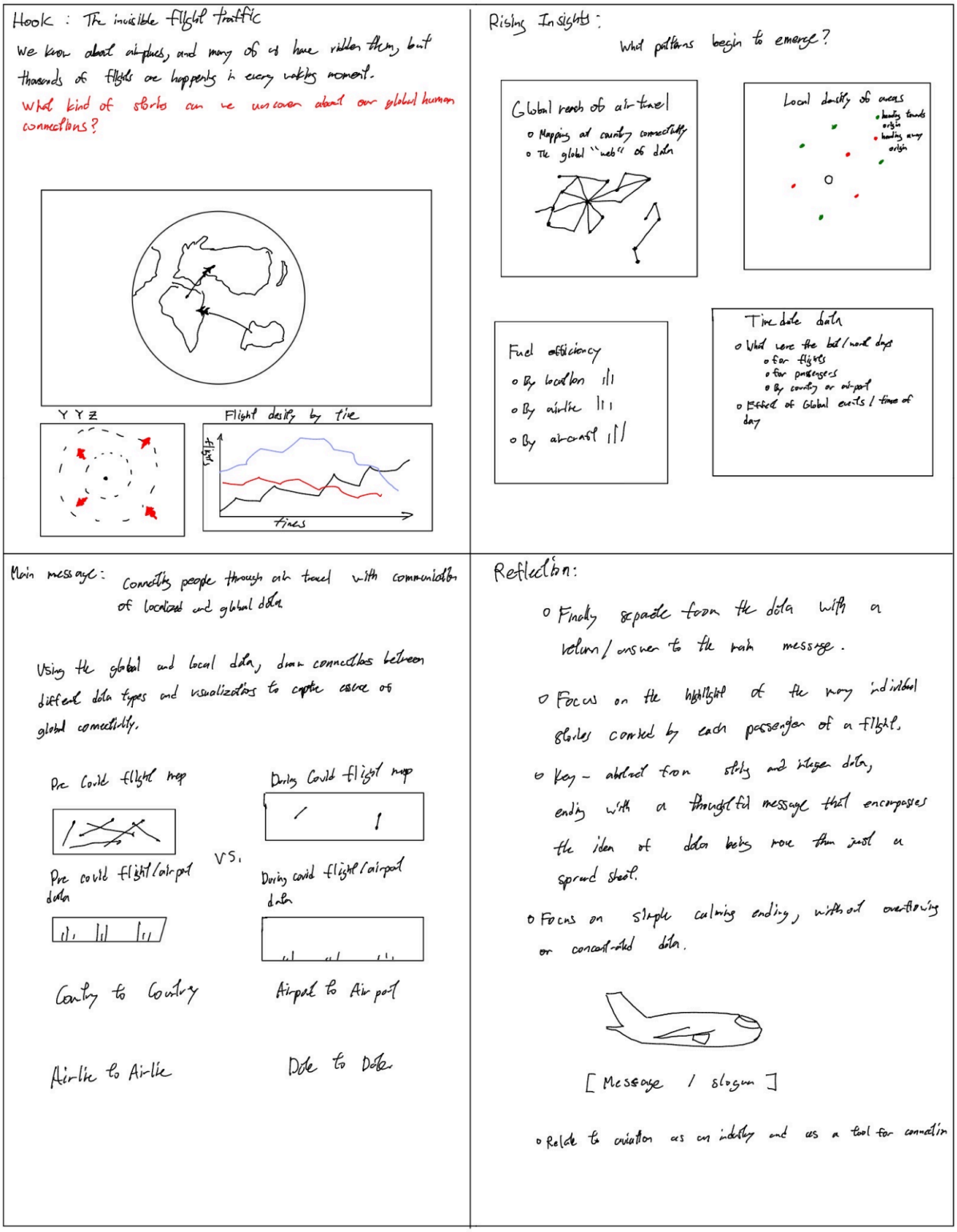
1 to 2 Insights chosen:

1.) Understanding the story of air travel through analysis of global connections to provide wide-reaching understanding that relates to all audiences.
2.) Communicate personal perspectives through localized data to give all audience members a more personalized understanding of familiar areas as they relate to air travel.

Main message:

Connecting people through air travel with communication of localized and globalized flight data.
…

Data storyboard



Instructions

Each team member will then create individual sketches of visualizations using a pen and paper that might answer your questions. As a team, you will decide which visualizations and insights you plan to pursue in your project. Finally, you will create an initial storyboard of the data story that you plan to tell. Please note, we expect you to have at least two **novel** visualizations in your final implementation.

fBelow are more detailed instructions for the sketch and storyboard steps.

We do require at least **4 sketches per group member**, a documentation in your process book of which sketches you have decided on, and **the data storyboard**. The sketches and the data storyboard can be done with paper and pen, and then uploaded to your process book. You can also use Miro, but it is not required.

After your storyboarding, we strongly encourage you to start prototyping as soon as possible!

This is a team assignment, please submit only once! The submission should be done by the assigned person (usually the team leader) in your team who is doing the submissions. The submission file should be a PDF made from the relevant tab in your process book.

========== Detailed instructions: ==========

Sketch step:
In this step, you will **individually sketch** visualizations to answer the questions you came up with during the last two milestones. You do not need to create a single visualization that can answer all the questions. Instead, think of visualizations that answer each question individually. **At least two of your sketches should be attempts at novel visualization designs!** Remember, your final data story requires two unique visualizations that have not been done before, so come up with as many of those unique ideas as you can.

