

Migration Into Australia

Mercury Website:

<https://mercury.swin.edu.au/cos30045/s102107602/DataVisualisationProject/MainPage.html>

GitHub Repository:

<https://github.com/Kaybeegee98/COS30045DataVisProject>

Validation Link (Google Forms):

<https://forms.gle/n5pSfusDicCN3o4U9>

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1 Introduction

1.1 Background and Motivation

This set of visualisations will be used primarily as a way to gauge the number of people migrating to Australia from other countries. It will also show the general increase in Australia's population due to migration.

The main users for these visualisations will be a mix of people looking to understand why migration occurs, what factors may affect people's choice to migrate, and the current state of migration in Australia. It can also be used by both Government and business owners looking to try and predict a surge in migration. This could be for many different reasons, such as;

- Predicting an increase in the labour force
- Predicting an increase in home seekers
- Predicting an increase in the student population.

Understanding migration can be an important factor in knowing how your country, and those inside of the country, operate. Using visualisations to show this information is one of the best methods to help people understand the data. While visualization is a great way to show the data, it is still important for the data to be complemented by text. Antony Unwin wrote about this very thing in his science review (Unwin, 2020), stating "*If you have read all the supporting text, the display is often memorable and readily understandable. If you have not, it is not. Graphics on their own are insufficient, they are part of a whole.*"

Quotes

- "*The effectiveness of data visualization can be gauged by its simplicity, relevancy, and its ability to hold user's hand during their data discovery journey*" - Jagat Saikia 2023
- "*Data visualization is the language of decision-making. Good charts effectively convey information. Great charts enable, inform, and improve decision making.*" - Dante Vitagliano 2023
- "*How we visualize data will evolve into more complex forms that better communicate uncertainty and complexity.*" — Amanda Makulec 2023

1.2 Visualisation Purpose

The website will allow users to:

- Understand why migration occurs
- Which Countries people are migrating away from
- Why people are migrating and what are the factors
- Understand the trend of migration

In order to show the different factors of why people migrate, we will be using a series of interactive visualisations. We will be using a Bar Graph to show the Net Overseas Migration of Australia over time. We will be using a Pie Chart to show the Countries associated with Australia's Overseas Born Population for a given year. We will use a Comparative Line Graph

to show the Inflation Rate over time. Finally, we will show the Unemployment Rate for different Countries over the years using a Stacked Bar Graph. This other data will allow our audiences to see reasons why people move out of Australia or into Australia. The migration data trends could be directly proportional to the unemployment and inflation rates meaning that if there are high unemployment and inflation rates then there are high levels of migration from that country.

The benefit of completing these objectives in these visualisations is that anyone looking to understand why migration is happening. It should also show how many people are migrating in and out of Australia. This will allow users to easily understand the information from the visualisations rather than reading a whole blurb.

1.3 Project Schedule

Week #	Tasks to be completed
Week 1	Find meaningful data with links, Begin work on Process Book tasks 1 & 2
Week 2	Collect more data and start graph sketches / Research possible graph types
Week 3	Continue Graph Sketches
Week 4	Begin Barebones coding and present in class
Week 5	Finish designing the main page
Week 6	Begin making base charts that hold important data
Week 7	Finish base charts, with a few extra pages to give context to the data
Week 8	Start adding interactive elements to the webpage
Week 9	Continue interactive Elements
Week 10	Work on the “look” of the website, Present Current Build
Week 11	Finish the website in its entirety, Present Current Build
Week 12	Present Complete Process Book and Peer Evaluation

2 Data

2.1 Data Source

Graph 1.1 Net overseas migration - Australia - historical(a)(b)

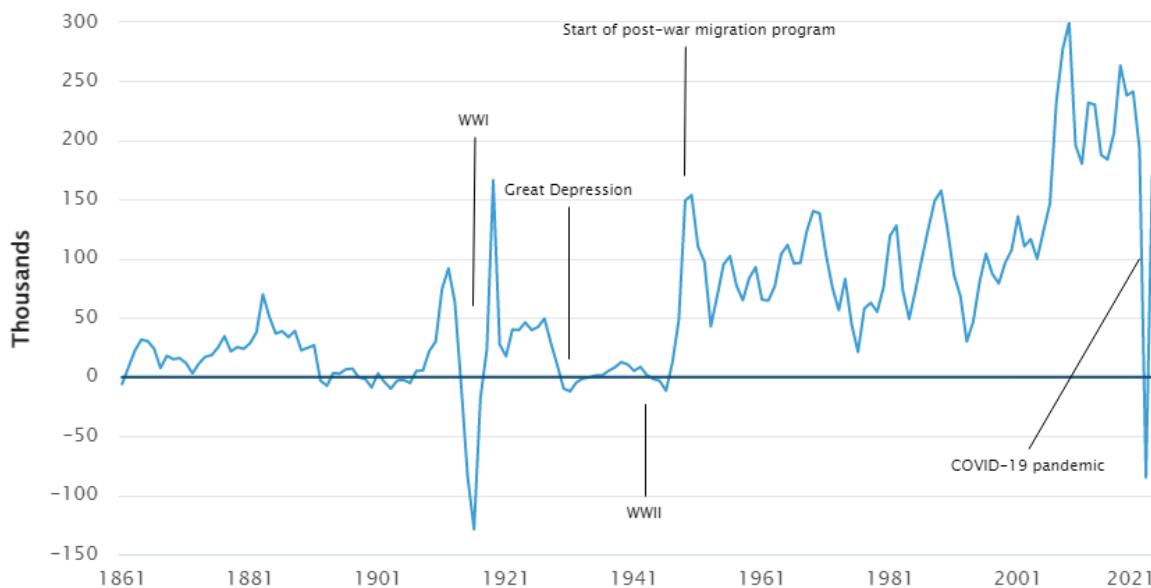


Figure 1, Net Overseas Migration up to 2022, Screenshot from
(<https://www.abs.gov.au/statistics/people/population/overseas-migration/latest-release>)

The primary dataset (Figure 1) will be used for gauging the migration into Australia. This data has been collected from the ABS (Australian Bureau of Statistics). Figure 1 showcases the number of migrations Australia has experienced every year since 1861. While it going back this far is interesting and helps maintain its credibility, we obviously won't be using that much data. Instead, we will start collecting values from 2015 onwards. Only the last 5 years matter for our objective, and we think having a few extra years can help contextualize more recent events, such as COVID-19.

Graph 1.3 Overseas-born - top 10 countries of birth, Australia - at 30 June - 2010, 2015 and 2020(a)(b)

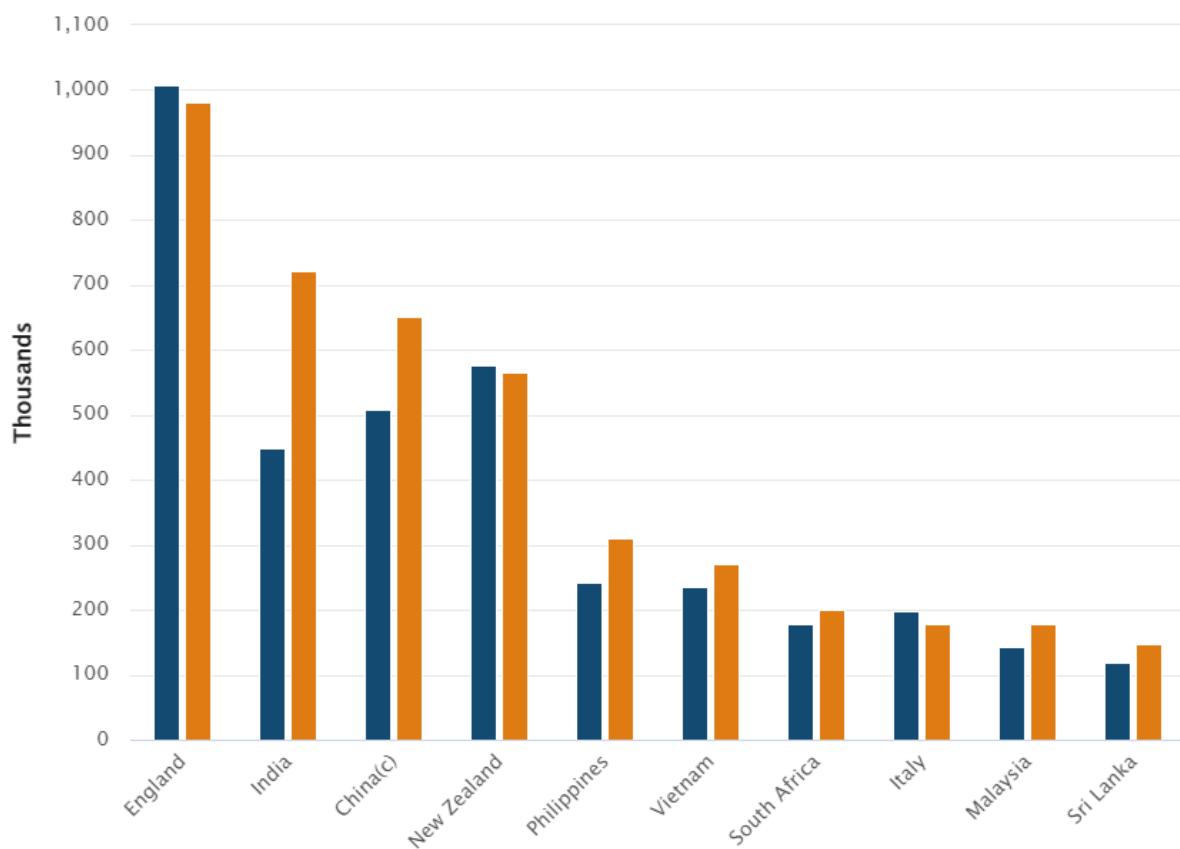


Figure 2, Overseas-born Migration (2015 & 2020), Screenshot from
(<https://www.abs.gov.au/statistics/people/population/migration-australia/latest-release>)

This figure (Figure 2) showcases one of the major data sets we will be using for this project. This dataset has the number of individuals in the thousands that are migrating to Australia from specific countries. For our website, we will only be collecting a few of these selections, six to be specific. Five of the selections were chosen due to them having the highest number of immigrants, those being England, India, China, New Zealand and The Philippines. The last selection was South Africa, due to it being a middle ground of the countries with a lower migration rate into Australia.

Figure 3 will be added in an attempt to help understand why people have been moving to Australia. This transformed dataset, alongside Figure 4, have both been collected from the Trading Economics website. Quoted from the Trading Economics website (Trading Economics, Accessed 05/05/2023), “*Trading Economics provides its users with accurate information for 196 countries including historical data and forecasts for more than 20 million economic indicators, exchange rates, stock market indexes, government bond yields and commodity prices.*” Through this website, we collected a range of different countries’ inflation rates and unemployment rates. This data starts on January 2018, and ends in October 2022, with each data point coming after 3 months (Jan - Apr - Jul - Oct - Jan).

Inflation Rates - %	Jan - 2018	Apr - 2018	Jul - 2018	Oct - 2018	Jan - 2019	Apr - 2019	Jul - 2019
Australia	1.9	1.9	2.1	1.9	1.8	1.3	1.
England	3	2.4	2.5	2.4	1.8	2.1	2.
India	5.07	4.58	4.17	3.38	1.97	2.99	3.1
China	1.5	1.8	2.1	2.5	1.7	2.5	2.
New Zealand	1.6	1.1	1.5	1.9	1.9	1.5	1.
Philippines	3.4	4.5	5.7	6.7	4.4	3	2.
South Africa	4.3	4.6	5.2	5.4	4	4.3	3.

