MILESTONE 3

PROCESS BOOK

2024

Climate Scenarios and Practical Actions

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Overview

Project Background

Climate change remains one of the most pressing issues of our time, with the 2015 Paris Climate Accords highlighting the need to limit global temperature rise.

However, current efforts are insufficient to meet these targets, as emphasized by the United Nations Framework Convention on Climate Change (UNFCCC). Effective climate action requires clear and accessible data visualization to inform policymakers and the public about emission trends and potential mitigation strategies.

Goal

We aimed to create an interactive and engaging data visualization that illustrates global greenhouse gas (GHG) emissions, focusing on CO2 emissions. By leveraging the power of visual storytelling, we seek to bridge the gap between complex climate data and actionable insights.

This visualization will help users understand historical emission trends, identify major contributors, and explore potential pathways to reduce emissions. It is based on the main bodies of work realised by the IPCC: scientific rproof, Impact and mitigation

Peer Assessment

Work was broadly split up by section, with each group member finding and cleaning data for their section.

Hod: Emissions
- General project structure, globe visualizations, data cleaning and pre-processing

Pablo: Impact
- Climate events & implications, process book styling, pop-up animations

Victor: Mitigations
- Majority of colour and style choices, emission projections and mitigations

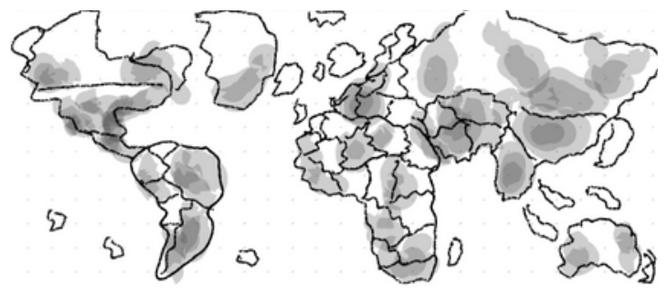
Emissions

Development Journey

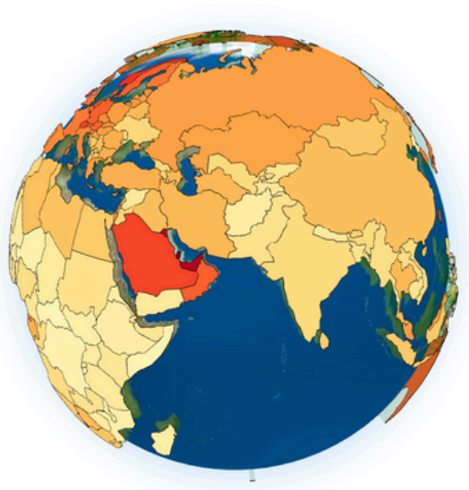
Countries

The goal of the emissions section was to create an **interactive** and **engaging** visualization that compares and communicates the relative contributions of different regions to global emissions.

Initial sketches included 2D maps with various visualization techniques such as heatmaps and choropleth maps.