Individually, you need to:

1. Use paper and pen (we prefer Sharpies) for your sketches. You can also use colored pencils and pens if you like, but it is not required. Remember, sketches are quick and do not need to be detailed or 'beautiful.'
2. Create **at least 4 sketches per group member** that answer some or all of the questions you came up with in previous milestones. It is OK if you create more than one sketch per question, and it is also OK if you do not address all of the questions, as long as you

address most of them. At least two of your sketches should try to fulfill the “unique visualization” requirements for your final submission.

3. As you are sketching, keep in mind what marks and channels you are using for each data type in your visualization. For each sketch, create a legend that describes the visual encodings of your data, similar to the Dear Data project.
4. Once you have finished your sketches and legends on paper, take pictures and upload them to your process book. It does not matter if you have one or multiple sketches per paper or picture. Make sure to put your name before the images in the document. Make sure you label each sketch with the question(s) it is answering.

Decide step:

In this step, you will work with your group to **decide** which sketches to implement in D3 during the prototype phase. You should pick between 4-6 of your sketched ideas.

As a group, follow these instructions:

1. Make sure you have each sketch labeled with the question it is answering. Add a question ID (e.g., a number) and the author’s name (e.g., using initials) for each of the sketches. If a sketch answers multiple questions, list all of them. You should also assign each sketch an ID.
2. This step is called “affinity diagramming.” You will first create a table to aggregate the information from the first step. If you sort the table according to Question ID, you may identify duplicate or almost identical sketches. Put them in the same row. An example table is shown here:

Sketch ID	Question ID	Author
1	1	PL
2, 11, 23 (these sketches are almost identical)	2	MV, OH, ZZ
8	2	CN
5	2, 3	WW

3. During this process, you may have found some sketches that need extra explanations. Ask the author to briefly introduce their ideas in more detail.
4. Before you start voting, give some time for everyone to carefully look at all the sketches. When deciding which sketch you want to vote for, please consider whether the sketch answers one of the **key** questions in an **effective** way and whether it is **suitable** for your **audience**.
5. Now, you can start to VOTE!
    a. Everyone gets **five** votes. You can cast multiple votes for a sketch, and you can vote for your own sketches, too.

    b. If you want to vote for a sketch, select the sketch ID in the table, and click the “Add a comment” button in the Google Doc. Write something like “Sketch 5: +1” to indicate your vote for this sketch.
    c. Add a column to the previous table to record each sketch's total number of votes.
6. At the end of the voting process, copy and paste the screenshots of your selected sketches and what questions they answer. Try to arrange them logically, from most relevant to least relevant. Again, we would like you to select between 4-6 sketches in total.
7. Add a one-paragraph explanation at the end summarizing your decisions and rationale for choosing the sketches you plan to implement.

Please document the above process in your process book.

Storyboarding:
In this step, you will work with your group members to create a storyboard to structure how you will communicate a key message about your data.

Please work on the following steps:

1. Pick your main message.
    a. First, we encourage you to individually explore your dataset again. Identify several insights (**at least 2-3 per team member**) that you think are important or interesting, either based on past or new explorations. Record these insights in your process book with each team member’s name.
    b. As a team, spend some time looking at the list and discussing the various insights. Pick **1-2 main insights** that you think are most important or interesting to your audience. Formulate each insight as a message (“so what”) in one sentence.
    c. Record your main message and why your group chose it in your process book.

2. Sketch your data storyboard. Following the four elements of a data story, you will create a data storyboard to communicate your main message. You may use digital whiteboard software like Miro, any other design software, or physical sticky notes and pens (our preferred option if you meet in person). The goal is not to make a polished artifact, but to think through and communicate the structure of your data story.
    a. Please make sure that your storyboard points are lined up with the four elements of a data story (hook, rising insights, main message, and solution).
    b. Take a screenshot of the final data storyboard (or a photograph of your sticky notes, in case you meet in person) and put it in your process book. Make sure your TAs will be able to read it!

Submission

Upload this process book worksheet to Quercus, making sure all images are included and legible. Make sure to only submit once per team!

W8 Prototype V1

Week 8: Prototype V1

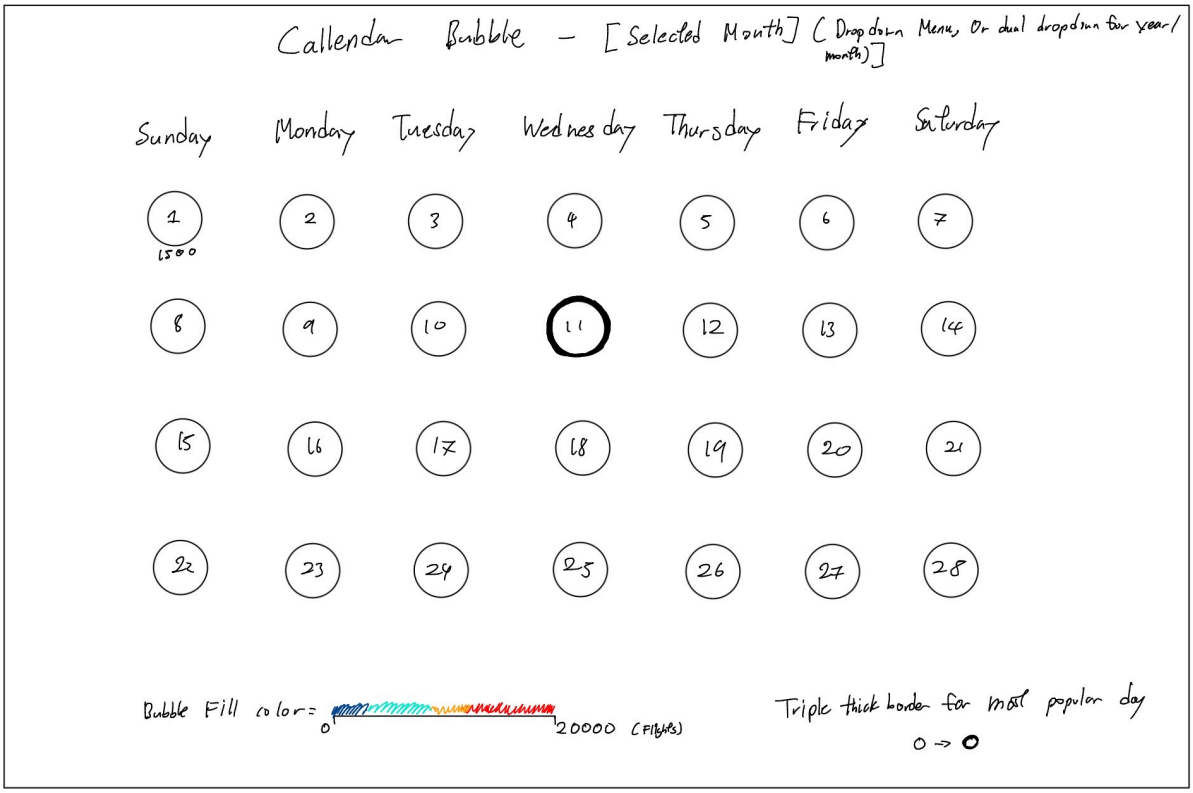
Notes (Novel vis design + interactions)