Figure 3, Inflation Rates transformed, Screenshot from Excel File, By Kyle Gibbs 21/03/23

Unemployment Rates - % (Seasonally Adjusted)	Jan - 2018	Apr - 2018	Jul - 2018	Oct - 2018	Jan - 2019	Apr - 2019	Jul - 2019
Australia	5.5	5.5	5.3	5	5.1	5.2	5.
England	4.2	4.2	4	4	3.9	3.8	3.
India	-	-	-	-	6.9	7.4	7.
China	5	4.9	5.4	4.9	5.1	5	5.
New Zealand	4.5	4.4	4.5	4	4.4	4.2	
Philippines	5	5.26	2.46	5.4	5.06	5.27	5.1
South Africa	26.7	26.7	27.2	27.5	27.1	27.6	2

Figure 4, Unemployment Rates transformed, Screenshot from Excel File, By Kyle Gibbs 21/03/23

2.2 Data Processing

A few select processing steps were needed in order to make the datasets usable on our website.

Starting with Figure 3 and Figure 4, the graphs were rotated to make it easier to read row by row. To do this, an extra column was added called “Date”, and all the country names in rows (E.G. Australia, England, India etc.) were repurposed. They were instead called “AustraliaValues”, “EnglandValues” etc. And became column names, much like “Date”. The matching data was then also rotated to make each cell correspond to a “Date” and a country’s values.

Figure 5 shows the transformed look of the dataset, and proved to be much easier to work with overall.

	A	B	C	D	E	F	G	H
1	Date	AustraliaValues	EnglandValues	IndiaValues	ChinaValues	NewZealandValues	PhilippinesValues	SouthAfricaValues
2	Jan-18	1.9	3	5.07	1.5	1.6	3.4	4.3
3	Apr-18	1.9	2.4	4.58	1.8	1.1	4.5	4.6
4	Jul-18	2.1	2.5	4.17	2.1	1.5	5.7	5.2
5	Oct-18	1.9	2.4	3.38	2.5	1.9	6.7	5.4
6	Jan-19	1.8	1.8	1.97	1.7	1.9	4.4	4
7	Apr-19	1.3	2.1	2.99	2.5	1.5	3	4.3
8	Jul-19	1.6	2.1	3.15	2.8	1.7	2.4	3.9
9	Oct-19	1.7	1.5	4.62	3.8	1.5	0.8	3.6
10	Jan-20	1.8	1.8	7.59	5.4	1.9	2.9	4.6
11	Apr-20	2.2	0.8	7.22	3.3	2.5	1.8	3
12	Jul-20	0.3	1	6.73	2.7	1.5	2.4	3.2
13	Oct-20	0.7	0.7	7.61	0.5	1.4	2.3	3.3
14	Jan-21	0.9	0.7	4.06	0.3	1.4	3.7	3.2
15	Apr-21	1.1	1.5	4.23	0.9	1.5	4.1	4.4
16	Jul-21	3.8	2	5.59	1	3.3	3.7	4.7
17	Oct-21	3	4.2	4.48	1.5	4.9	4	5
18	Jan-22	3.5	5.5	6.01	0.9	5.9	3	5.7
19	Apr-22	5.1	9	7.79	2.1	6.9	4.9	5.9
20	Jul-22	6.1	10.1	6.71	2.7	7.3	6.4	7.8
21	Oct-22	7.3	11.1	6.77	2.1	7.2	7.7	7.6

Figure 5, Alterations to Datasets, Screenshot from Excel, by Kyle Gibbs, 02/04/23

One issue that was presented when working with the dataset in Figure 5 was the way that the dates were being read. Unfortunately, the way that Excel was reading the dates caused issues due to its inbuilt formatting. This was resolved by selecting the cells, going into the formatting section and turning off the data formatting.

The same steps were taken when creating Figure 6, with all the same problems and solutions. Additionally, Figure 6 originally contained some missing variables in the Unemployment rates for India. To fix this, I used a guide gathered from the website, “statology”, to instead interpolate the data. The selected method was to use the calculations the website had provided for finding the linear growth of the dataset. This equation was “Step = (End - Start) / (#Missing obs + 1)”. This provided us with an average amount of growth each missing step should contain, and this allowed us to use the data collected without any complications.

	A	B	C	D	E	F	G	H
1	Date	AustraliaValues	EnglandValues	IndiaValues	ChinaValues	NewZealandValues	PhilippinesValues	SouthAfricaValues
2	Jan-18	5.5	4.2	6.1	5	4.5	5	26.7
3	Apr-18	5.5	4.2	6.3	4.9	4.4	5.26	26.7
4	Jul-18	5.3	4	6.5	5.4	4.5	2.46	27.2
5	Oct-18	5	4	6.7	4.9	4	5.4	27.5
6	Jan-19	5.1	3.9	6.9	5.1	4.4	5.06	27.1
7	Apr-19	5.2	3.8	7.4	5	4.2	5.27	27.6
8	Jul-19	5.3	3.9	7.3	5.3	4	5.15	29
9	Oct-19	5.3	3.8	8.1	5.1	4.2	5.42	29.1
10	Jan-20	5.3	4	7.2	5.3	4.1	4.59	29.1
11	Apr-20	6.3	4.1	23.5	6	4.2	5.32	30.1
12	Jul-20	7.5	4.9	7.4	5.7	4	17.6	23.3
13	Oct-20	7	5.1	7	5.3	5.3	9.96	30.8
14	Jan-21	6.3	5.1	6.5	5.4	4.9	8.8	32.5
15	Apr-21	5.4	4.9	8	5.1	4.7	8.7	32.6
16	Jul-21	4.7	4.4	7	5.1	4	6.9	34.4
17	Oct-21	5.2	4.1	7.7	4.9	3.4	7.4	34.9
18	Jan-22	4.2	3.8	6.6	5.3	3.2	6.4	35.3
19	Apr-22	3.9	3.8	7.8	6.1	3.2	5.7	34.5
20	Jul-22	3.5	3.5	6.8	5.4	3.3	5.2	33.9
21	Oct-22	3.4	3.7	7.9	5.5	3.3	4.5	32.9

Figure 6, Alterations to Datasets, Screenshot from Excel, by Kyle Gibbs, 02/04/23

3 Requirements

3.1 Must-Have Features

- **Title** - it is used to tell users what kind of data we are presenting through our visualisations so that the information to the user.
- **Axes and Scales** - we will scale to identify the x-scale and y-scale to describe the independent and dependent variables in a visualisation, this will help the audience identify what variables they are looking for.
- **Axis Labels** - To let users know what axis they are looking at
- **Brief Explanation** - To make sure that all audiences understand what we are trying to communicate in the visualisation and they can interpret it and take actionable steps
- **Colour Scheme** - We will use a colour scheme to represent the different types of messages we are trying to communicate (eg, red means negative, green means positive)
- **Bar/Line Charts** - These are the things we are going to use for our visualisations
- **User-friendly/interactive web page** - This will allow the user to clearly see the webpage and it will allow users to easily use the website.
- **Good design techniques** - the bar/chart will be presented nicely so it won't have any issues for the user to see
- **Comparative graph** - comparing unemployment rates and inflation rates to migration rates. Later changed to instead be 2 different graphs, a Line Graph and a Stacked Bar Graph

3.2 Optional Features

- 1) **Mouse over text to display information** - This would be nice to have the information pop up when the mouse hovers over the bar chart but it's not necessary
- 2) **Interactive buttons** - it will be nice to have some interactive buttons that when users click on a button it leads to another thing or it tells some information.
- 3) **Year slider interactive storytelling** - Slow increments of the years to the current make the visualization tell a story of how migration in Australia
- 4) **Removing selected countries from the stacked bar** - Originally thought of adding more interactability to the stacked bar graph, it was decided not to be a priority due to time and difficulty restraints.
- 5) **Table of Contents**
- 6) **Movement from Table of Contents** - Both this and 5 would make it easier to navigate to specific sections of the website.

4. Visualisation Design

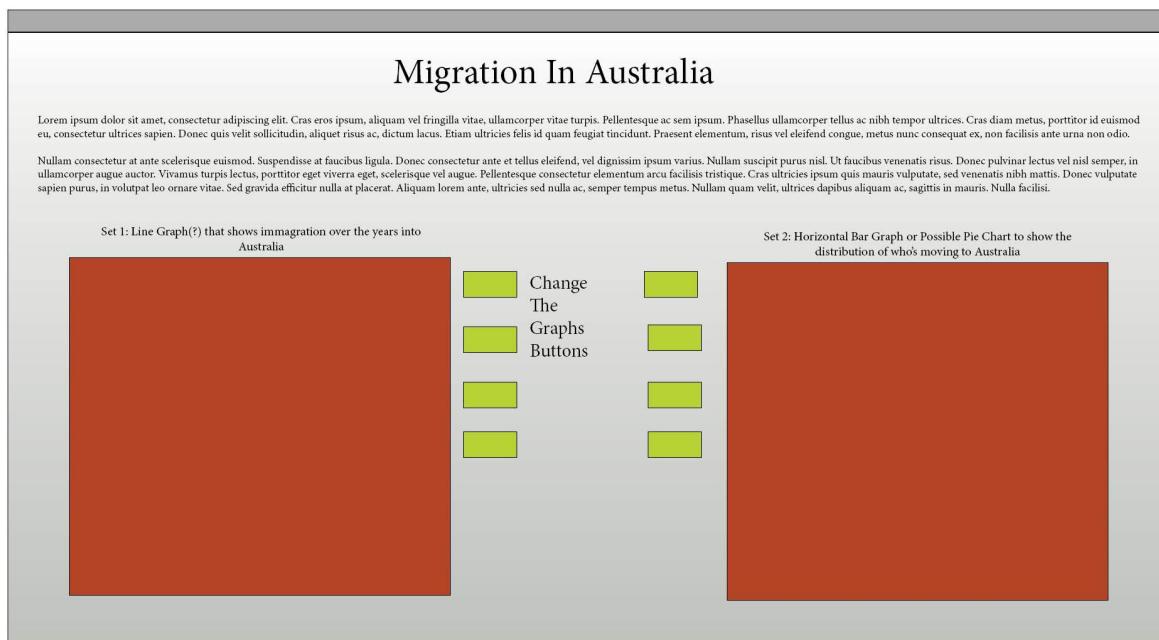


Figure 6, First webpage iteration, Screenshot from Adobe Indesign, by Kyle Gibbs, 06/04/23

Figure 6 showcases the original design thought for the website. This design was considered bad as the didn't use spacing very well. A large aspect of visual design is placement, and with the objects so haphazardly placed around the page, it made it difficult to see the important sections.

