THE IMPACT OF CLIMATE CHANGE IN AUSTRALIA

DESIGN REPORT

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Contents

Introduction

This report aims to discuss and describe the design principle of the Data Visualization Project: The Impact of Climate Changes in Australia.

This visualization project aims to elaborate on the same topic from the Data Exploration Project, however, an interactive narrative visualization will be implemented this time to answer the previous question in a more comprehensive way**.**

Purpose of the report

The message to be conveyed in this visualization project is: **Climate change is happening and we can feel it.**

Climate change is always a popular topic, most of us learned the harsh condition that earth is facing since we were kids. In Melbourne, thousands of people attended the climate rally this year.

Figure 1. Climate rally in Melbourne CBD

Even though, climate change is still something that seems pretty far from us. This makes me wonder, **do most people realize the impact the climate change?**

Target audience

The target audience of this Data Visualization Project is the general public of Australia as it aims to raise the awareness of people regarding climate change.

Design

The design phase of this project follows the five design sheet methodology. After brainstorming, I combined and refined three of the visualization designs that can present the topic most comprehensively.

For the initial design please refer to the appendix.

Due to the data collected and the limitation of front-end skills, I decide to make a couple of pivots after the initial five design sheets. However, the principle of the design remain remains the same: **To help people understand the topic of "Climate Change"**.

Design Flow

This narrative visualization project will guide the audience through several stages:

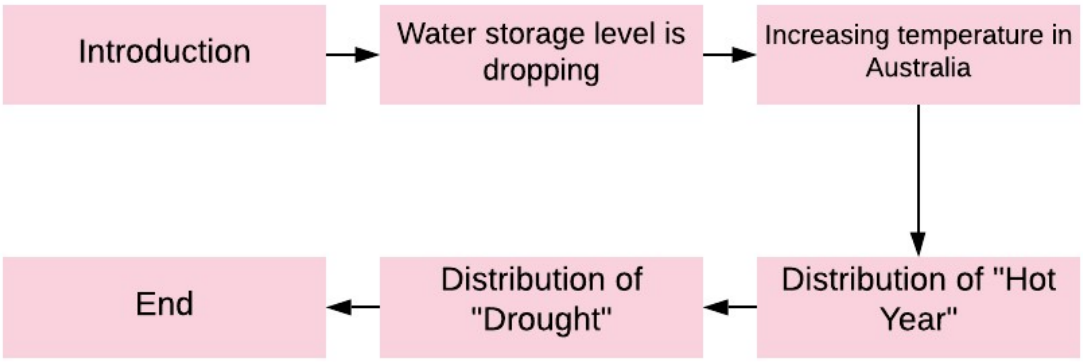


Figure 2. The design flow

The introduction part will get the audience's attention by raising a question: How much do you know about climate change?

Then a bar chart will be introduced to demonstrate one of the concerning issues Melbourne is facing: The decreasing water storage.

Next, a multi-line chart will be introduced to present the increasing temperature in three of the major cities in Australia.

After that, a histogram and an interactive bubble chart will be used to demonstrate the increasing “abnormal climate” Australia is experiencing.

Final Design

The final design will be justified and demonstrated in several aspects:

- The navigation
- Word cloud: Introduction
- Bar chart: Decreasing water storage level
- Multi-line chart: Increasing temperature
- Histogram: More heatwaves
- Bubble Chart: More droughts

Navigation

The navigation of this project will be implemented by using a side navigation menu. The reason for this design change is that the navigation menu gives a clearer picture of each stage throughout this project, while the carousel/slider is not able to provide such information.

The audience can choose to scroll through the project or simply click each section.