2D Heatmap

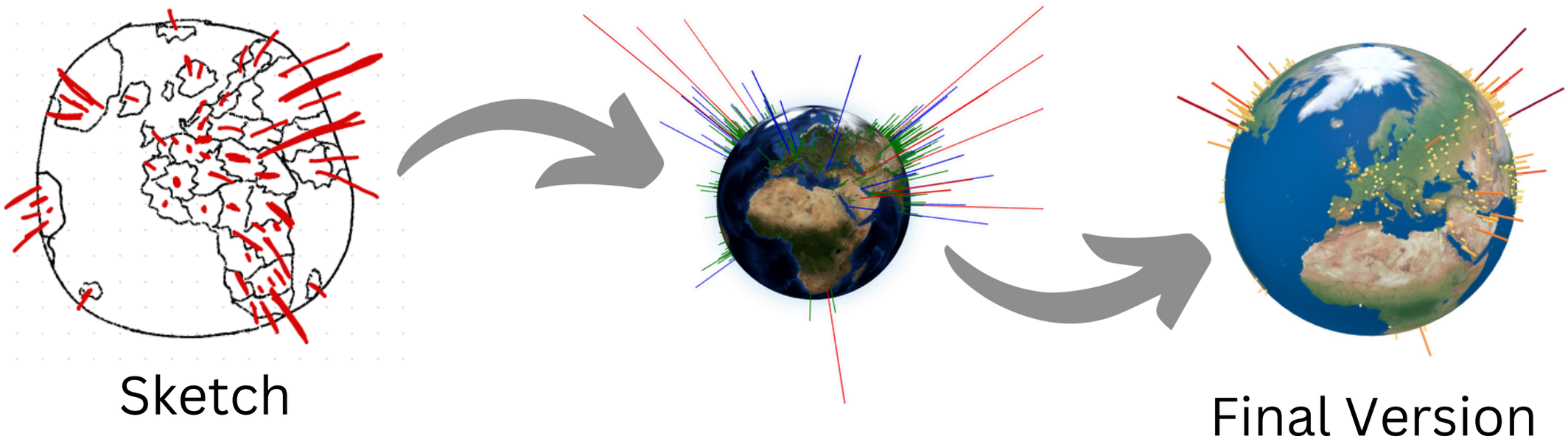


3D Choropleth

Ultimately, I used a 3D Choropleth globe for a **dynamic and immersive experience,** leveraging the extra dimension for added emphasis and information. Users can **interact** with the visualization through a **timeline**, allowing for the comparison of data across different years.

Cities

The initial prototype used the free globe.gl library with randomized point locations to test the concept.



Sketch

Initial Prototype

Final Version

I then added latitude & longitude coordinates for each city in the dataset and populated the globe with accurate locations and emission levels, showing regional emission variations within countries.

Emissions

Challenges

```python
DATA_DIR = Path(__file__).parent.parent / 'data'
INPUT_FILE = DATA_DIR / 'owid-co2-data.json'

with open(INPUT_FILE) as infile:
    input_data = json.load(infile)

filtered_data = {}
yearly_min_max = {}
for country, value in input_data.items():
    iso_code = value.get("iso_code")
    if (iso_code is None or len(iso_code) != 3):
        # not a country, or missing iso_code
        continue

    filtered_data[iso_code] = {}
    for annual_data in value['data']:
        year = annual_data['year']
        share_global_co2 = annual_data.get('share_global_co2')
        co2 = annual_data.get('co2')

        if (share_global_co2 is not None):
            if (year not in yearly_min_max):
                yearly_min_max[year] = {
                    "max_share_global_co2": share_global_co2,
                    "min_share_global_co2": share_global_co2
                }
            else:
                if (share_global_co2 > yearly_min_max[year]["max_s
                    yearly_min_max[year]["max_share_global_co2"] =
                if (share_global_co2 < yearly_min_max[year]["min_s
                    yearly_min_max[year]["min_share_global_co2"] =

            filtered_data[iso_code][year] = {
                'share_global_co2': share_global_co2,
                'co2': co2
            }
```

A key challenge was ensuring **performance** of the visualization, especially when handling large datasets. Filtering the datasets to only include **relevant indicators** and **pre-calculating normalization values** significantly improved performance. This filtered data was then exported in **JSON format** for efficient use in the visualization.

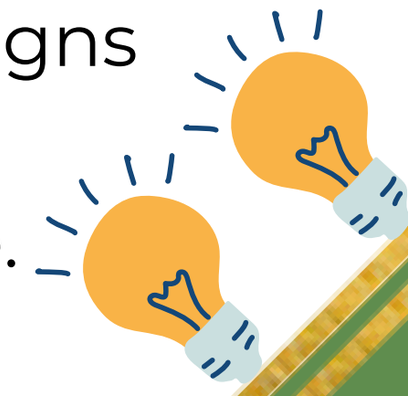
Another challenge was making the visualization **interactive** and **user-friendly**. Initial prototypes included basic hover interactions, but I expanded this to include a **dynamic timeline feature**. This allowed users to see how emissions changed over time, with countries updating based on their share of global CO2 production.