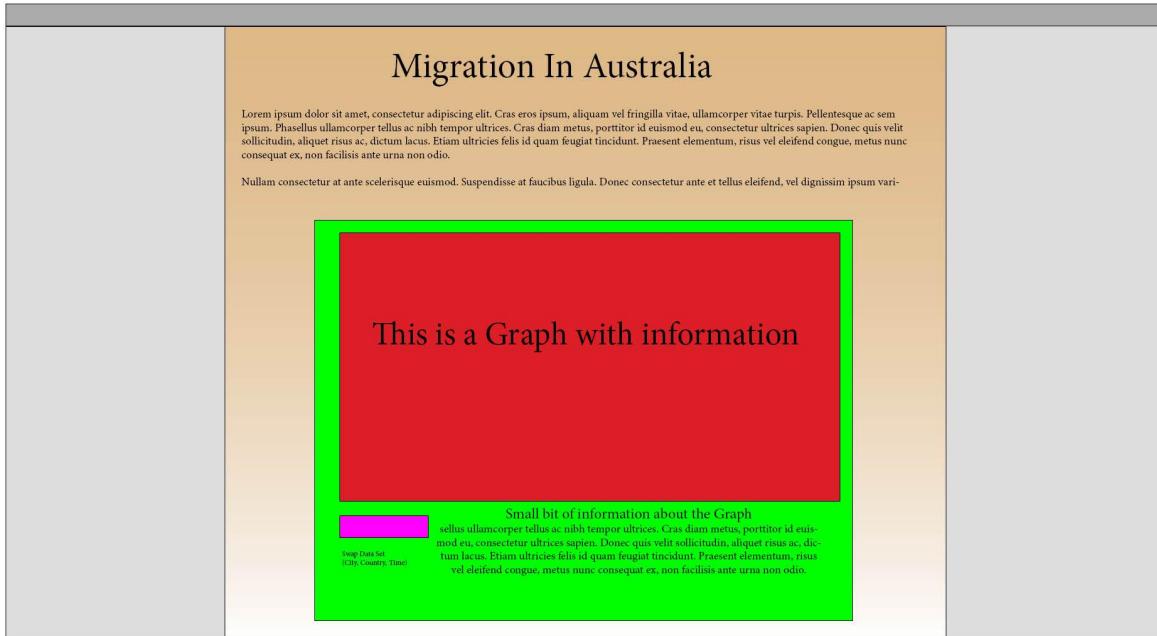


Figure 7, Second webpage iteration, Screenshot from Adobe Indesign, by Kyle Gibbs, 06/04/23

Figure 7 showcases the new design for the webpage. Following examples from other web pages, like the Australian Bureau of Statistics, Kaggle and The Sydney Morning Herald, we focussed on the page being split into 3 separate sections. The middle section would present the information in paragraphs, followed by a graph. This would help break up the information into more sizeable chunks, with the graph helping to highlight different features. This design was deemed good enough to go into future development work, testing out different colour schemes to find what would be best suited for displaying the information.

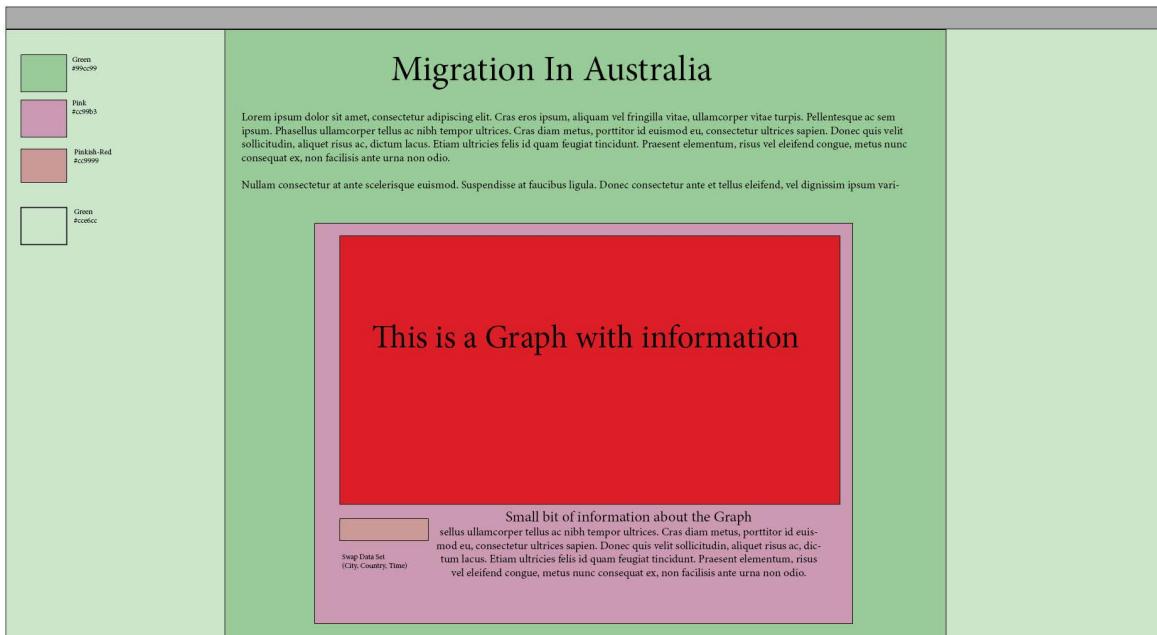


Figure 8, Second webpage iteration - Coloured Green, Screenshot from Adobe Indesign, by Kyle Gibbs, 10/04/23

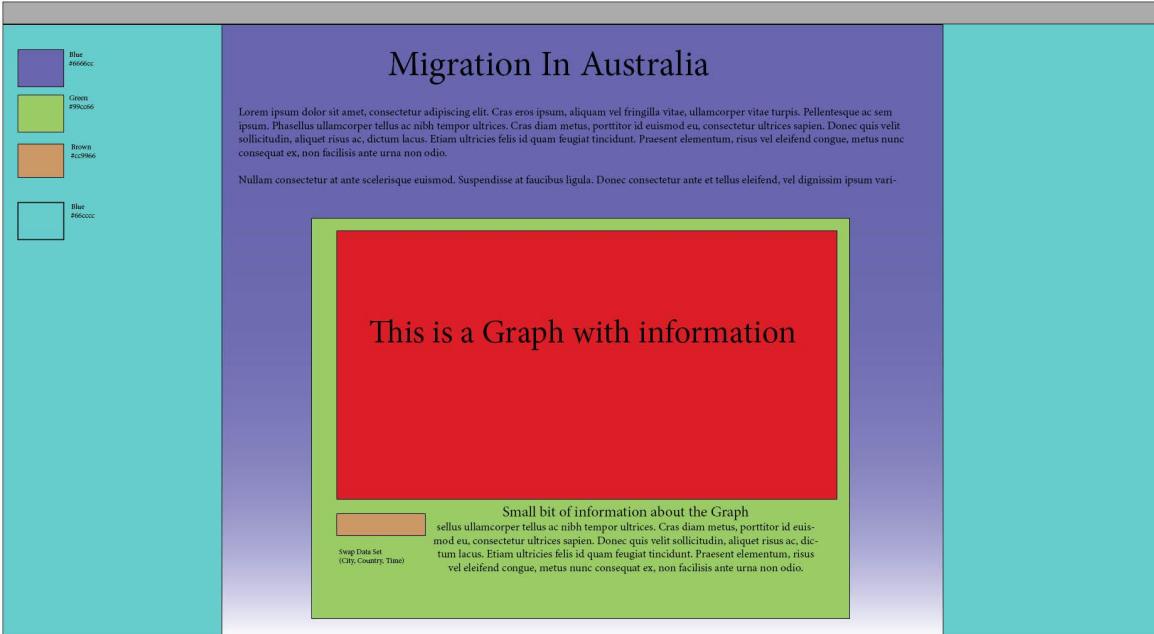


Figure 9, Second webpage iteration - Coloured Blue, Screenshot from Adobe Indesign, by Kyle Gibbs, 10/04/23

After testing out some different colours (using ColorHexa to aid with colour choices), we originally settle on the green colouration (Figure 8) to use while programming the website. We felt like this one had enough colour to aid us in designing the website, without it being too distracting.

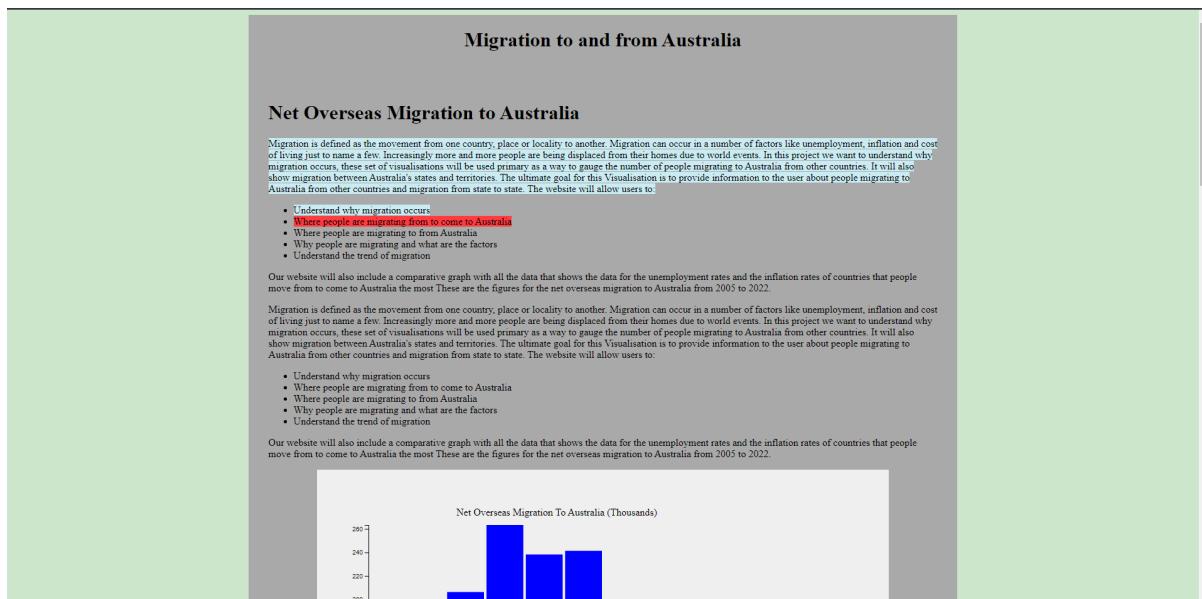


Figure 10, Second webpage iteration - Coloured Blue, Screenshot from Adobe Indesign, by Kyle Gibbs, 06/04/23

After testing out some of the above colourations, we found that the colours did not look good when translated onto a website screen. Instead, we used a colour scheme based on Figure 11's values and found that it better fit the feeling we were aiming for better. We made a few adjustments to the colours chosen, making sure that each colour was web safe.