- The homepage has the visualization for flight data per day per month. Here the completed visualization is below. The line visualization is based on flight data and has different points that you can hover on to see a tooltip displaying the date and number of actual flights.

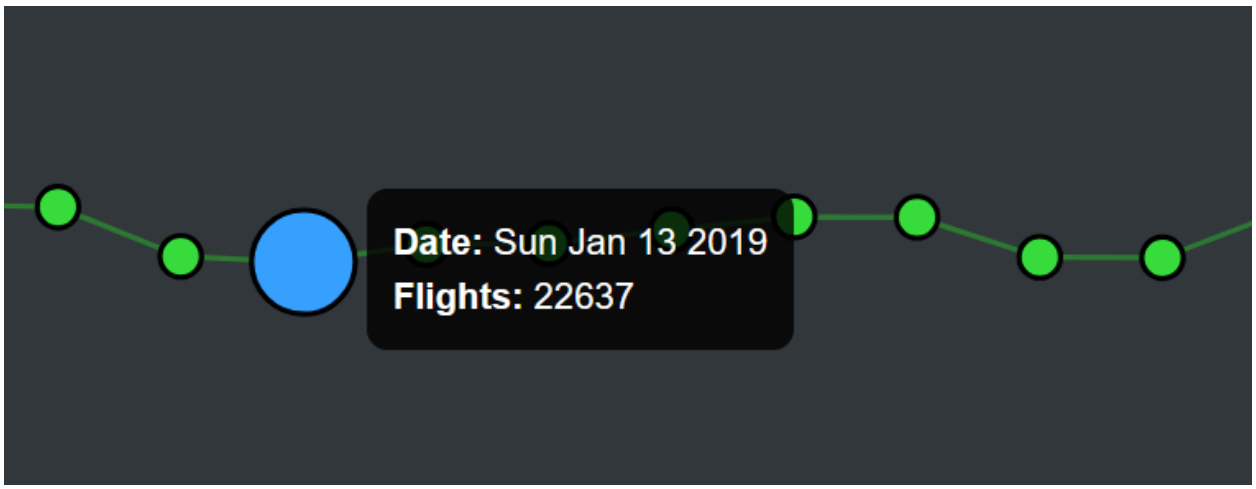
- Hovering over the selected date will enlarge it and change its color to blue, which will return after hovering off the point.

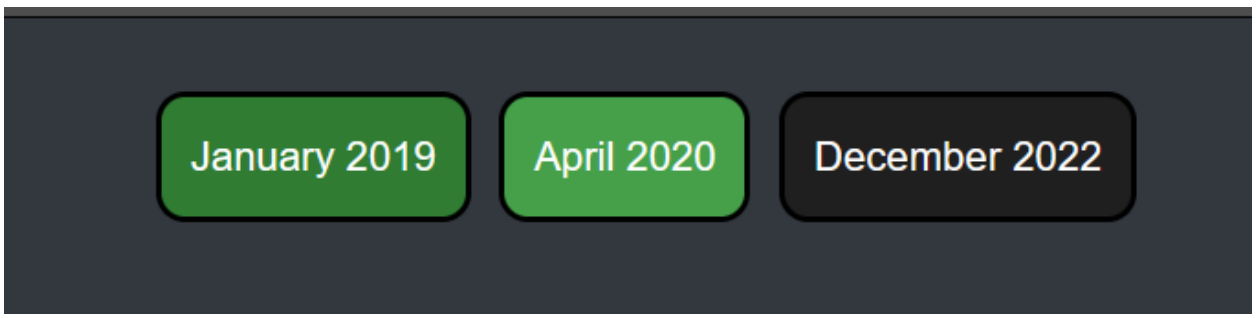
- On the front page there is a button at the top to swap to the globe visualization. Similarly on the globe visualization there is a button to swap back.