Figure 3. Side navigation menu

Word cloud: The introduction

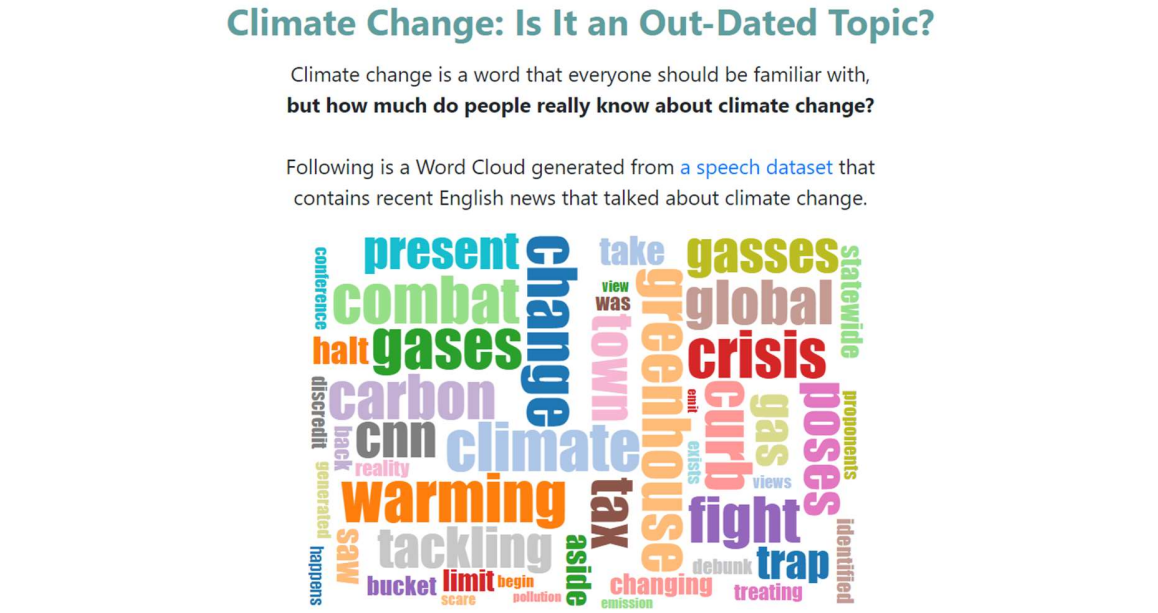


Figure 4. Wordcloud of speech data on climate change

As the first section, a word cloud will be used to introduce the topic: How well do you know about climate change?

This word cloud is generated from a speech dataset that contains recent English news that talked about climate change.

The purpose of the design is to get the attention and interest, as a word cloud is comprehensive and can present the keywords easily.

Bar chart: Decreasing water storage level

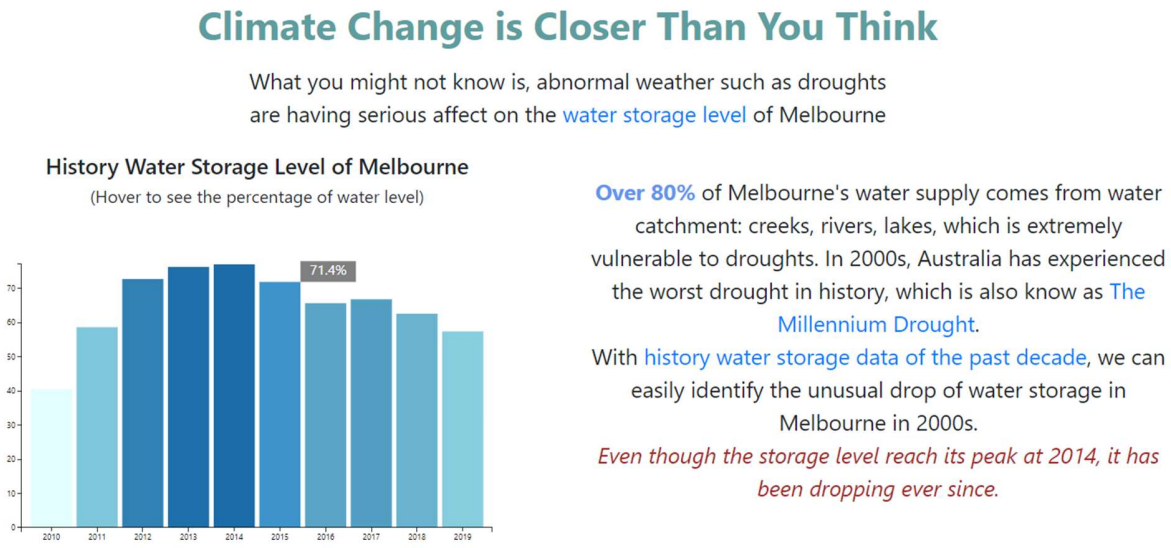


Figure 5. The "Water storage level" section

In the second section, a bar chart is used to present **the decreasing water storage level of Melbourne**. It's generated from the history water storage level dataset offered by one of the state-owned water service providers: Melbourne Water.

When hovered, tooltips will be appended to present the exact percentage of water storage level.

The purpose of this design is to bridge the gap between the general public and the word "climate change", as the water supply is closely related to our daily life. On the other hand, the water storage level is heavily affected by the climate, which proves the impact of climate change in Australia.