Website color scheme #4: Clean and highlighted

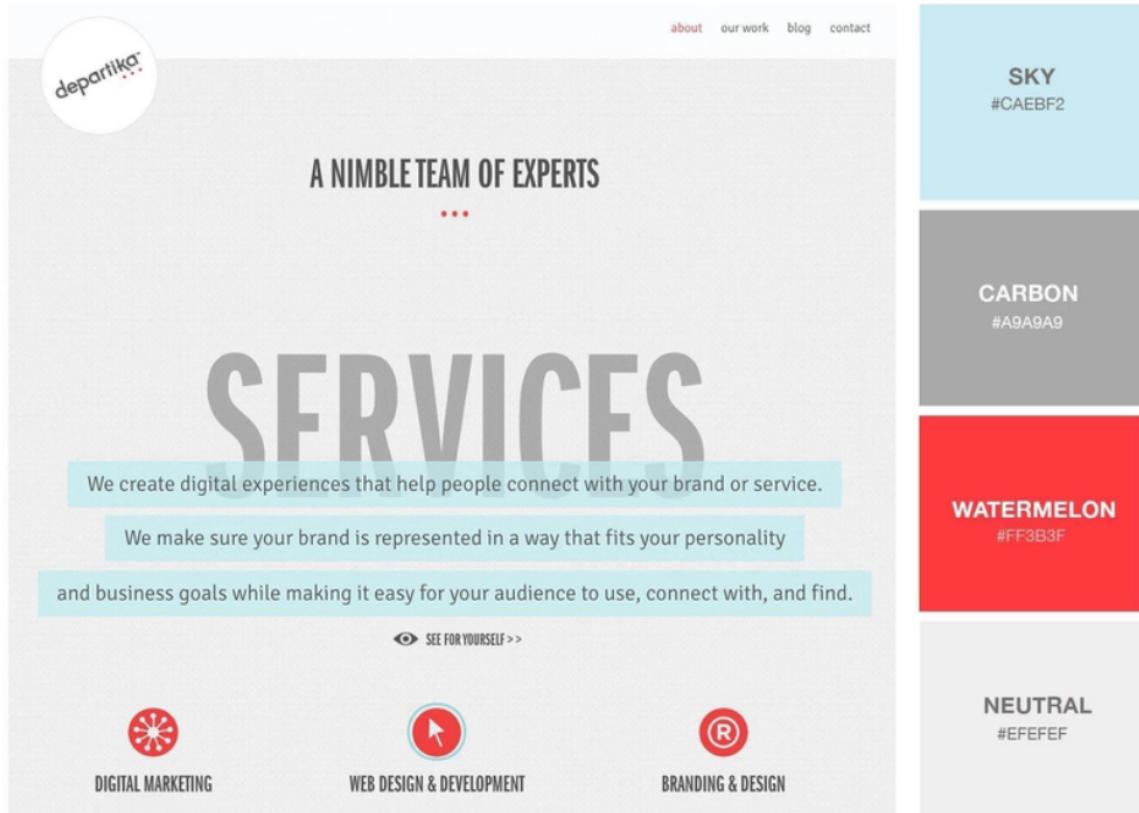


Figure 11, Reference image for Colours, Screenshot from Canva (<https://www.canva.com/learn/website-color-schemes/>)

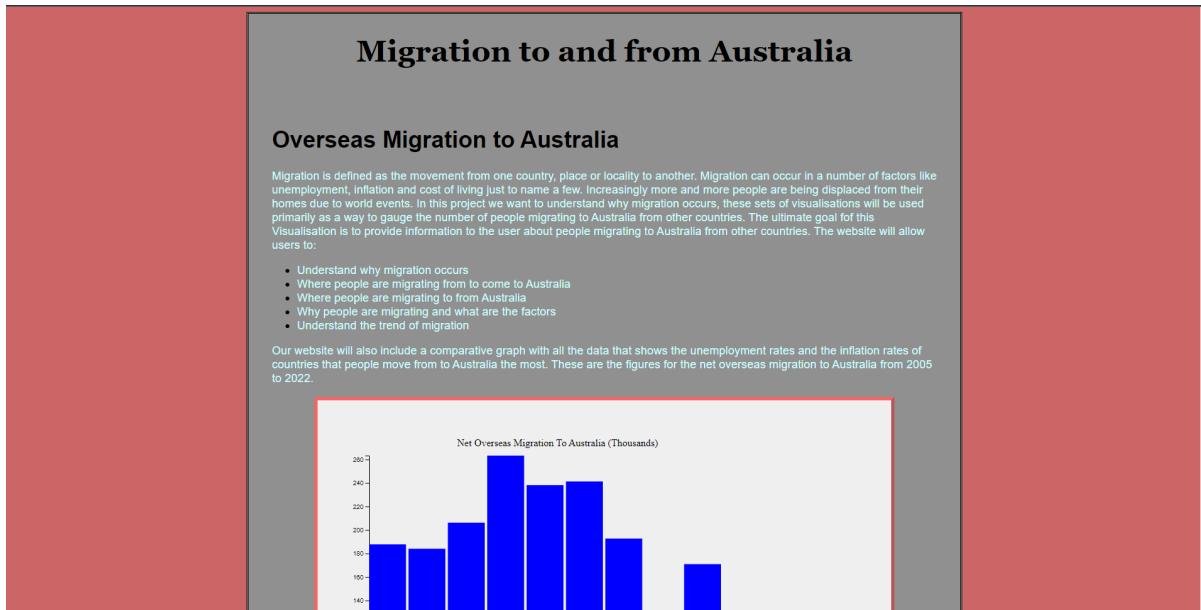


Figure 12, Programmed Website - Red Colouration, Screenshot from Web Browser, by Kyle Gibbs, 25/05/23

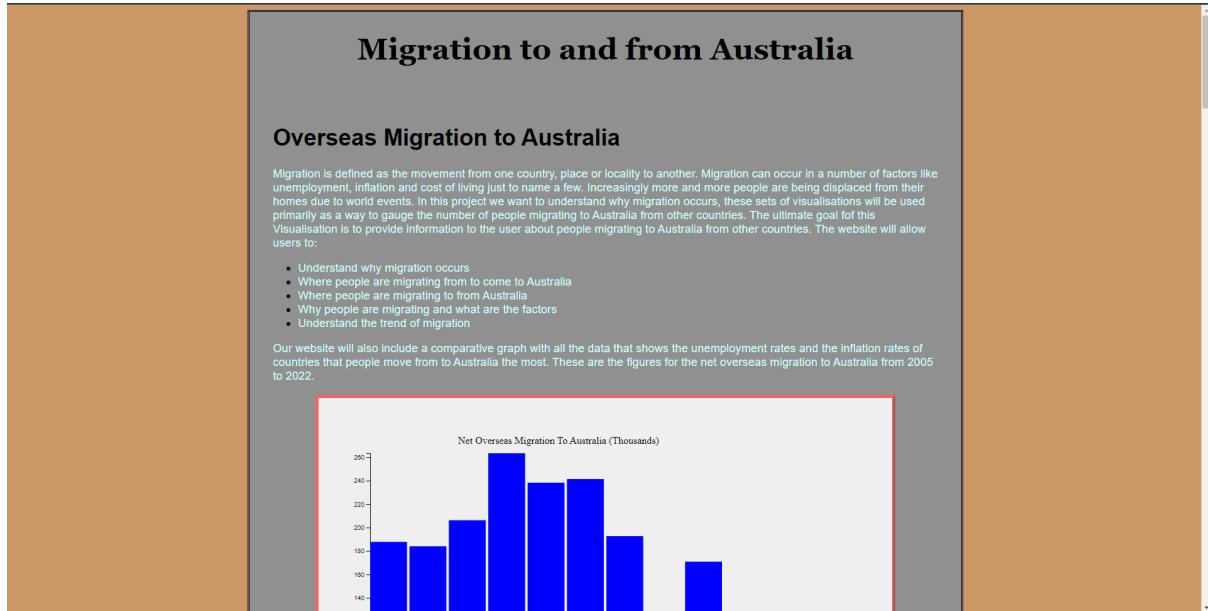


Figure 13, Programmed Website - Brown Colouration, Screenshot from Web Browser, by Kyle Gibbs, 25/05/23

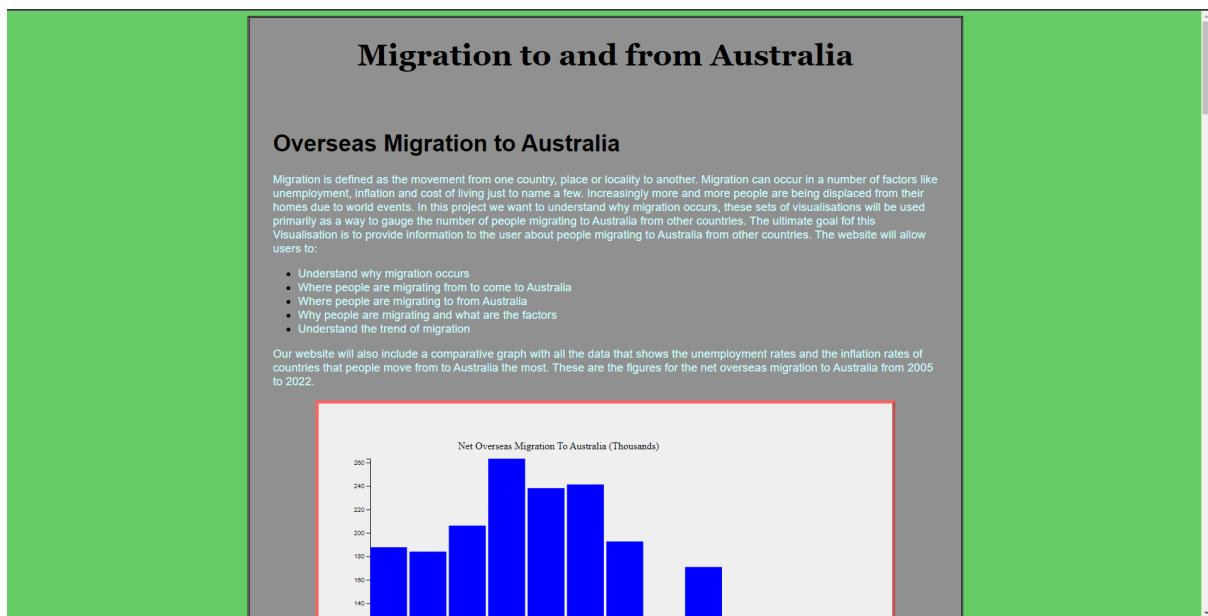


Figure 14, Programmed Website - Green Colouration, Screenshot from Web Browser, by Kyle Gibbs, 25/05/23

Figures 12-14 each display the website using different colours as the background (#cc6666, #cc9966 and #66cc99 respectively). Out of these choices, the green one was chosen as it appears like it would be a nice contrast to the blue text. The final colours chosen were:

- #66cc66 for the Background
- #909090 for the middle div
- #ccffff for the text colour
- #003399 for the bolden text at the end
- #ff3333 for the graph border
- SlateGrey (#708090) for the key background

Choropleth design

This is just a sample choropleth colour scheme that we can use to represent the different types of migration levels. This follows the principle of colour hue and colour saturation because it's displaying different colours for the different types of migration levels and it also compares the brightness of the colours when comparing between different countries. The red colour would be linked to high migration rates and light blue would be linked to low migration rates.