- The top visualization has not been implemented yet and is left as a place holder. Since the idea is similar to the bottom visualization, we may use it to add on as a multi-view accompanying the line visualization for flight data by date. It will be based on the same dataset and look something like this:

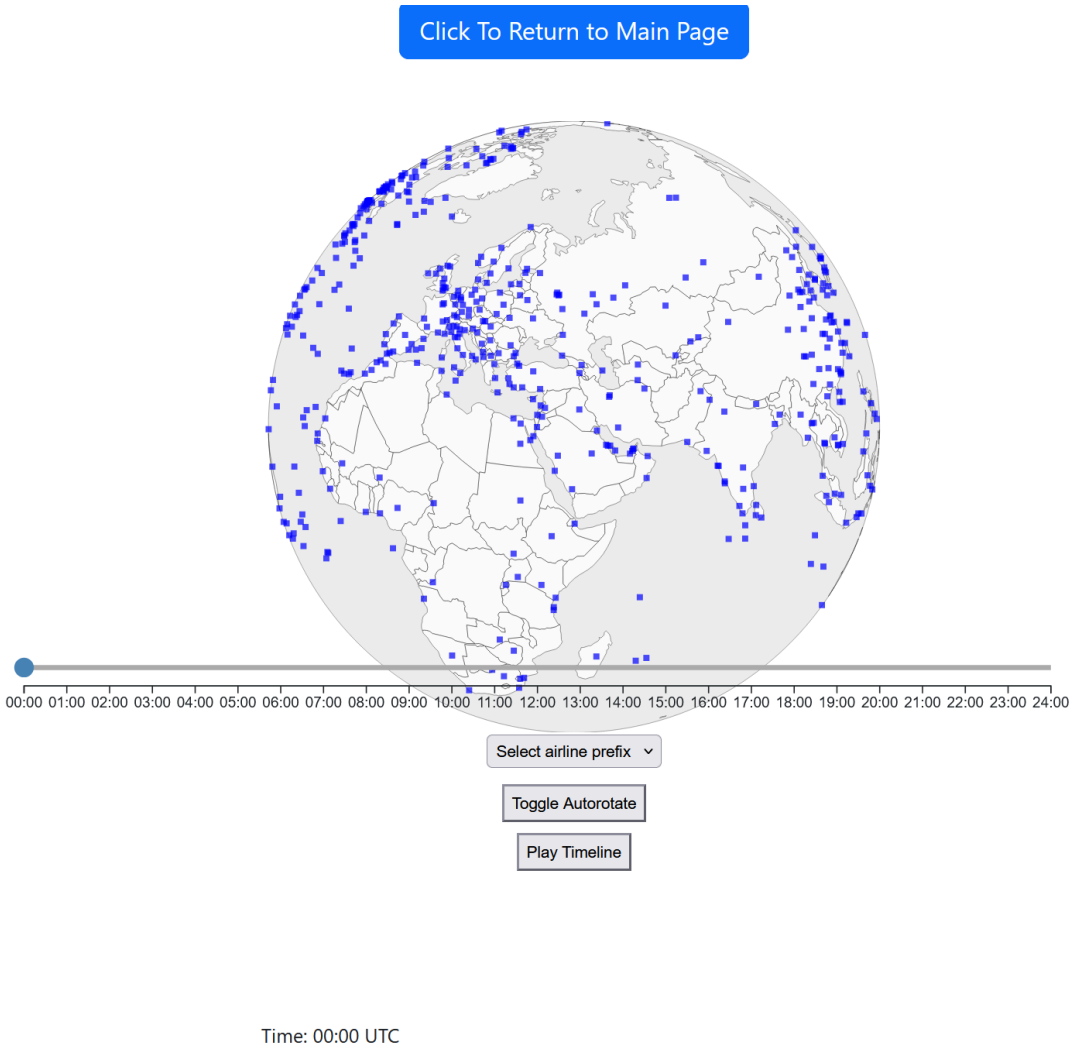


Main page look at interactivity and button to globe page:





Globe page visualization and button back:



Github repository: https://github.com/Arthur0033/techstream

Contributions:
Adam: Created globe prototype from github as well as globe page functionality
Borys: Drafts from this document based on future visualizations as well as basic implementation logic.
Qianren Pan: Drafted a rough webpage design to integrate functionality
Arthur: Created visualization for flights by day of month, and draft for top visualization. Added basic home feature buttons.

Drafts by Borys:

I got basic animation working, but didn't yet with actual data. The plan for this visualization is to include it in the “plane/airport card” that is in the globe visualization. It is meant to show radar as it will look in the plane/airport we get information. It allows people to get a better understanding of the means pilots and traffic controllers see the world to have better immersion. From a technical standpoint it is relatively easy to map the longitude and latitude to the graph, as we can set the focused airport/plane as a center and calculate relative position based on them. The code for the visualization is yet to be refactored and changed, but I include