Timeline

Impact & User Experience

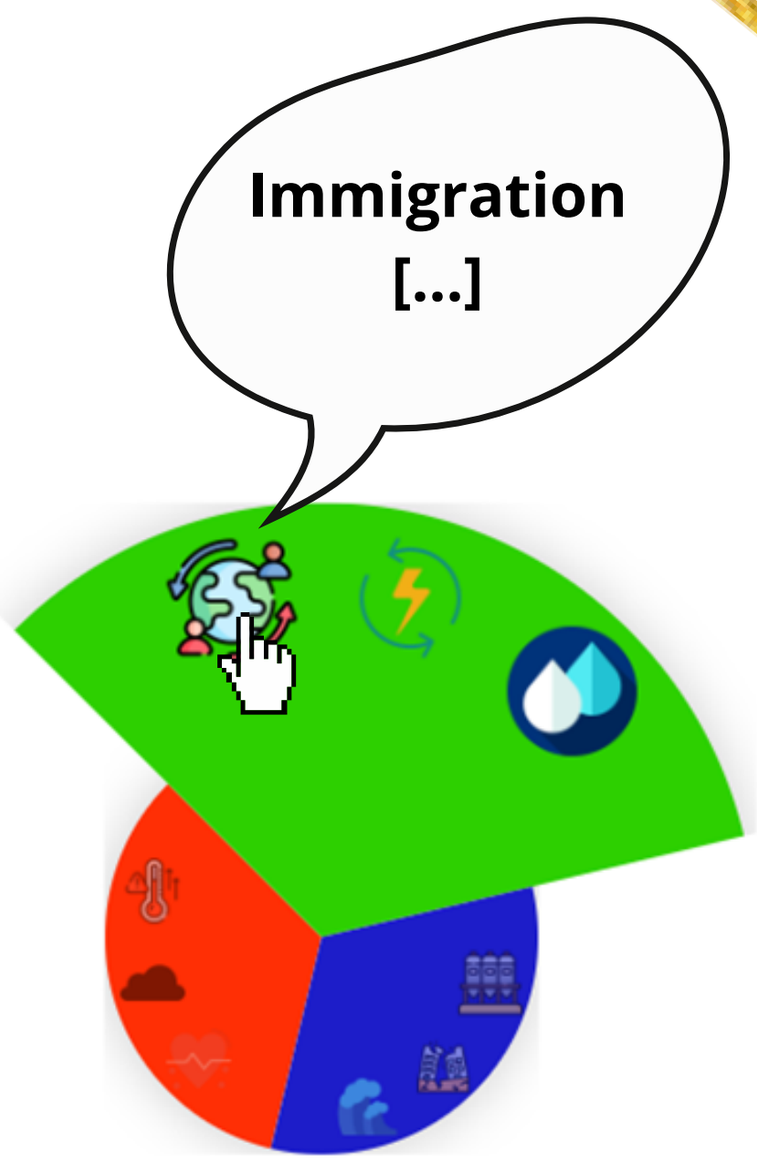
The final visualization provides a **comprehensive view** of global emissions, with features like the dynamic timeline making it easy for users to **explore historical data** and understand **trends over time**.

The use of the 3D globes makes the data more engaging and accessible, helping users to see the **big picture** while also being able to drill down into **specific details**. This approach aligns with the project's goal of making complex climate data **understandable** and **actionable** for a broader audience.



Impact

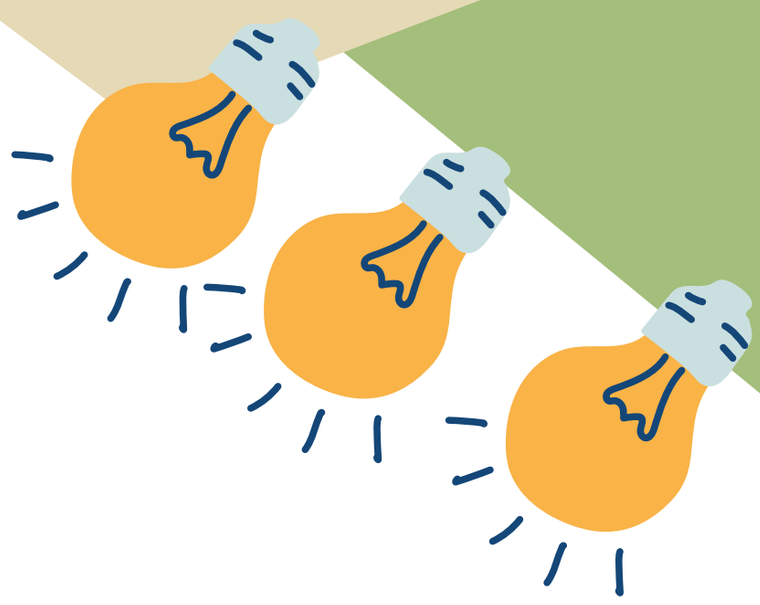
For the Impact section, I wanted to create an engaging and interactive experience for users. My initial idea was to create an interactive image that would allow users to explore different scenarios. By hovering their mouse over different parts of the image, users could access explanations of how each scenario could unfold.



I created a prototype using a map of the world, where users could zoom in and out to explore different regions. I also included various icons to represent the different scenarios, making it easy for users to identify and explore the impacts of each event.

However, it felt like something was missing... something that would explain how these factors were interconnected. I wanted to provide a comprehensive understanding of the various actions that influence each environmental factor in our society and daily lives.