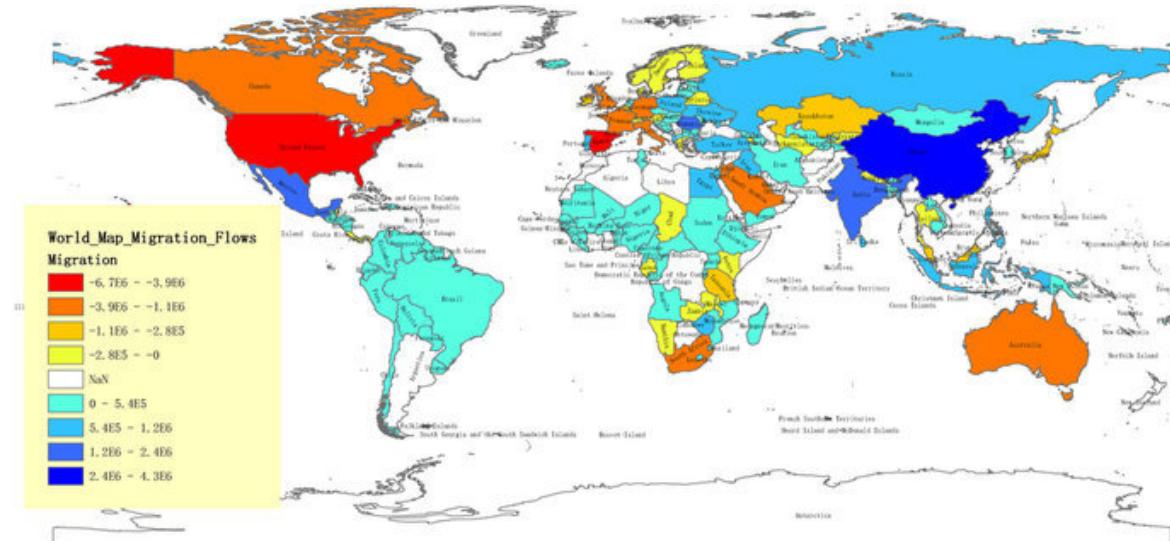


Figure 15, Chloropleth, Screenshot from Research Gate
(https://www.researchgate.net/figure/Net-International-Migration-Flow-Map-The-colours-describe-the-net-international_fig4_307896332)

Bar chart design

Figure 16 is a rough sketch of what our bar chart should look like. The layout looks nice with it being centred with a margin on the right and the title in the centre. This bar chart is meant to show where people are migrating from. There could also be two bar charts next to each like the one in the image below with one showing the year 2015 and the other bar showing the year 2020 or something like that.

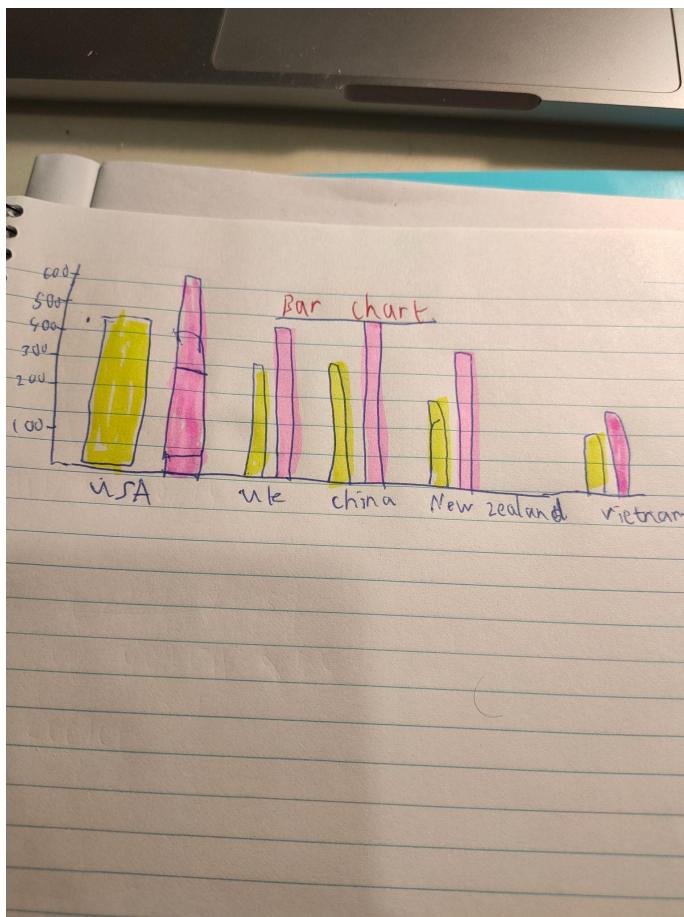


Figure 16, Bar Chart Prototype, Picture from Sketch, by Lachie Ho, 08/04/23

Figure 17 is also a good layout in the bar chart, with the title being clearly displayed at the top right and there is information about the graphs. We also like the fact they are using colour saturation as they going from the lightest to the darkest green from left to right.



Figure 17, Bar Chart Example, Screenshot from Web Browser, by Lachie Ho, 12/04/23

Line Chart design

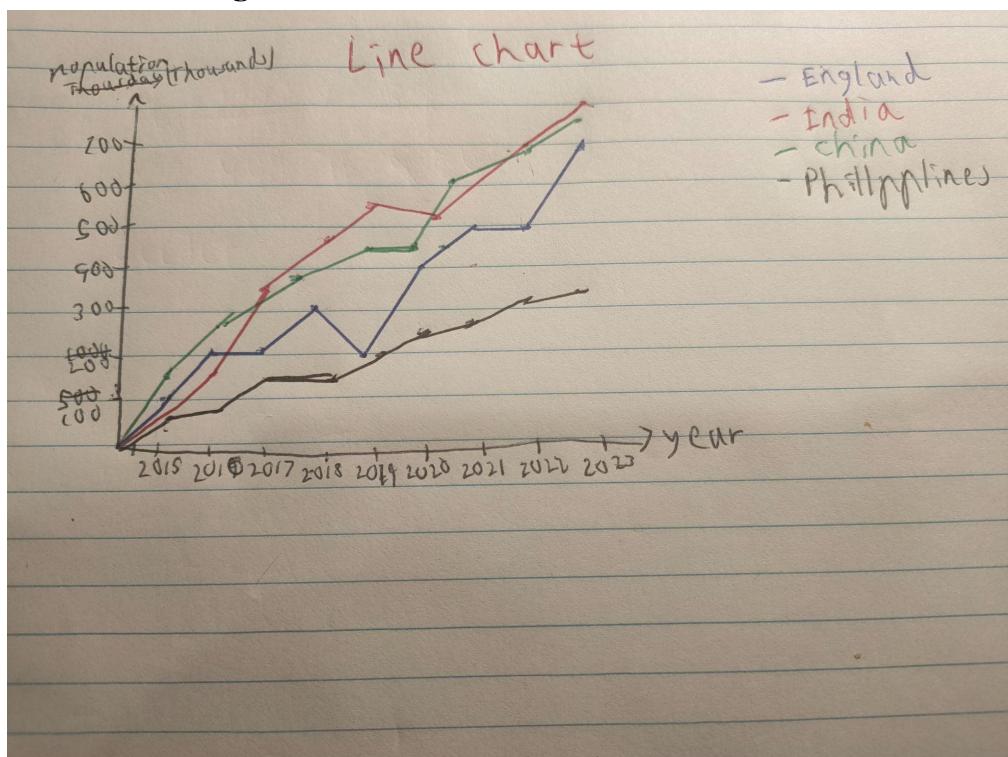


Figure 18, Line Chart Prototype, Picture from Sketch, by Lachie Ho, 9/04/23

This idea of the line chart sketch (Figure 18) is to achieve a graph that shows the migration from different countries during a period of time (mainly every year). The main idea of this rough sketch is to clearly show the different countries by using different colours so that the audience can clearly identify the country they are looking at.

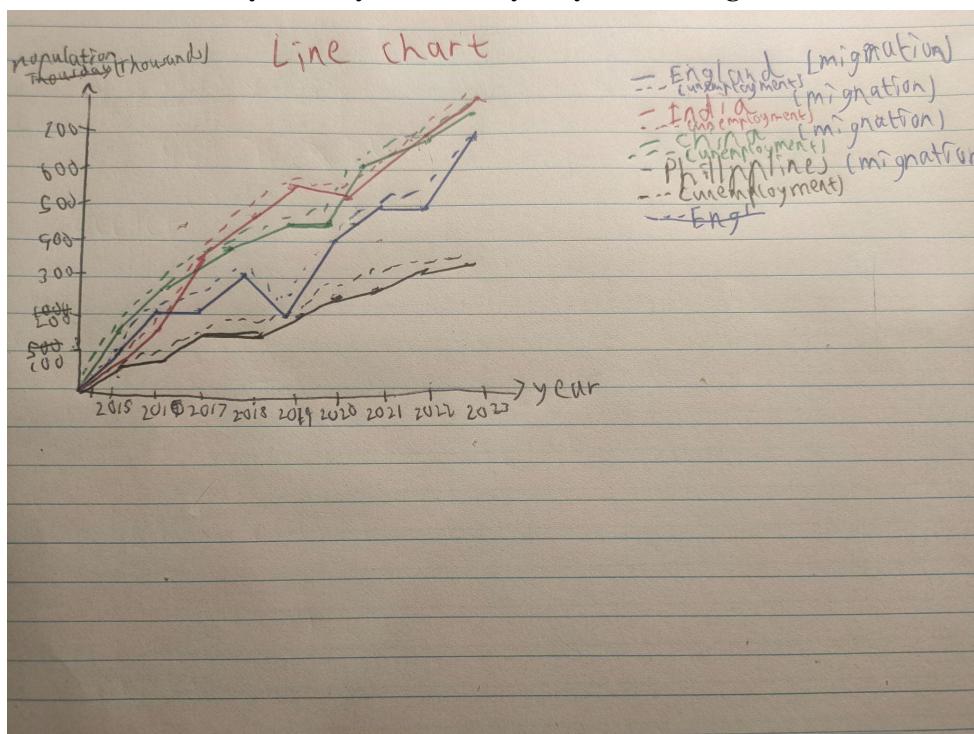


Figure 19, More informative Line Graph, Picture from Sketch, by Lachie Ho, 9/04/23

In this line chart we can compare the migration rates with the unemployment rates to see if there is a relationship between them. The dotted line would be the unemployment rates for each country and the solid line would be the migration data. As you can see in this rough sketch we can assume that the unemployment rates and migration data are completely correlated to each other.