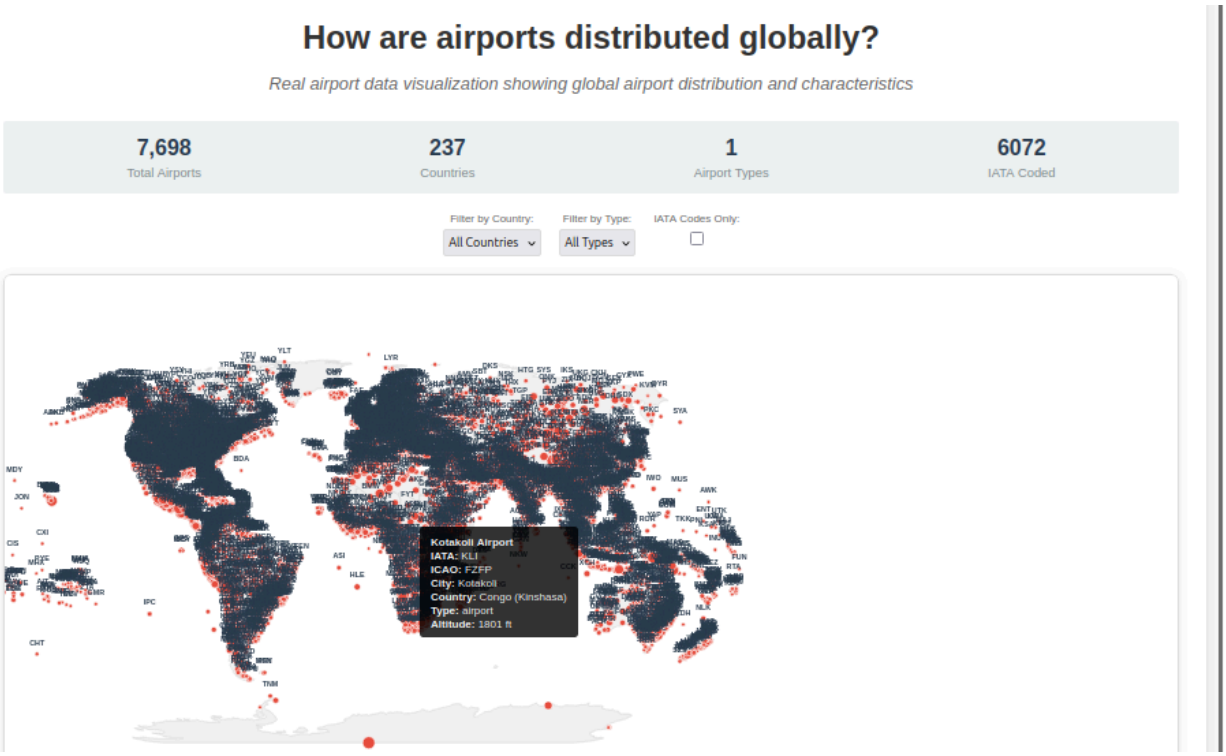
some snippets from it below:

```
    function initializeRadar() {
        const container = document.querySelector('.radar-container');
        const screen = document.getElementById('radar-screen');

        radarSize = Math.min(window.innerWidth, window.innerHeight) - 40;
        centerX = radarSize / 2;
        centerY = radarSize / 2;
        radius = (radarSize - 10) / 2;

        // Set radar screen size
        screen.style.width = radarSize + 'px';
        screen.style.height = radarSize + 'px';

        // Create radar grid
        createRadarGrid();

        // Process and display flights
        processFlights();

        // Show radar
        document.getElementById('loading').style.display = 'none';
        screen.style.display = 'block';
    }

    function createRadarGrid() {
        const grid = document.getElementById('radar-grid');
        grid.innerHTML = '';

        // Create range rings
        for (let i = 1; i <= 4; i++) {
            const ring = document.createElement('div');
            ring.className = 'range-ring';
            const ringRadius = (radius / 4) * i;
            ring.style.width = ringRadius * 2 + 'px';
            ring.style.height = ringRadius * 2 + 'px';
            ring.style.left = (centerX - ringRadius) + 'px';
            ring.style.top = (centerY - ringRadius) + 'px';
            grid.appendChild(ring);
```

```
        // Add range labels
        const label = document.createElement('div');
        label.className = 'range-label';
        label.textContent = `${Math.round(ringRadius / 15)}nm`;
        label.style.left = (centerX + ringRadius - 15) + 'px';
        label.style.top = (centerY - 8) + 'px';
        grid.appendChild(label);
    }

    // Create compass directions
    const directions = ['N', 'E', 'S', 'W'];
    directions.forEach((dir, i) => {
        const angle = (i * 90) * Math.PI / 180;
        const x = centerX + Math.cos(angle - Math.PI/2) * (radius + 20);
        const y = centerY + Math.sin(angle - Math.PI/2) * (radius + 20);

        const direction = document.createElement('div');
        direction.className = 'compass-direction';
        direction.textContent = dir;
        direction.style.left = (x - 5) + 'px';
        direction.style.top = (y - 5) + 'px';
        grid.appendChild(direction);
    });
}

function processFlights() {
    if (!flightData || !flightData.flights) {
        console.error('No flight data available');
        return;
    }

    const flights = flightData.flights;

    console.log(`Processing ${flights.length} flights`);

    // Clear existing blips
    const existingBlips = document.querySelectorAll('.flight-blip');
    existingBlips.forEach(blip => blip.remove());

    // Create flight blips
```

```
        flights.forEach(flight => {
            createFlightBlip(flight);
        });

        // Update flight count
        document.getElementById('flight-count').textContent = `TRACKING ${flights.length}
AIRCRAFT`;
    }
```

Second draft by Borys:



We still think about how to incorporate the change from the globe to the flat map, however there's already a visualization outline to present all/filtered airports. In the case shown in the screenshot showing all the airports. It allows for better spatial understanding of the locations of the airports.

I include some code snippets as well, even though it needs to be modified extensively, so the code is not pushed yet to github.