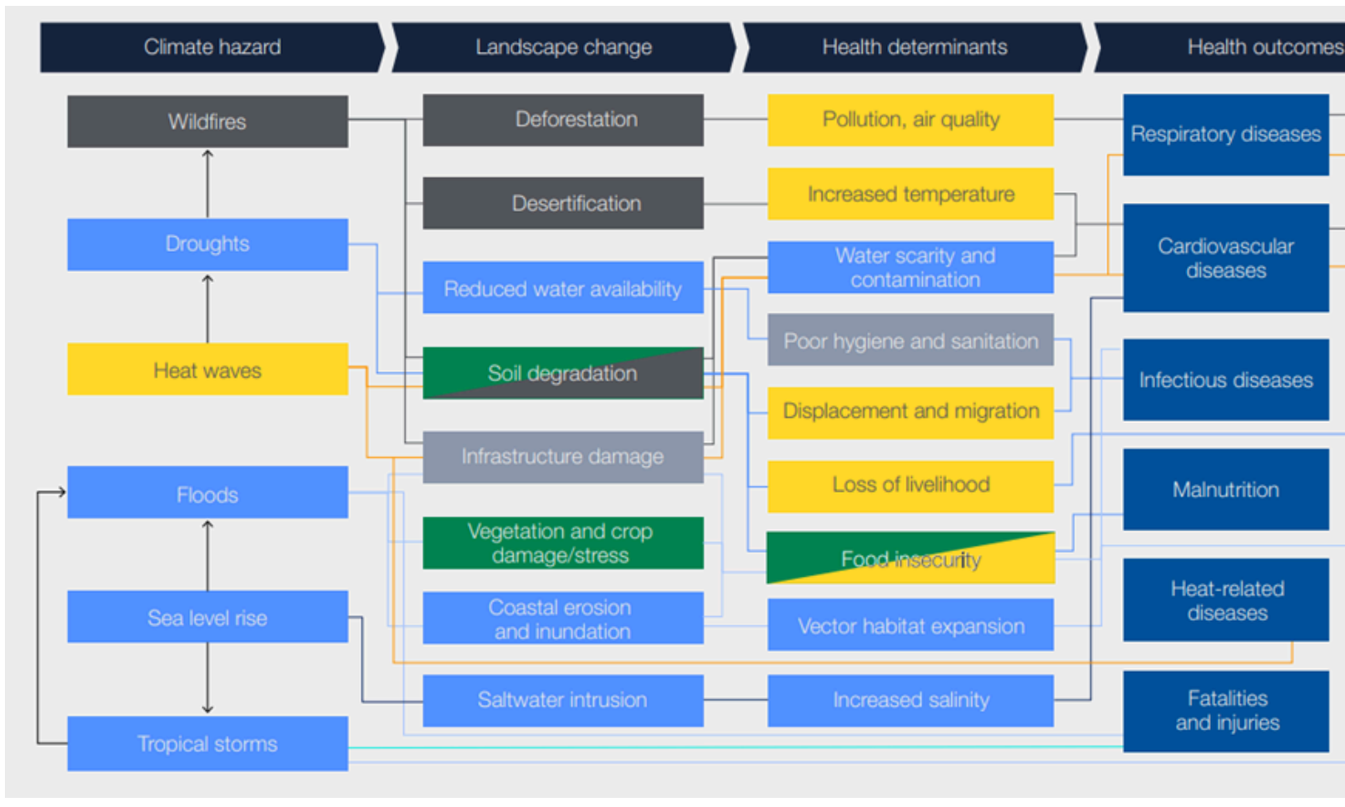
Impact



After much thought, I finally arrived at a solution. Why not create a visualization that encompasses the entire process, allowing users to explore the different scenarios by clicking on them, while still keeping the origin of the event visible? This approach would enable users to see the big picture and understand how each action and event are interconnected.

Reading some papers I found this picture. And I knew this was going to be the origin. But how overwelming this graph is. Why not exploring one climate hazard at a time ?

Letting the user delete, move the node around to let him organize his toughts.



Implementation

I began by creating my own dataset for each action, meticulously removing any connections that could potentially confuse or mislead users.

I found a library called Draw2d.js. This incredible, **FREE** library allowed me to build blocks and connections between them, creating a dynamic and interactive visualization. However, I quickly discovered that the library was relatively unknown and the documentation was challenging to understand. The coding part was about adapting the design to the user inputs (change of position, node deleted).