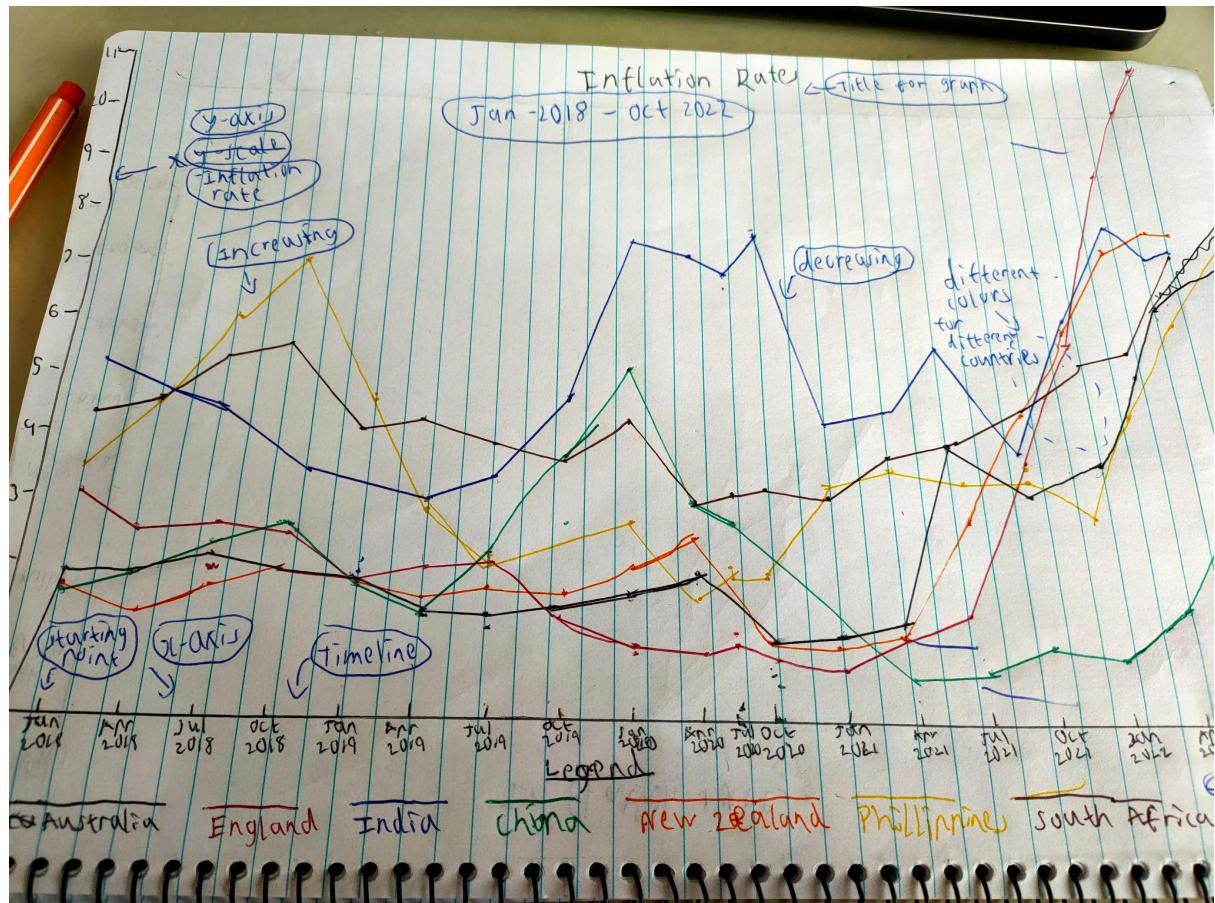


Figure 20, More informative Line Graph, Picture from Sketch, by Lachie Ho, 16/04/23

Figure 20 is one of the inflation rates graphs as an updated sketch that we could use. As you can see the inflation rates are listed on the y-axis ranging from 1 to 11 and the timeline is listed on the x-axis ranging from Jan 2018 to Oct 2022. As you can see we have used different colours to represent each country like black is for Australia and red is for England. This can differentiate what country we closely want to look at and whether to make a judgement on if the inflation rate is increasing or decreasing over time.

Unemployment rates

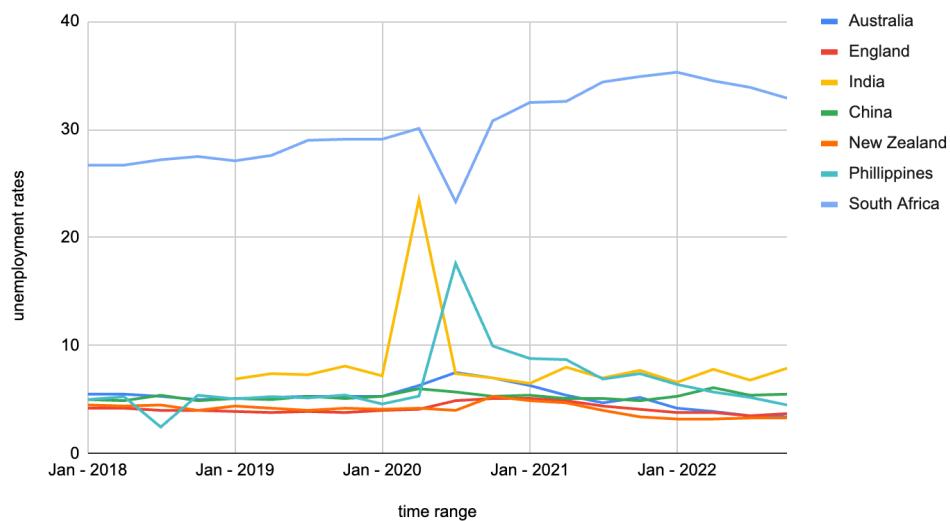


Figure 21, Updated Unemployment Line Graph, Picture from Sketch, by Lachie Ho, 20/04/23

Figure 21 is an updated unemployment rates line chart that was created in Google Sheets. As you can see in the y-axis you can see the unemployment rate in percentage and in the x-axis, we can see it done in months from the time range from Jan 2018 to Jan 2022. Within that time range you can see that South Africa is likely an outlier because the unemployment rates start in the 20 to 30's range and the other countries start in between the 5 and 10 range. Another kind of outlier is India because within the dataset there are missing values from the time range from Jan 2018 to Jan 2019, therefore in the graph, we could see the line starting from Jan 2019. When it hits Jan 2020 there is a big increase in unemployment and then when it hits July 2020 it drops significantly. Overall it looks like there is a steady rate of unemployment because it always drops and picks up again.

Updated bar chart

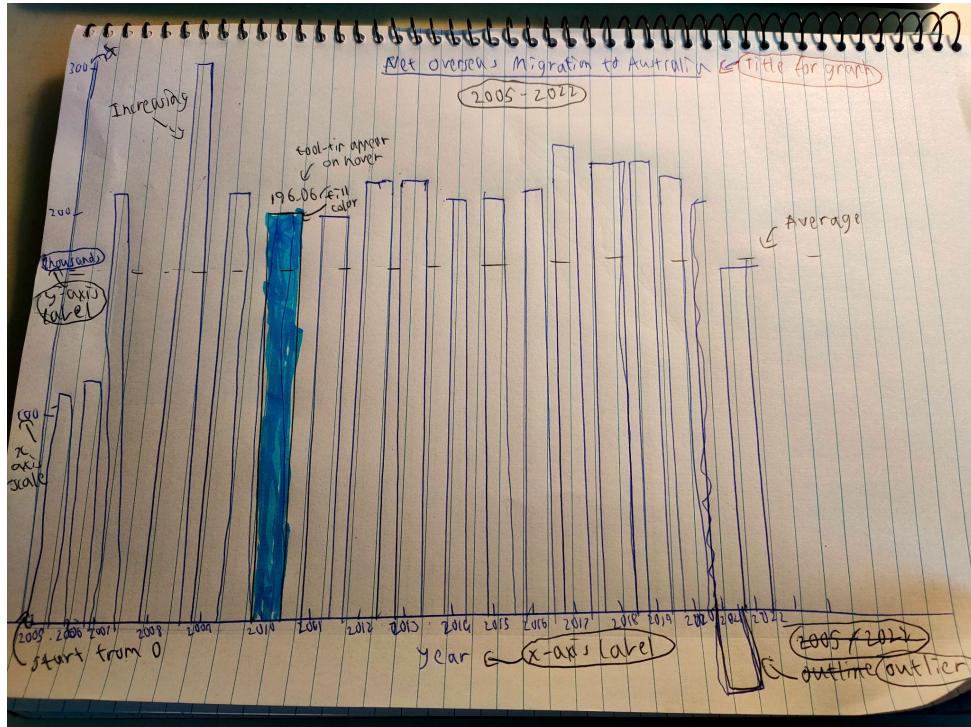


Figure 22, Advanced Bar Graph, Picture from Sketch, by Lachie Ho, 18/04/23

Figure 22 is an annotated version of the bar chart called Net Overseas Migration to Australia from the time range of 2005 to 2022. It has an x-axis for the year range of 2005 to 2022 and a y-axis for the migration rates with the scale to be in number in the 100s. The migration rates to Australia are looking pretty good as there was a big jump in 2008, but as the rates went down in 2009, they remained steady throughout the years. They always have increased and decreased a bit. A dotted line was drawn to indicate the average migration rate coming into Australia, which is pretty good. However, there is one outlier which is in 2021 when the migration level was negative -84.94. We annotated this to show that there is an outlier, which is most likely caused by the COVID-19 pandemic. We have also annotated that we should use a tooltip on each bar so that when someone hovers over the bar it displays the number on top of the bar.

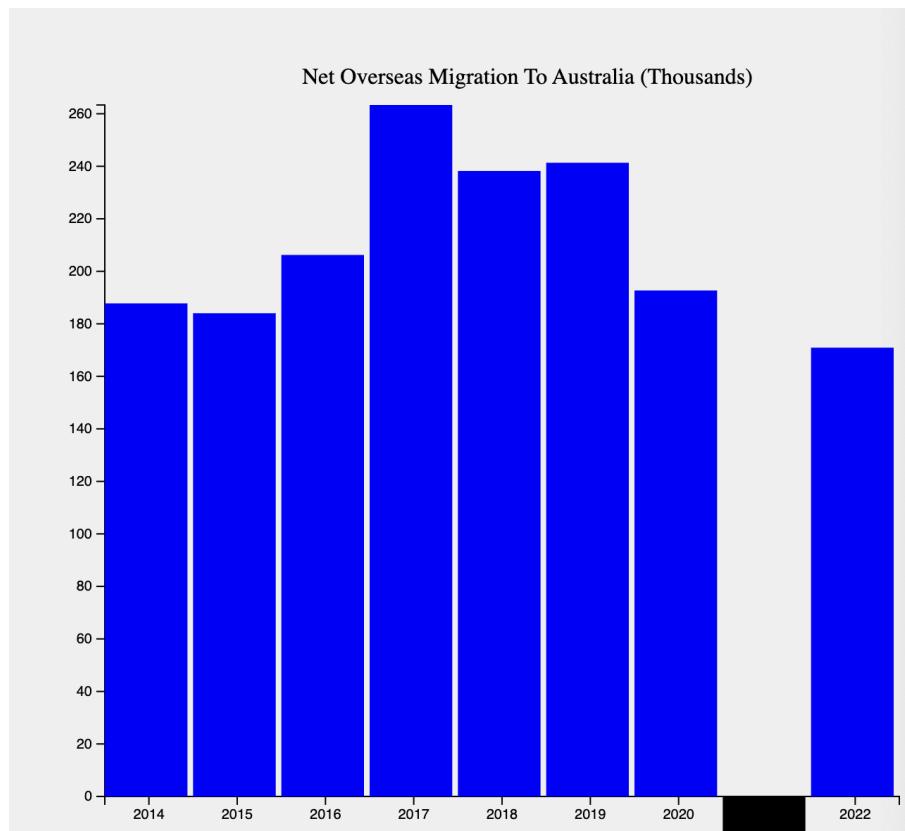


Figure 23, Bar Graph, Screenshot from Web Browser, by Lachie Ho, 1/06/23

Figure 23 is the bar graph we created using D3. As is visible by the graph, we created a simple bar chart that covers the net overseas migration to Australia represented in thousands. We have chosen the colours of the chart to be blue because we think it would attract the viewer's attention and make the chart easy for the audience to see. We have decided to show the last 5 to 10 years due to this being our targeted time frame for the project.