Code:

```
    function initializeVisualization() {
        svg = d3.select("#chart");
        svg.selectAll("*").remove();
```

```
        g = svg.append("g");

        // Create projection
        projection = d3.geoNaturalEarth1()
            .scale(150)
            .translate([400, 300]);

        path = d3.geoPath().projection(projection);

        // Draw world map background

d3.json("https://raw.githubusercontent.com/holtzy/D3-graph-gallery/master/DATA/world.geojso
n")
            .then(function(world) {
                g.append("g")
                    .selectAll("path")
                    .data(world.features)
                    .enter().append("path")
                    .attr("d", path)
                    .attr("fill", "#f0f0f0")
                    .attr("stroke", "#ccc")
                    .attr("stroke-width", 0.5);

                renderAirports();
            })
            .catch(function(error) {
                console.log("Could not load world map, rendering airports only");
                renderAirports();
            });
    }

    function renderAirports() {
        // Clear existing airports
        g.selectAll(".airport").remove();
        g.selectAll(".airport-label").remove();

        // Color scale for airport types
        const typeScale = d3.scaleOrdinal()
            .domain(["airport", "heliport", "seaplane_base", "balloonport", "closed"])
            .range(["#e74c3c", "#3498db", "#2ecc71", "#f39c12", "#95a5a6"]);
```

```
    // Size scale based on airport importance
    const sizeScale = d3.scaleSqrt()
        .domain([0, d3.max(filteredData, d => d.altitude || 0)])
        .range([2, 8]);

    // Draw airports
    const airports = g.selectAll(".airport")
        .data(filteredData)
        .enter().append("circle")
        .attr("class", "airport")
        .attr("cx", d => projection([d.longitude, d.latitude])[0])
        .attr("cy", d => projection([d.longitude, d.latitude])[1])
        .attr("r", d => sizeScale(d.altitude || 0))
        .attr("fill", d => typeScale(d.type || "airport"))
        .attr("stroke", "#fff")
        .attr("stroke-width", 1)
        .on("mouseover", function(event, d) {
            showTooltip(event, d);
        })
        .on("mouseout", function(event, d) {
            hideTooltip();
        });

    // Add labels for major airports
    const majorAirports = filteredData.filter(d => d.iata && d.iata !== '\\N');

    g.selectAll(".airport-label")
        .data(majorAirports)
        .enter().append("text")
        .attr("class", "airport-label")
        .attr("x", d => projection([d.longitude, d.latitude])[0])
        .attr("y", d => projection([d.longitude, d.latitude])[1] - 10)
        .text(d => d.iata)
        .style("font-size", "8px")
        .style("font-weight", "bold");
}

function updateStats() {
    const totalAirports = filteredData.length;
```

```
    const countries = [...new Set(filteredData.map(d => d.country))].length;
    const types = [...new Set(filteredData.map(d => d.type))].length;
    const iataAirports = filteredData.filter(d => d.iata && d.iata !== '\\N').length;

    d3.select("#total-airports").text(totalAirports.toLocaleString());
    d3.select("#countries").text(countries);
    d3.select("#airport-types").text(types);
    d3.select("#iata-airports").text(iataAirports);
}
```

Instructions

You will create a first working visualization prototype. You do not have to have all your visualizations up and running, and it does not need to be completely interactive, but the overall structure and the content should be clear. We will ask you to hand in your code in its current state. After this submission, you'll only have a few more weeks to iterate on your prototype, test it with other people, and submit the final version.

The exact requirements are:

- Name of students that worked on prototype V1 submission.
- Data scraping and cleaning complete (using the real data sets)
- **At least two D3 visualizations already partly implemented (including data loading and the basic vis, filtering does not have to work yet)**, and detailed drafts for 2-3 more visualizations
- **At least one of the implemented visualizations should be one of your novel designs**
- Rough webpage design and structure has to be done and implemented (placeholders for visualizations, text, and images allowed)
- Storytelling is clear
- Interactions (e.g., filtering, brushing, etc.) have to be designed (at least in a textual description and some sketches)
- Up-to-date process book

Finally, you will fill out this self and peer evaluation form to reflect on how well you and your teammates performed in the final project so far. **Every team member** needs to fill out this form. Only the teaching team will see your responses. This form may affect the grades of team

members who did not pull their weight. We will ask you to fill in the same form again at the end of the final project.

Put your novel vis design and interaction design in your process book and submit a pdf version of it together with the implementation code, all in a zip file.

This is a team assignment, please submit only once! The submission should be done by the assigned person (usually the team leader) in your team doing the submissions.

Please check the final project overview for more information about the final project.

W11 Prototype V2

Week 11: Prototype V2

We expect you to be 95% done with the implementation of your visualizations and your data story. It should be ready to be tested by a random person the following week.

Specific requirements:

- Please submit only code and data! (Your process book should be up-to-date, but at this point, **your project website should stand on its own**, without needing to explain things in the process book.)
- All views must be complete and working by this point!
- We will evaluate the progress you made from Prototype V1 to Prototype V2.
- You will have two weeks until the final submission. The last week is meant for fine-tuning, incorporating feedback, documenting, creating the screencast, etc.

If the dataset is too large to upload, please contact your project mentor so that they can either copy your dataset directly or use Dropbox, etc.

This is a team assignment. Please submit only once! The submission should be done by the assigned person in your team (usually the team leader) who is doing the submissions.

Please check the final project overview for more information about the final project.

W12 Test

Week 12: Think-Aloud Session

PROJECT LINK: https://neloduka-sobe.github.io/techstream/

For each think-aloud session, create a new copy of the feedback table below. During the session, one team member should carefully listen to the tester and document their observations and feedback in the "Notes" column. Ensure that all sections of the table are completed for each tester. **You must conduct at least 3 independent think-aloud sessions and document feedback for all 3.**

Tester 1

	Notes (To be filled by project leads)
Tester Name	Jackson
Describe any usability issues or confusion the tester encountered while using the prototype.	Loading time for the visualization, long text, tester did not click the areas in the first graph, misunderstanding the dates in visualization showing the states before, during and after pandemic - the dates seemed arbitrary. Difficulty interpreting and comparing months due to inconsistent scales. Did not understand what the dots on the globe meant. Zoom issues on graphs (especially the aircraft visualization). Too many aircraft models shown, overwhelming and unclear.
Was the tester able to understand the main message of the data story? (e.g., Yes/No + why/why not?)	Yes, the comparison on data in different periods related to pandemics was evident.
What parts of the interface or visualization did the tester find most engaging or effective?	The interactive elements were engaging. Animation in the second visualization drew attention. The idea of comparing pre/during/post-pandemic states was clear and interesting (in general, not on specific visualizations, and how they delivered it)
What parts did the tester find confusing or less effective?	Dates and time periods seemed arbitrary. Hard-to-interpret graphs due to different scales. First graph's click interactions were unclear, tester expected hover instead. Aircraft visualization: too many models, labels and axes hard to read, zoom broke layout. Text too long and too small, overwhelmed the user.