Multi-line chart: Increasing temperature

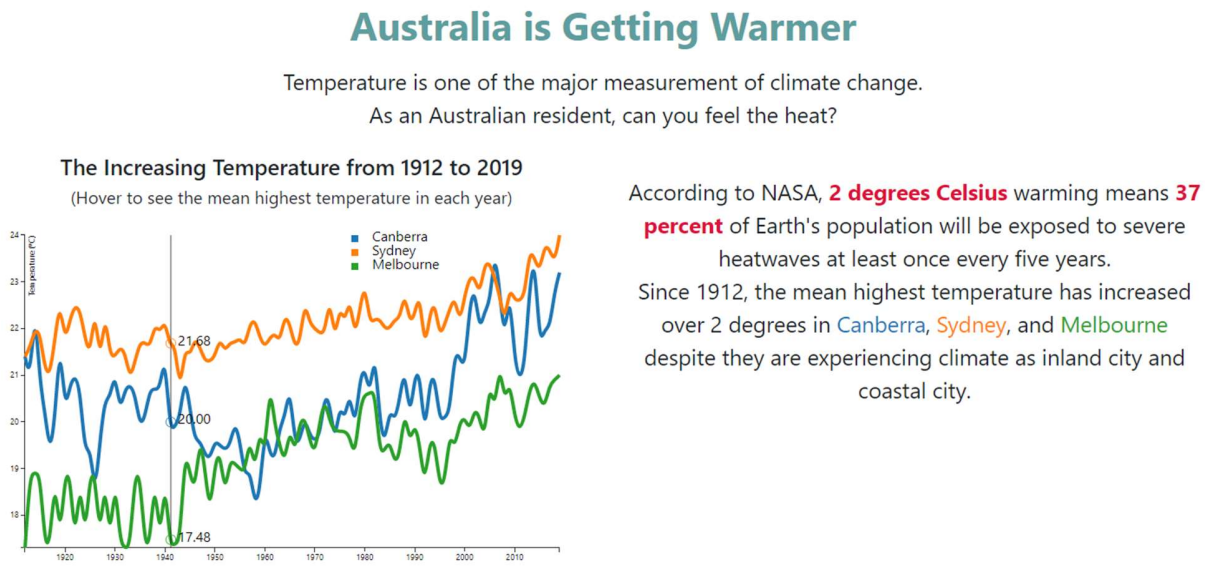


Figure 6. The "Australia is Getting Warmer" section

As the next section, a multi-line chart is used to present **the trend of increasing temperature in Canberra, Sydney, and Melbourne since 1912**.

This is generated from the “monthly mean highest temperature” data published by the Bureau of Meteorology.

When hovered, a line will be appended to show the temperature in each city for a detailed comparison.

The purpose of this design is to help the audience to understand:

- The increasing temperature
- The comparison of temperature among different cities

Histogram: More heatwaves

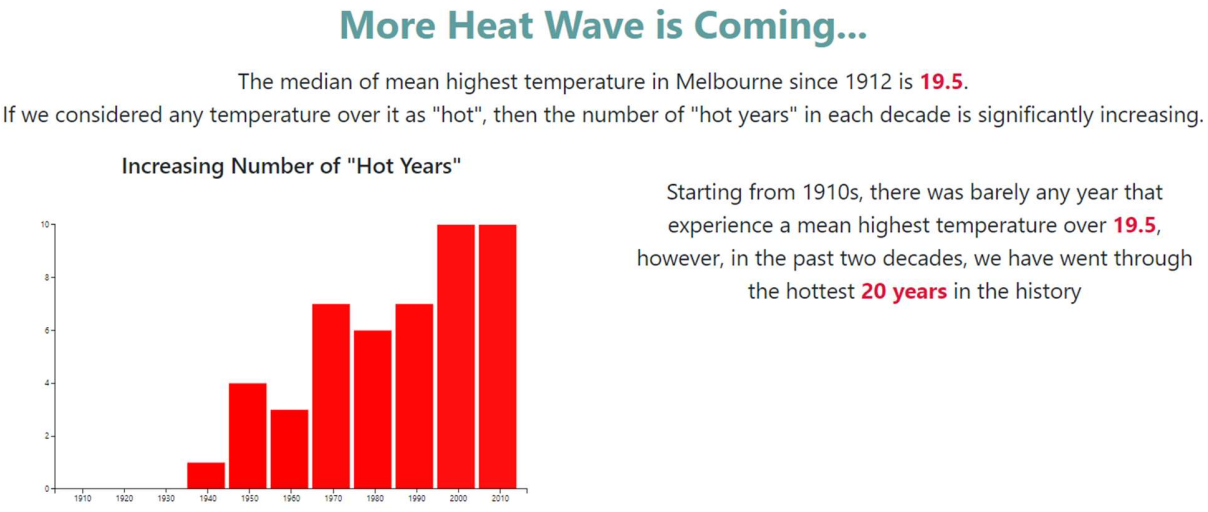


Figure 7. The "More Heat Wave is Coming" section

This section demonstrated **the distribution of "Hot Years" in Melbourne**, which are years that experienced a higher temperature than the median.

This design remains the same from the initial design sheets since the histogram is the most common and popular way of presenting distribution.