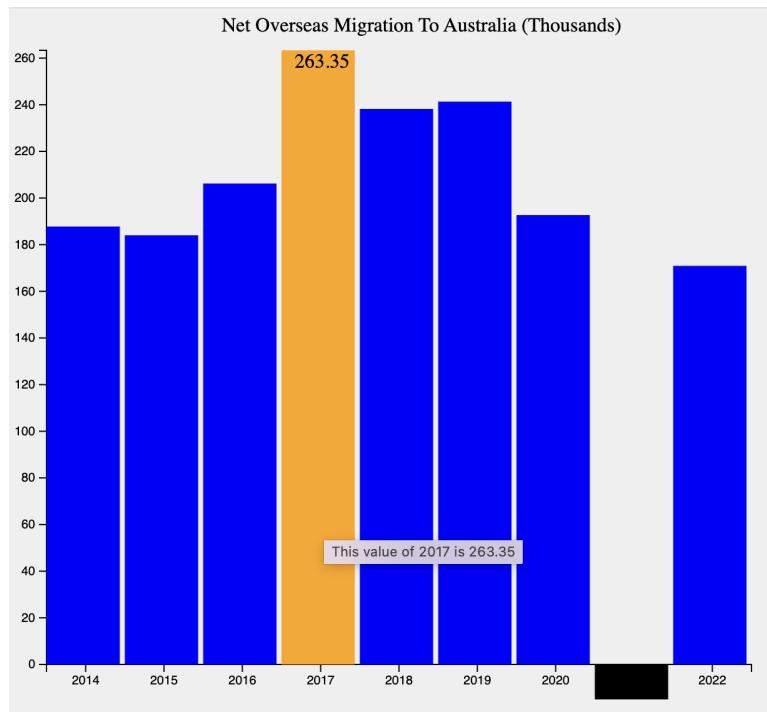


Figure 23, Bar Graph with interactivity, Screenshot from Web Browser, by Lachie Ho, 1/06/23

As you can see in Figure 24, we have added some interactivity for the bar chart so when the user hovers over it, the bar will change its colour from blue to orange. This shows that the user selected it. It will also show the exact number in the middle so users can see the exact value with text saying that the value of “year” is “number”.

Pie chart

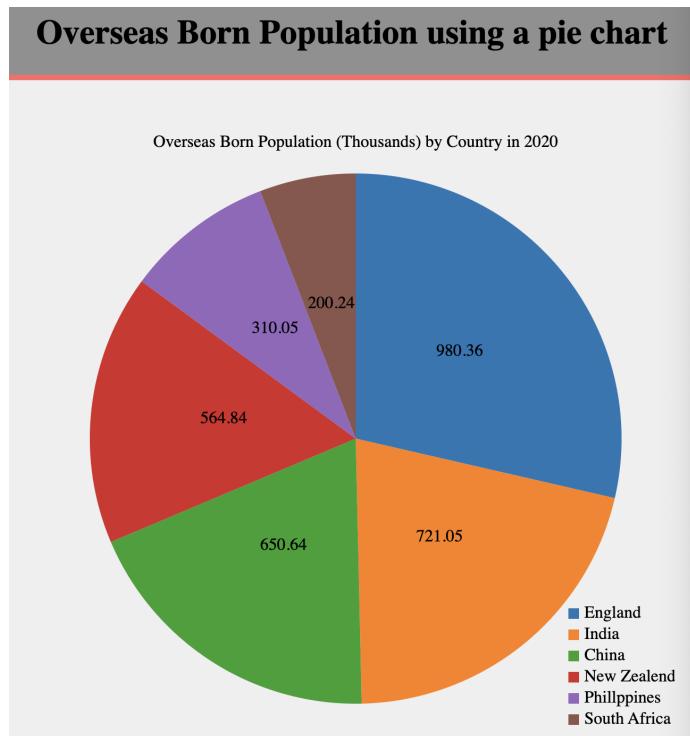


Figure 24, Pie Graph, Screenshot from Web Browser, by Lachie Ho, 1/06/23

Figure 24 is the pie chart from the website created in d3. The pie chart shows the overseas-born population (in the thousands) by country during 2020. We have decided to create this pie chart to show who is coming from where to Australia. As is visible in the graph, the migrants that came to Australia are from a range of different countries. These Countries include:

- England
- India
- China
- New Zealand
- The Philippines
- South Africa

Overseas Born Population using a pie chart

Overseas Born Population (Thousands) by Country in 2020

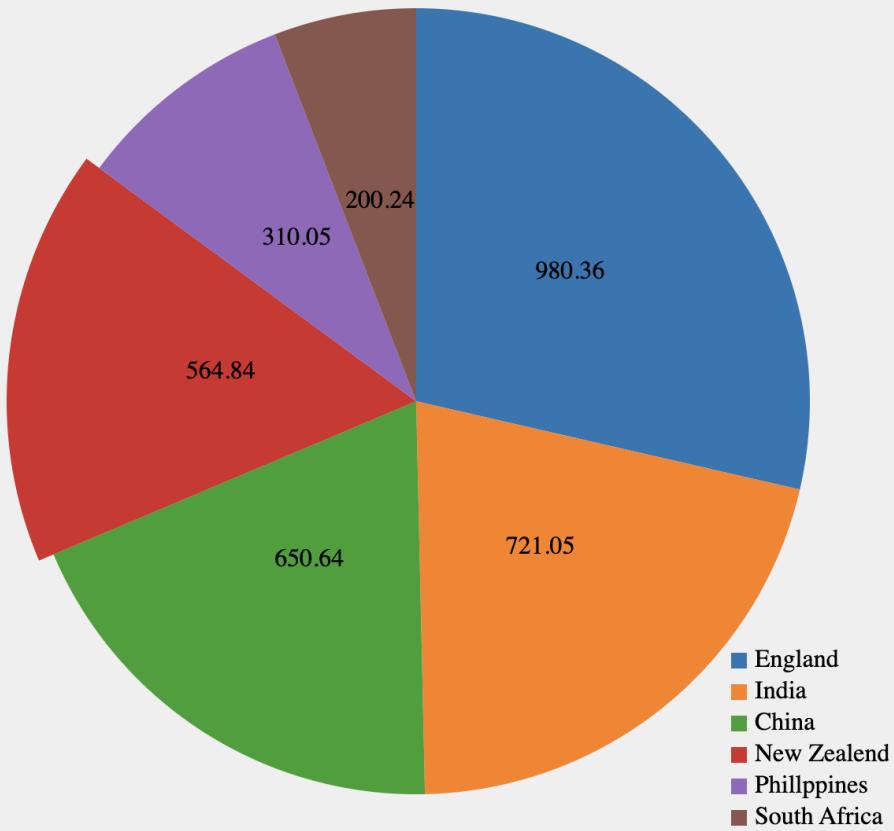


Figure 24, Pie Graph with interactivity, Screenshot from Web Browser, by Lachie Ho,
1/06/23

As you can in Figure 24, the pie chart has interactability by increasing in size when the user hovers over it. This can help the user being able to better see which slice of the pie they are trying to view.

Line Graph

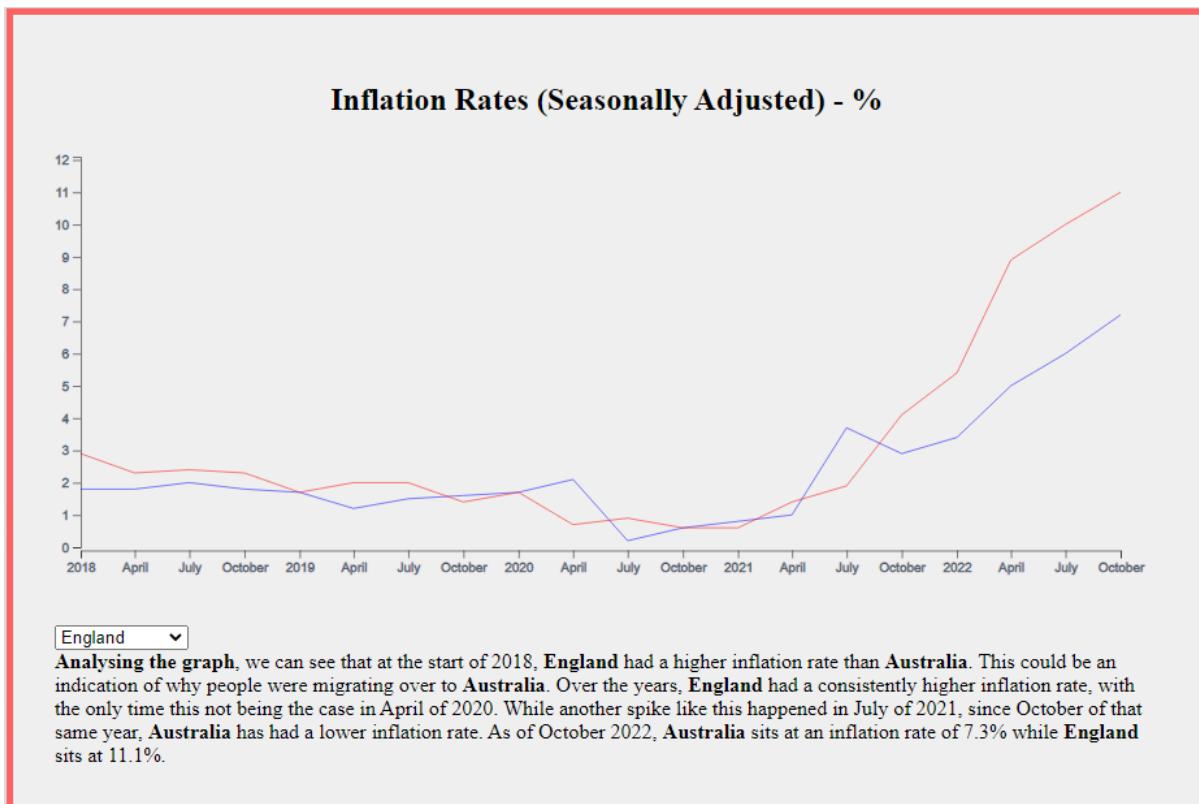


Figure 25, Line Graph, Screenshot from Web Browser, by Kyle Gibbs, 1/06/23

Figure 25 showcases the final design for the line graph. This line graph is in place to show the Inflation Rates over the years for each country. The drop-down menu allows the users to select which country they want to compare to Australia's inflation rate. This means that the user can better designate which inflation rates they want to view. The text box underneath the inflation rate also changes depending on the selection, as is visible in when comparing Figure 25 to Figure 26.



Figure 26, Line Graph Interactability, Screenshot from Web Browser, by Kyle Gibbs, 1/06/23

Figure 26 shows off the interactability of the line graph. Whenever the drop-down menu is changed, the red line changes to match the selected country. The text also changes to provide the correct information. When the line graph is hovered over, a red dot appears to help the user see which 2 values they are trying to view. There is also an information box that appears above the chart to provide the values of the graph to the users.

Stacked Bar Graph

Figure 27 (depicted below) is the stacked bar graph that was created for the website. It is being used to display the Unemployment Rates for each of our selected countries in our set period of time. This was used as a good way to display a bunch of numerical data efficiently. There are also Country Keys found above the stacked bar graph to allow users an easier experience of knowing what colour is associated with what country.