	Buttons on top in the last visualization were not noticed or used. Unclear meaning of globe dots.
Did the tester encounter any inconsistencies in design, data, or narrative?	Inconsistent connection between line graph visualization based on one month of data and connection to the effect of covid on the world. Sizes of design in subtitles or text inconsistent between visualization or slides.
Were there any unexpected interactions or insights that emerged during the session?	Glitch in failing to hover over elements within first visualization. Button for continuing hidden due to page size on last visualization.
What specific improvements or changes did the tester suggest for the prototype?	Use less verbose text. More indicators to easily understand interactivity with visualizations. Maintain text sizes. Incorporate zooming adaptability.
Did the tester suggest any additional insights or visualizations to include?	No
General observations or comments from the tester.	Text is long for the parts, skipped reading some parts, went back to better understand what's going on. The visualization asks questions but then doesn't really address the question. Hover maybe underneath the fuel graph, user hovers the text user didn't click the visualization. Verbose text, less text, more visualization addressing it. Text bit to small Hard to interpret and compare the different months, seems cherrypicked 1-1 comparison. Different scales make it hard to compare. One question, one or two sentences. For the aircrafts the user was moving head to read the left y axis, visualization is a bit to small and the zoom messes it up A lot of airplane models, maybe fewer models, no idea what they are, maybe the card of the aircraft. What is the difference between models Click to filter -> click to highlight Loading issue for the globe Don't know what dots mean Didn't use the buttons on top A lot of planes is just confusing Animation with the second visualization

	Show the graph while hovering

Tester 2

	Notes (To be filled by project leads)
Tester Name	Sam
Describe any usability issues or confusion the tester encountered while using the prototype.	The mouseover tooltip in the first graphic was flashing. Missing date labels on globes. Needs legend on the globe to explain details. Buttons in transitions instead of timers.
Was the tester able to understand the main message of the data story? (e.g., Yes/No + why/why not?)	Might be too much text in the transition slides. They did understand the main story and the types of changes were highlighting.
What parts of the interface or visualization did the tester find most engaging or effective?	Spent most time with globe but missed some of the interactions due to issues with UI.
What parts did the tester find confusing or less effective?	Took a moment to understand scrolling. Took some time to understand the bar graph, had some trouble identifying the key insight. Wasn't sure about the %age in the tooltip in the bargraph. Waiting for data load was a bit crazy. The user zoomed in and couldn’t see the continue button. Tool tip issues. Needs guidance on globe interaction.
Did the tester encounter any inconsistencies in design, data, or narrative?	Found seeming inconsistency in bar graph data. I expected to see an increase but it seemed like it would decrease.
Were there any unexpected interactions or insights that emerged during the session?	Missing Continue Button. Glitching on mouseover tool tip in first visualization.
What specific improvements or changes did the tester suggest for the prototype?	Make line graphs show all data on one screen with different colors. Change the scaling of the line chart to better understand changes. Suggested change to bar graph in wording of less flights rather than no actual recovery to match the data. Legend to support final visualization of the globe.
Did the tester suggest any additional insights or visualizations to include?	No.
General observations or comments from the	Too much text in explanations.

tester.	Liked functionality of both scrolling and arrow keys to move between slides.

Tester 3

	Notes (To be filled by project leads)
Tester Name	Jasmine
Describe any usability issues or confusion the tester encountered while using the prototype.	A little confused with the connection between name or title of project and the theme.
Was the tester able to understand the main message of the data story? (e.g., Yes/No + why/why not?)	Yes, but not after the first screen. Could not be understood based solely on title, but after the culmination of all the data story parts was able to understand the theme.
What parts of the interface or visualization did the tester find most engaging or effective?	Found the animation / interactivity fun on the first visualization and also enjoyed the design. Enjoyed interactivity with the line graph.
What parts did the tester find confusing or less effective?	Jumped back and forth accidentally in navigation. Why was data not including the year 2021 on some data visualizations?
Did the tester encounter any inconsistencies in design, data, or narrative?	Found the data a bit confusing on the total flight time linegraph (months not the same so patterns not consistent).
Were there any unexpected interactions or insights that emerged during the session?	Glitching on first visualization mouseover interaction. No continue button for final globe visualization.
What specific improvements or changes did the tester suggest for the prototype?	Suggested popups for information around extreme drops in flight numbers for the linegraph visualization. Explanations for why flights decreased around christmas or a highlight. Compare yearly information for flight data rather than months.

Did the tester suggest any additional insights or visualizations to include?	Addition to current visualizations of yearly data and incorporation of popups behind major events related to chosen time periods.
General observations or comments from the tester.	Enjoyed the connection between the visualizations as well as the information describing it though it could be less dense.

Based on the results of your ‘think aloud’ study, what would you improve in your data story?

- Add less text in transition slides, but maintain a clear connection and explanation between visualizations
- Add more clear distinguishing labels for interactivity, titles and subtitles that better describe each visualization.
- Adding legends for more descriptive information especially for complex visualizations like globe visualization.
- Comparison between years for flight data for line graph visualization to maintain consistency.