The dataset used here is wrangled from the same source of data in the last section, where the frequency of "Hot Year" is calculated for each decade.

Bubble Chart: More Droughts

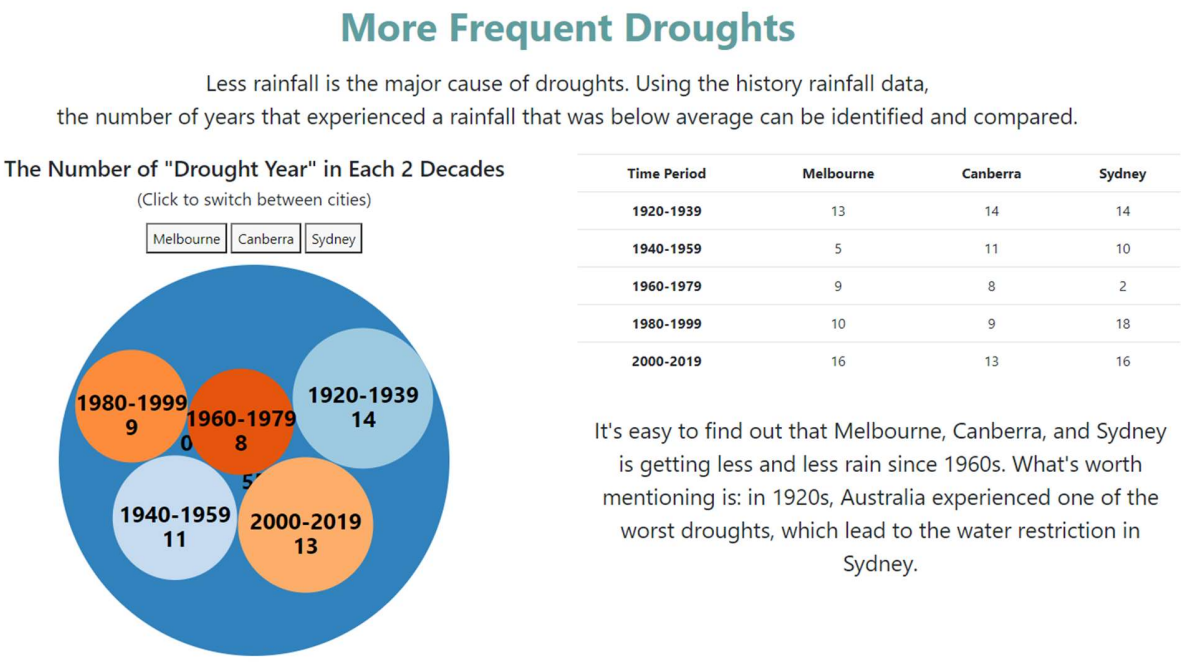


Figure 8. The "More Frequent Droughts" section

In the last section, an interactive bubble chart is used to present **the distribution of droughts in Melbourne, Canberra, and Sydney since 1920.**

Besides, the detailed data of droughts happen in every 20 years are also present in the table on the right side.

This is generated from the “monthly rainfall” data published by the Bureau of Meteorology.

The design purpose of this page is to help the user to understand the fact that **Australia is experiencing more droughts even compared to the worst time in history**.

Implementation

The implementation of this data visualization project is in a similar stack of front-end development

The project stack

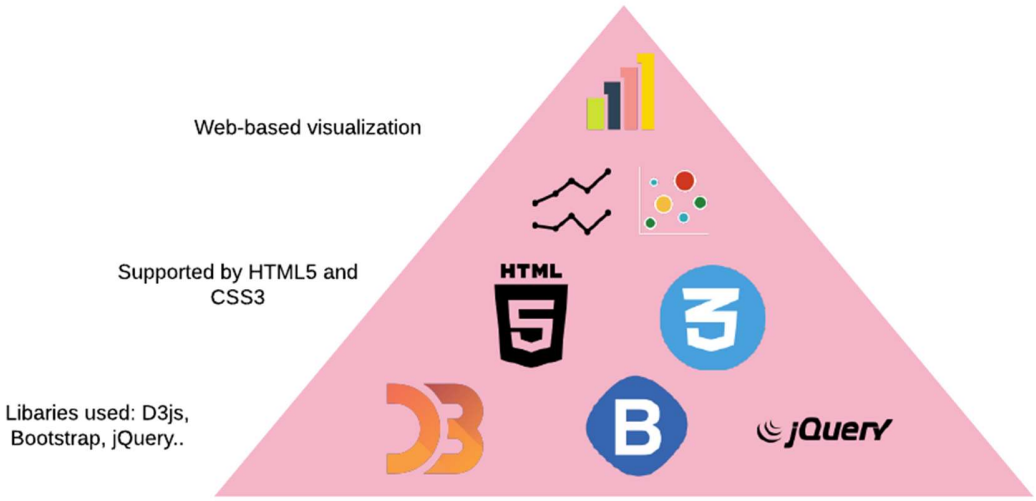


Figure 9. The stack of project

D3.js is used as the visualization tool in this project while there are also several external libraries used to achieve a better and friendly design:

- Font awesome
- Bootstrap
- jQuery

Data Sources and Wrangling

There are three data sources used in this project:

- Speech data collected from English news
- History water storage level data from Melbourne Water
- Weather data from the Bureau of Meteorology of Australia (consists of rainfall and temperature)

Speech data collected from English news

This is a speech dataset that contains words that collected from English news that were related to the topic of climate change.

The initial dataset is in CSV format with over 1000000 rows x 9 columns. After sampling, the latest 400 words were selected and used to generate the word cloud.

URL:

https://blog.gdeltproject.org/a-new-part-of-speech-dataset-to-explore-climate-change-narratives-in-english-online-news-2016-2020/

History water storage level data in Melbourne

This is a history water storage level dataset given by one of the state-owned water providers: Melbourne Water.

This dataset is in CSV format with 10 rows x 14 columns.

URL:

https://www.melbournewater.com.au/water/water-storage-and-use#/ws/freq/weekly/type/storage

Monthly total rainfall data

This is a history rainfall dataset that was collected by the Bureau of Meteorology of Australia.

The initial dataset is in CSV format with various sizes due to the difference in weather stations.

After sampling, the rainfall records from 1920 were selected, the average rainfall is calculated, and the frequency of record with a below-average rainfall is used to generate the bubble chart.

URL:

http://www.bom.gov.au/jsp/ncc/cdio/weatherData/av?p_nccObsCode=139&p_display_type=dataFile&p_startYear=&p_c=&p_stn_num=066006

http://www.bom.gov.au/jsp/ncc/cdio/weatherData/av?p_nccObsCode=139&p_display_type=dataFile&p_startYear=&p_c=&p_stn_num=070072

http://www.bom.gov.au/jsp/ncc/cdio/weatherData/av?p_nccObsCode=139&p_display_type=dataFile&p_startYear=&p_c=&p_stn_num=086018

Monthly mean highest temperature data

This is a history mean highest temperature dataset that was collected by the Bureau of Meteorology of Australia.

The initial dataset is in CSV format with various sizes due to the difference in weather stations.

After sampling, the temperature records from 1912 were selected, the median temperature is calculated, and the frequency of record with an over-average temperature is used to generate the multi-line chart and histogram.

URL:

http://www.bom.gov.au/jsp/ncc/cdio/weatherData/av?p_nccObsCode=36&p_display_type=dataFile&p_startYear=&p_c=&p_stn_num=087036

http://www.bom.gov.au/jsp/ncc/cdio/weatherData/av?p_nccObsCode=36&p_display_type=dataFile&p_startYear=&p_c=&p_stn_num=073007

http://www.bom.gov.au/jsp/ncc/cdio/weatherData/av?p_nccObsCode=36&p_display_type=dataFile&p_startYear=&p_c=&p_stn_num=087031

User Guide

This visualization project is designed as a single page: Users can choose to scroll through his journey or simply click the navigation bar on the left side to jump to a certain section.

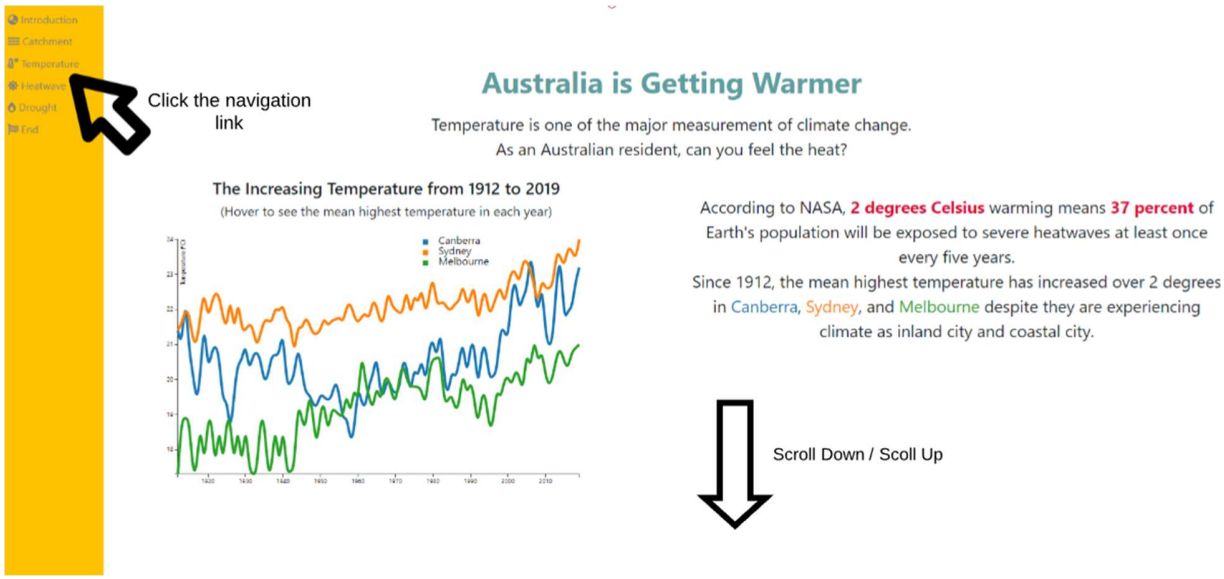


Figure 10. Navigation guide

For further instruction of each chart, please refer to the “Final Design” section

Conclusion

This visualization project helps the general public of Australia to understand the impact of climate change. Start with the word cloud, the audience is introduced to the topic and further details. The water storage level visualization brings the audience closer to the topic as the water supply is crucial for our daily life. Then, the multi-line chart presents the increasing temperature in different cities demonstrated that climate change is having a significant impact in Australia: both inland cities and coastal cities. In the end, a histogram and a bubble chart are used to demonstrate the increase of abnormal climate: more heatwaves and droughts.

The advantage of web-based narrative visualization

Comparing to the previous data exploration project, this data visualization project is more powerful in terms of story-telling:

- The audience can have a clear picture of climate change after going through each stage.
- The audience can get more involved in the topic by manipulating the interactive charts on their own.
- Interactive charts can demonstrate both the core concept and detailed information, allows the audience to develop insights on their need.

What can be further improved?

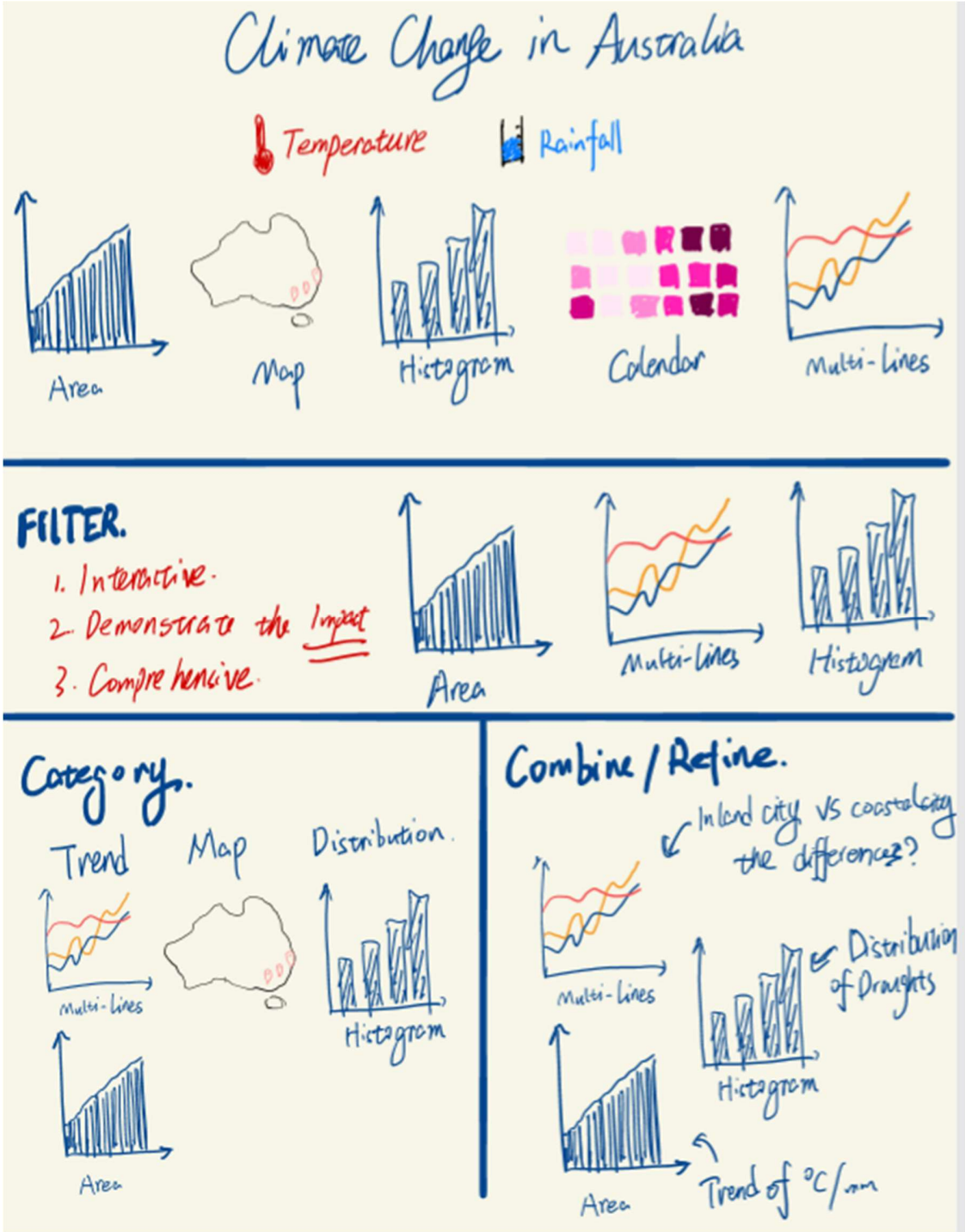
The measurement of climate change can be further elaborated on to give the audience a more complete look of the situation: Emissions of CO2, Sea level…

Bibliography

Australian Government. (2015, September). Natural disasters in Australia. Retrieved from https://web.archive.org/web/20171112120245/http://www.australia.gov.au/about-australia/australian-story/natural-disasters

Appendix

The five design sheets were updated on feedback after the presentation:



LAYOUT

TITLE	Inland VS Coastal	
AUTHOR	Yue	
TASK	DATE	SHEET
map	16/06/2020	2

OPERATIONS

Focus / Zone

Canberra is an Inland city.
Last year, Canberra experience 500mm of rainfall - - -

- - - - - - - - - - - -

\+ Demonstrate the geo-location of cities.

\- No direct comparison between cities.

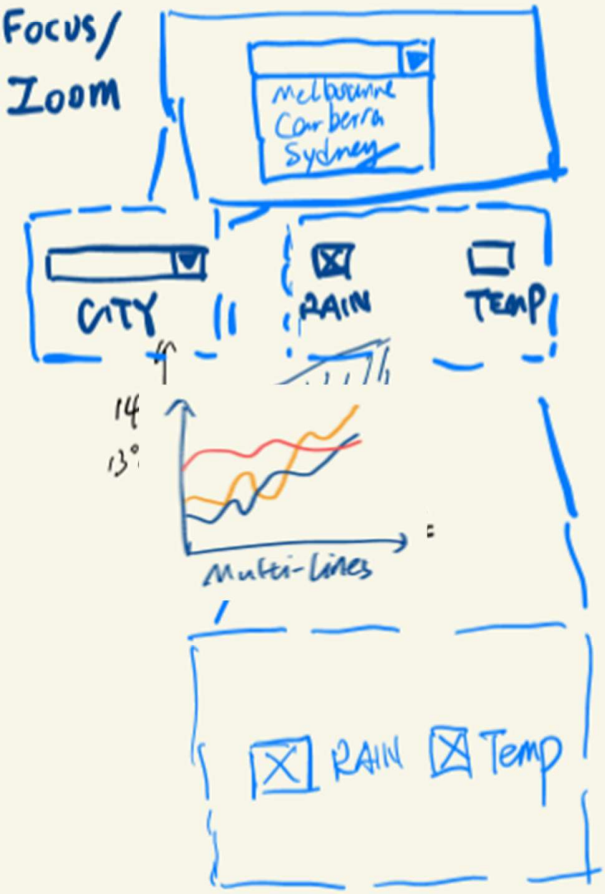
LAYOUT

TITLE	Trend of climate	
AUTHOR	YUE	
TASK	DATE	SHEET
Trend	16/06/2020	3

OPERATIONS

1. Select City
2. Tick Rain / Temp

Focus / Zoom

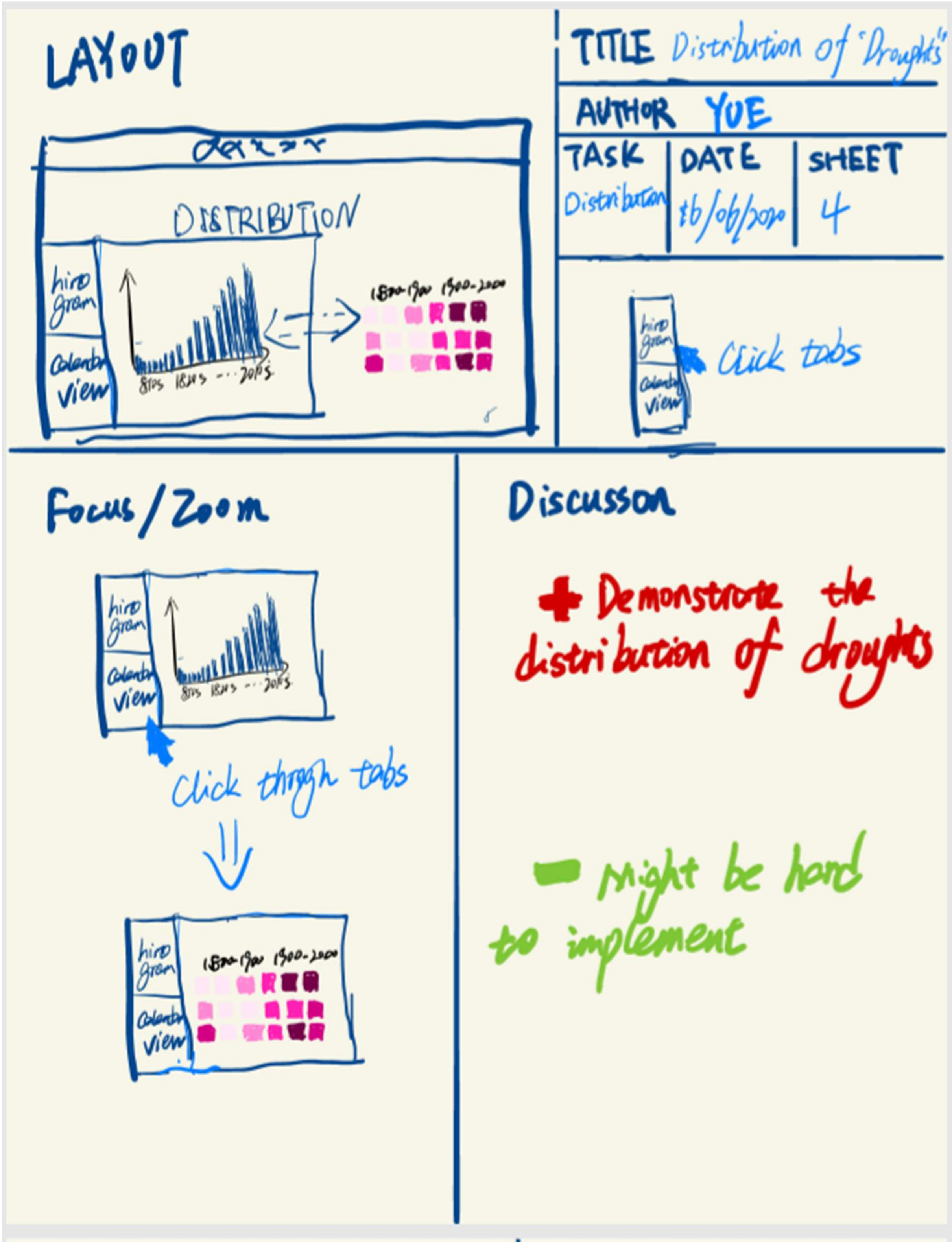