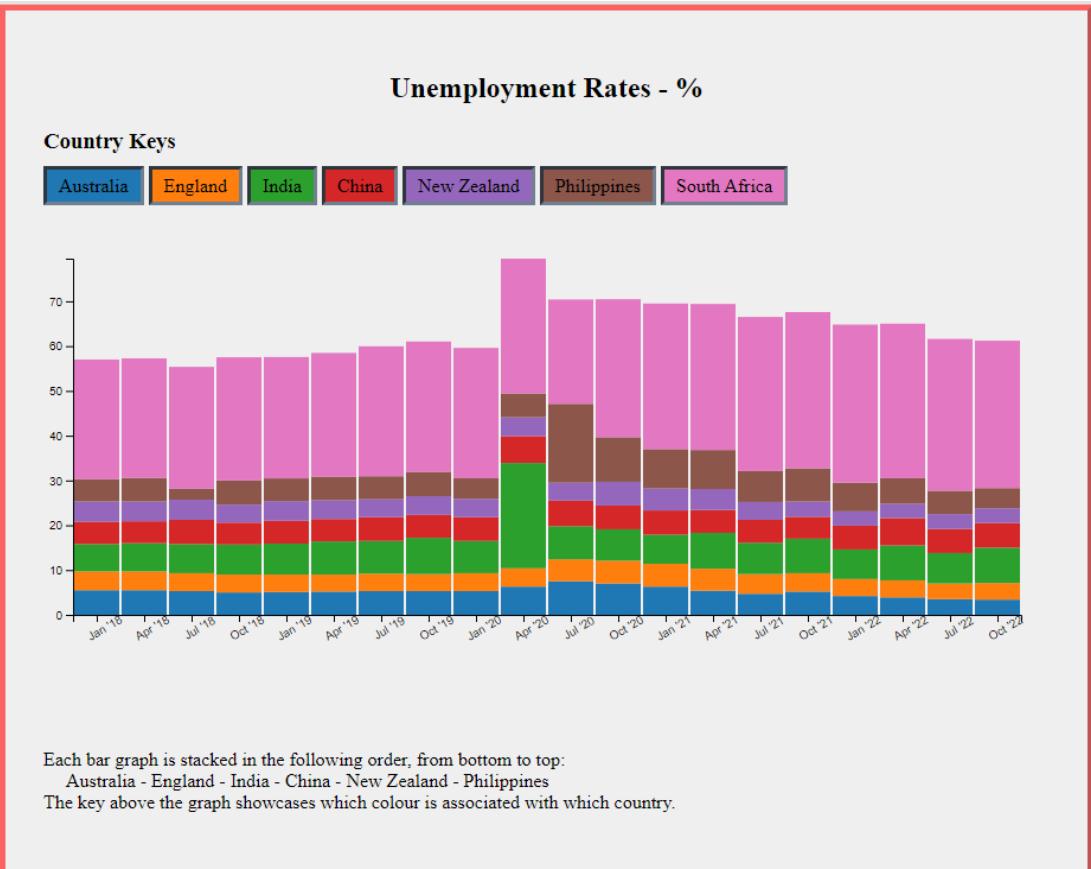


Figure 27, Stacked Bar Graph, Screenshot from Web Browser, by Kyle Gibbs, 1/06/23

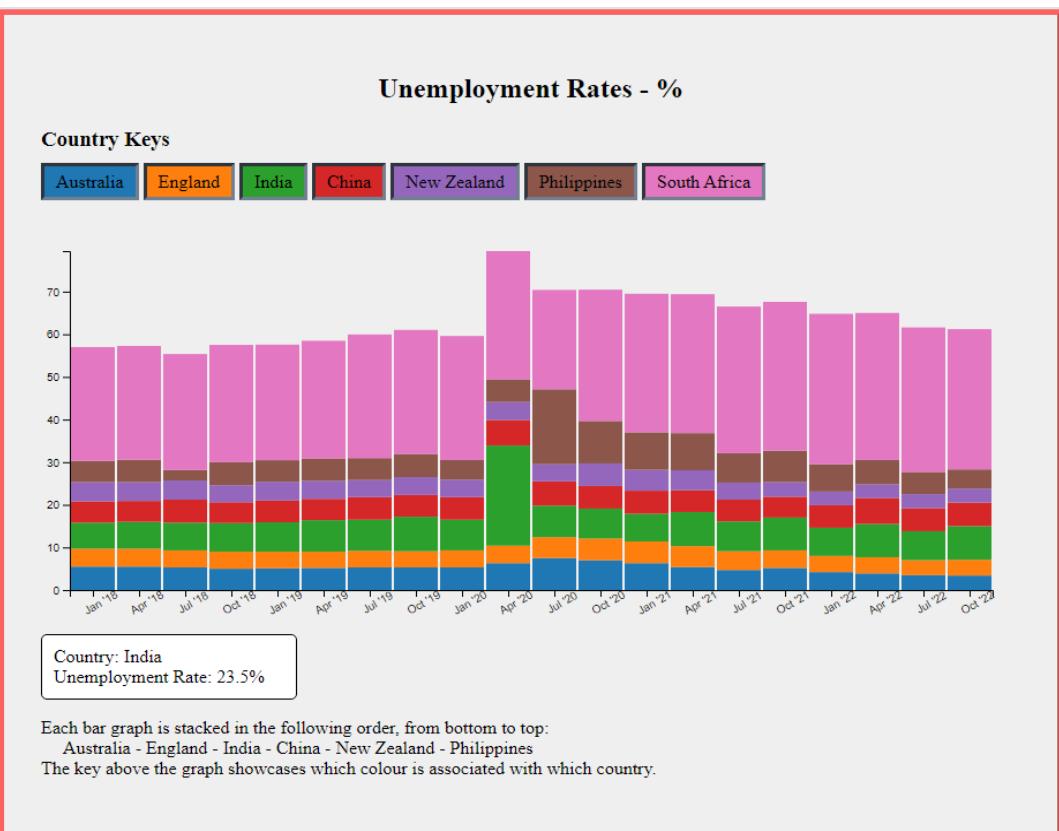


Figure 28, Stacked Bar Graph Interactability, Screenshot from Web Browser, by Kyle Gibbs, 1/06/23

Figure 28 depicts the interactability aspect of this graph. As the user hovers over different segments of the stacked bar graph, it will print out some values in a small box. These values showcase what country is being hovered over, as well as what the Unemployment Rate for the country was at that time. This should allow the users ease of knowing what each value is simply by hovering over it.

5 Validation [Optional - Bonus Points]

In order to receive validation for our Website, we constructed a google forms document in order to receive responses from a range of people. Some basic intro was asked (Name, Age, Gender, Consent), and then instructions were made to go to the website, interact with the visualisations and read the text. After the users were done, they were presented with a series of questions. These questions were:

- Did the website work as intended?
- Did the information interest you?
- What part of the website did you like the best and why?
- What part of the website did you like the least and why?
- Was the page layout cohesive and easy to navigate?
- What do you think you learnt from the visualisations?
- What do you think was the best-looking graph and why?
- Did the colour scheme suit the website?
- What would you like added to the Website?
- What could be improved upon?
- Any last comments?

An example of some of these responses can be found in Figure 22.

The screenshot shows a Google Forms response for the question "What could be improved upon?". It displays six responses listed vertically:

- potentially a lighter background to improve ease of reading
- Overall asthetics e.g font and colour
- More contrast between background and text
- The colour scheme and the vertical scrolling
- some wording
- Fix up the overflow graphs.
The pie chart only show one year 2020. Would be good to show the overseas born in a stacked bar graph that matched the first bar graph.

Figure 22, Validation, Screenshot from Google Forms, by Kyle Gibbs, 01/06/23

From this validation, we found that while most people thought the information and graphs were overall good, one major issue proved to be the colour scheme. This was an easy adjustment to make, and the changes can be found in Figure 23.

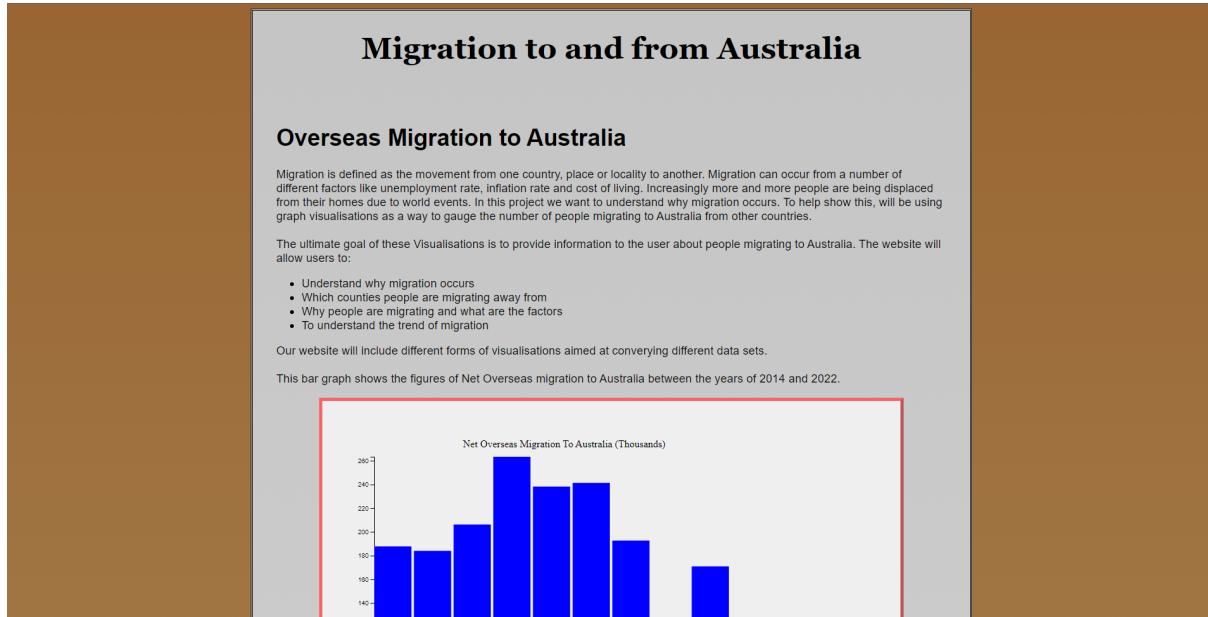


Figure 23, Final Website, Screenshot from Web Browser, by Kyle Gibbs, 01/06/23

As can be seen, the background colour has returned to the brown colouration (#996633), except now it has a gradient as it goes down that gets lighter as it reaches the bottom (#cccc99). The middle dive also has gotten slightly lighter and also contains a gradient (#c5c5c5 to #ececce).

Another change we made according to the validation was that some people noted some minor spelling and grammatical errors. This is important to be correct on any website, so a double check for all information to make sure it was correct and up to date was done.

If we had more time with this project, many of the suggestions would be good to have, such as better navigation and less scrolling.

6 Conclusion

Throughout this entire project, we have enhanced our knowledge of the uses of D3 in a data visualisation project. We did this by working with 4 different styles of visualisations, those being the Line Graph, Bar Graph, Stacked Bar Graph, and finally, the Pie Graph.

We also worked on our general website programming skills, as a large part of the project was not only the design but the functionality of our website. The colour scheme was an aspect that we struggled with a bit. Thanks to the information we gathered during the validation phase of our project, we believe that our end result was much better.

Gathering datasets needed for visualisations was not something we have worked on before. As such, this was a major learning opportunity for us, and a great chance to delve into an experience that was unique for us.

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