Are there any additional insights and visualizations you would use? Would you amplify or change your message? Did your narrative work? Did the tester get your takeaways?

- No additional insights or visualizations
- Testers got narrative and takeaways, the issue was mostly with bugs or some unclear moments in visualization but not overall message.

Decide as a team which of these improvements you will implement and write down your decisions and why you made them in your process book as a numbered list.

Boris:

- Bar graph preview of plane. To add more connection to the plane theme.
- Fixing usability bugs and glitches. To make visualization interactivity and animation seamless. (PARTIALLY FIXED)
- Fixing confusion in color encodings. To make data representations more clear. (FIXED)

Arthur:

- Fixing bugs in glitching first visualization. To allow a normal viewing process. (FIXED)
- Changing the color of the line graph to monochrome as color doesn’t add much here (prof suggestion). Done to remove any excess color. (FIXED)
- Changing text for hover to make it more clear on the interactivity for first fuel gauge visualization (FIXED)
- Line graph chane to use yearly data and overlap years. To add more distinct and less biased comparisons (PARTIAL).

- Haven’t incorporated line graph change due to time limitations, have created and parsed the data, just need to finalize the graph and restructure.

Adam:

- Integrating visualization of the globe to better fit the theme. To increase cohesion between all visualizations.
- Fixing usability issues, including the button to continue currently hidden. So that all functionality works.
- Adding legend and Subtitles to graph description. Done in order to add more clarity and detail.
- Current menu bar stacked together, change the row positionings to differentiate the between usages.

Qianren:

- Changing verbose text down to a couple sentences of only the most valuable information. To lessen load on the viewer to read large sections of text.

Implement the intended changes and check them off your list (e.g., adding “done”). You can distribute the tasks among your team members. If you are unable to implement specific changes, please explain why and describe the expected results in your process book.

Instructions

You will conduct a think-aloud study with a person from another team in class. You need to document the results of the study and use them to make changes to your prototype for your final submission a week later.

Make sure that you get feedback from at least 3 independent think-aloud sessions!

Please complete the following steps for your think-aloud study:

1. If needed, make a new copy of the table above.
2. Welcome the tester and thank them for spending time with you. Write down your tester’s name in the form in your process book. Then allow your tester to view and freely manipulate your Prototype V2 using a laptop.

3. The team leader will then conduct a think-aloud study with the tester for **10 minutes**. During the test, **do not offer any explanations, answer any questions, or interfere in any way.** If necessary, remind the tester to talk about what they are doing.
4. During the think-aloud study, the rest of the team will **silently** write down general observations in the form. Please do not interrupt the flow of the tester with any questions or remarks.
5. After the think-aloud study is over, spend another **5 minutes** to ask your tester to elaborate on things that you would like to clarify. Use the questions in the test form as a starting point and feel free to add more questions.
6. At the end, after about 15 minutes, thank the tester once again before they leave to join their own team.

Discuss the results of the think-aloud study in your team. In your process book, answer the following questions:

- Based on the results of your 'think aloud' study, what would you improve in your data story?
- Are there any additional insights and visualizations you would use? Would you amplify or change your message? Did your narrative work? Did the tester get your takeaways?
- Decide as a team which of these improvements you will implement and write down your decisions and why you made them in your process book as a numbered list.
- Implement the intended changes and check them off your list (e.g., adding "done"). You can distribute the tasks among your team members. If you are unable to implement specific changes, please explain why and describe the expected results in your process book.

Lastly, submit a link to your project website alongside your process book PDF—make sure your TAs can access it. While this isn't the final submission yet, the teaching team will use these links to determine the Best Project Awards next week. Whether you think you are in the running for the award or not (have some self-confidence!), you are required to submit a website link.

This is a team assignment, please submit only once! The submission should be done by the assigned person (usually the team leader) in your team who is doing the submissions. Please submit this process book tab as a PDF on Quercus, **alongside a live link to your current project**.

Please check the final project overview for more information about the final project.

W13 Final Presentation

Week 13: Final Presentation

Prepare a 5-minute presentation to be conducted in class. You can have one person do the presenting or alternate between team members, whatever works best for your group.

The presentation should briefly motivate your problem (why is this interesting?), document some of the interesting parts of your process, share any challenges you faced during development, and finally, have a live demo!

Conciseness is a virtue here—we want to get through every team, so make sure to fit your presentation into the allotted time. Also, make sure your demo is ready to be run live (reasonable loading times, tested for major bugs/crashes, etc.)

At the end of this class, we'll announce the winners of the Best Final Project awards.

Please submit your slides on Quercus.

Motivate your problem:

- The effect of covid on flight travel
- How the world looked before during and after covid

Document some interesting parts of your process:

Any challenges:

Live demo:

W14 Final Submission!

Week 14: Final Submission!

You made it to the end! It's time to wrap up your project and put together a final submission.

Submit the following items in a single .zip file:

- **Process book:** a link to your Google doc, that documents every step and design decision of your final project.
- **Data:** Submit all the cleaned data that you used in your project. If the data is too large to upload, store it on a cloud storage provider such as Dropbox or OneDrive.
- **Code:** All website files and libraries assuming they are not too big to include.
- **Final Project Video:** A max. 2-minute screencast with narration that shows how your audience would go through your data story. Ideally, you should just submit a link to a hosted video (you can upload it to YouTube, and if you don't want it to be public, set it to "Unlisted").
- **README:** The README file must give an overview of what you are handing in—which parts are your code, which parts are libraries, and so on. The README must contain URLs to your project websites and screencast videos.

Lastly, fill in the peer evaluation form again. Every team member should fill it out individually.

Once you've done all of that, you're good to go! Congrats on your hard work throughout the semester!