Discussion

+ Demonstrate the trend of rainfall / °C in each cities.

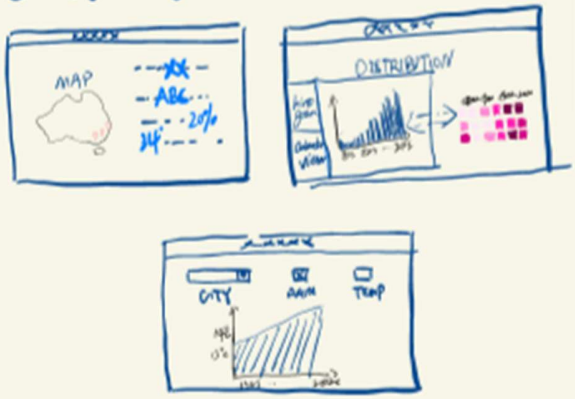
− Might be hard to implement.

− No direct comparison.



LAYOUT
TITLE Distribution of "Droughts"
AUTHOR YUE
TASK
Distribution
DATE
16/06/2020
SHEET
4
DISTRIBUTION
Click tabs
Focus/Zoom
Click through tabs
Discusson
+ Demonstrate the distribution of droughts
- Might be hard to implement

LAYOUT



TITLE: Climate change in AU

AUTHOR. W.U.

TASK	DATE	SHEET
	07/06/2021	5

OPERATIONS:

Click slide arrow

Focus - Zoom

An overview of climate change in different cities (inland & coastal)

The trend of rainfall & temperature in different cities

Distribution calender view of drought year

Discussion!

✚ Will present the increase / decrease of temperature / rainfall amount

▬ The comparison of inland / coastal city is not clear.