Mitigation

To understand better the choices we can make when talking about the mitigation of climate change, the IPCC offers many tools from which we had to choose. We decided to settle on two, which represent higher, and lower levels of abstraction.

Due to the high level of complexity offered in the visualizations present in the reports of the IPCC, we wanted to condense the data into more streamlined plots that were easy to read for the general public. But the question that remained, was which dataset to choose from the 4288 available to pass on our message? That we can still make it.

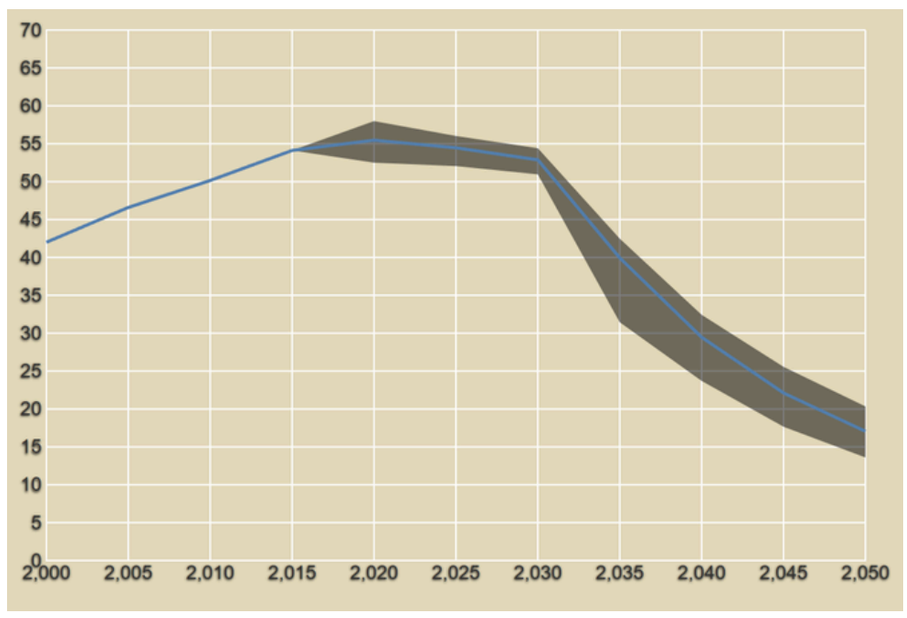
ipcc **All: 4288** Data Class: 213

We settled on two of them:

<u>The first</u> is the creation of various heating scenarios based on the amount of GHG gases emitted in thed next 30 years

While simple, these graphs easily allows the reader to understand the magnitude of the task at hand.

In only 30 year, we have to reduce our emissions by more than 90%!



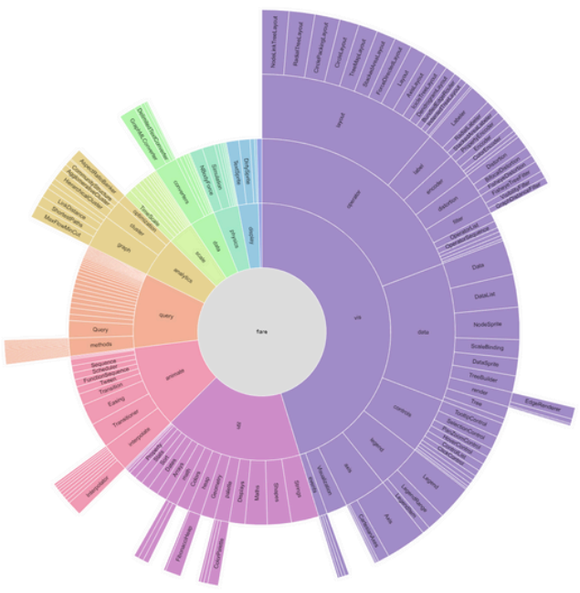
<u>The second</u> step focusses on potential solutions and mitigation solutions offered by the IPCC.

We wanted to make people understand that the solution can come directly through their contribution

There exists many areas where we can already reduce our carbon foot-prints, both as individuals and as actors in an industry. The sunburst visualization from d3.js offers a perfect support for hirearchical organisation of data.

This way, a user can look for an area of interest and gradually focus on more specific topics where their contribtions could be greatly valued.

And all of this is achieavable before 2030.



Conclusion

Through our presentation of the IPCC's work in simple, effecctive visualization, we hope to have conveyed the urgent need for concern, education and action for the fight against climate change.

Thank you d3, fullpage and globe for allowing us to pass on that message, and don't forget: