



Migration in Australia

Website Link:

<https://mercury.swin.edu.au/cos30045/s103847174/Project/LandingPage.html>

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Introduction

Background and Motivation

Throughout history, populations have sought to immigrate/migrate to different countries. The rate which populations immigrate, has increased/decreased each year due to a wide range of global factors. Currently, there are no widely available visualisations depicting the inflows/outflows of migrant populations into Australia. This is problematic for policy makers, researchers/academics, non-governmental organizations, citizens, and journalists in Australia, who wish to educate themselves on the inflows and outflows of migrant populations in Australia. Policy makers may struggle to make informed decisions, without widely accessible immigration information. To solve this issue, the project first aims to analyse and display the inflows/outflows of migrant populations in Australia. The project aims to deliver a wide range of readable visualisations that depict the inflows/outflows of immigrant populations.

Who will be interested in the visualisation? What tasks will they want to do?

The following section outlines the audience of the visualisation and the tasks they may wish to perform.

Policy makers

Policy makers (e.g. government officials) responsible for managing immigration in Australia, would be interested in understanding the trends in immigration. They would use this visualisation to construct an informed opinion on the inflows and outflows of immigrant populations in Australia. Policy makers may also use this visualisation to support an argument/belief/ contention when conversing with other policy makers. Lastly, policy makers would want to be able to identify which countries have the highest inflow rate of immigration into Australia. This would allow them to plan and predict for future immigrants.

Researchers and academics

Researchers and academics would be interested in studying immigration patterns in Australia. They may reference the visualisation in academic literature to promote discussion, or to debate a contention. Additionally, academics need visualisations that require minimal effort to understand. Therefore, a simple written explanation of the data is important.

Non-Governmental organisations

Humanitarian organisations operating in Australia would be interested in using the visualisations to analyse the immigration patterns in Australia. They may also be interested in

analysing the immigration patterns of specific countries. Lastly, they may use the visualisation to identify which country has the highest inflow of immigrants into Australia. This would help humanitarian organisations plan for future immigrant populations in the future.

Journalists and media outlets

Various journalists and media outlets would be interested in displaying the visualisation to the general public. This could be through articles/stories on the internet or displayed in short videos. Media outlets would desire a visualisation that could be explained and understood in a short period of time. They may use the visualisations to convince audience members to support a contention.

The general public

The public would be interested in educating themselves on the effect of crisis on immigration. The visualisation may be used by teachers to educate children in schools. Therefore, the visualisations should be tested for suitability with a wide range of ages/individuals.

Key terms

The visualisations depict a wide range of data. In order to understand the data, the following key terms must be understood.

Inflows of foreign population by nationality: Refers to the number of immigrants entering Australia.

Outflows of foreign population by nationality: Refers to the number of immigrants leaving Australia.

Acquisition of nationality by country of former nationality: The number of immigrants who have changed their citizenship to Australian from their former nationality.

Migrant: A person who is moving location within their countries borders (Migrants, asylum seekers, refugees and immigrants: What's the difference?, 2022)

Immigrant: A individual who leaves their country with the intention to settle in a foreign country (Migrants, asylum seekers, refugees and immigrants: What's the difference?, 2022).

Visualization Purpose

The purpose of the project is to educate the public on the inflows and outflows of immigrants in Australia. The project also aims to educate policy makers, researchers/academics, organisations, citizens, and journalists in Australia on the topic.

With a visualization depicting the changes in inflow/outflow of immigrants, the project would also aim to help users to answer the following questions:

- How have immigration rates changed in Australia from 2000- 2016?

- What are the inflows and outflows of immigration each year?
- Which countries or regions have experienced the greatest inflow or outflow of immigrants into Australia?
- How have policies and interventions impacted immigration rates?
- What are the number of immigrants each year who identify as Australian?
- What are the patterns of immigration? Is immigration predictable or unpredictable?

The possible benefits of the completed visualization include:

- Providing policymakers with evidence-based insights into immigration patterns and trends, educating and informing policy/ program development.
- Enhancing the public's understanding of immigration and the factors that influence immigration decisions, thereby reducing stigmatization and misconceptions about immigrants.
- Enabling NGOs and humanitarian organizations to better target their services and interventions to meet the needs of people affected by immigration.
- Providing researchers and academics new insights into immigration patterns and trends, to identify new areas for research and inquiry.
- Facilitating media coverage of immigration trends and patterns, thereby raising awareness, and generating public interest in the issue.

Project Schedule

The project will be completed between the 13th of March to the 21st of May. In order to, complete the project in a timely manner, the team created goals/milestones to be completed. The section below outlines the milestones that were achieved to complete the project.

Milestone no.1

By the 9th of May, the team aimed to complete multiple drafts of the visualisations. By this time, a visualisation was selected. To complement the visualisation, a dataset was chosen. Files for the dataset were selected. An initial draft of the website was completed. Additionally, the introduction and data section of the process book was completed.

Milestone no.2

By the 16th of May, the website was completed. The dataset was thoroughly researched, and the process book completed. Improvements to the website were added.

Milestone no.3

By the 23rd of May, improvements to the process book were completed. The webpage was finalised, and peer review completed. The project was reviewed to identify areas for improvement.

Below is a visual representation of the project schedule

Date to be completed	9 th of May	16 th of May	23 rd of May
Milestone no.1	<ul style="list-style-type: none"> • Visualisation selected • Dataset chosen • Files for dataset selected • Initial draft of website completed • Introduction and data section of process book completed. 		
Milestone no.2		<ul style="list-style-type: none"> • Dataset thoroughly researched. • Website completed • Process book completed. • Improvements to website added 	
Milestone no.3			<ul style="list-style-type: none"> • Improvements to process book webpage finalised • Peer review completed. • Project reviewed to identify areas for improvement.

Data

Data Source

The dataset is from the Organisation of Economic Co-operation and Development Australia (International Migration Database, n.d.). Their website contains databases with statistics covering topics such as immigration and unemployment rates. The dataset is represented in a tabular format and utilizes quantitative data (that is data that can be counted, measured or given a value). Each line in the dataset represents the number of immigrants (represented by the Value attribute) in Australia in a given year (represented by the Year attribute).

CO2	Country of birth/nationality	VAR	Variable	GEN	Gender	COU	Country	YEA	Year	Value
AFG	Afghanistan	B11	Inflows of foreign population by nationality	TOT	Total	AUS	Australia	2000	2000	887

Table 1 Each line in the dataset quantitatively measures the number of immigrants from a particular country in a given year.

The attributes are, Country name, Country Code, Variable, Gender, Year and Values. The data values are ordinal.

Original dataset											Flag Codes	Flags
CO2	Country of birth/nationality	VAR	Variable	GEN	Gender	COU	Country	YEA	Year	Value	Flag Codes	Flags
AFG	Afghanistan	B11	Inflows of foreign population by nationality	TOT	Total	AUS	Australia	2000	2000	887		
AFG	Afghanistan	B11	Inflows of foreign population by nationality	TOT	Total	AUS	Australia	2001	2001	456		
AFG	Afghanistan	B11	Inflows of foreign population by nationality	TOT	Total	AUS	Australia	2002	2002	660		
AFG	Afghanistan	B11	Inflows of foreign population by nationality	TOT	Total	AUS	Australia	2003	2003	1015		
AFG	Afghanistan	B11	Inflows of foreign population by nationality	TOT	Total	AUS	Australia	2004	2004	1340		
AFG	Afghanistan	B11	Inflows of foreign population by nationality	TOT	Total	AUS	Australia	2005	2005	3463		
AFG	Afghanistan	B11	Inflows of foreign population by nationality	TOT	Total	AUS	Australia	2006	2006	3465		
AFG	Afghanistan	B11	Inflows of foreign population by nationality	TOT	Total	AUS	Australia	2007	2007	2560		
AFG	Afghanistan	B11	Inflows of foreign population by nationality	TOT	Total	AUS	Australia	2008	2008	2033		
AFG	Afghanistan	B11	Inflows of foreign population by nationality	TOT	Total	AUS	Australia	2009	2009	1696		
AFG	Afghanistan	B11	Inflows of foreign population by nationality	TOT	Total	AUS	Australia	2010	2010	1618		
AFG	Afghanistan	B11	Inflows of foreign population by nationality	TOT	Total	AUS	Australia	2011	2011	2030		
AFG	Afghanistan	B11	Inflows of foreign population by nationality	TOT	Total	AUS	Australia	2012	2012	1623		
AFG	Afghanistan	B11	Inflows of foreign population by nationality	TOT	Total	AUS	Australia	2013	2013	2178		
AFG	Afghanistan	B11	Inflows of foreign population by nationality	TOT	Total	AUS	Australia	2014	2014	5686		
AFG	Afghanistan	B11	Inflows of foreign population by nationality	TOT	Total	AUS	Australia	2015	2015	3323		
AFG	Afghanistan	B11	Inflows of foreign population by nationality	TOT	Total	AUS	Australia	2016	2016	3197		
AFG	Afghanistan	B11	Inflows of foreign population by nationality	TOT	Total	AUS	Australia	2017	2017	3566		
AFG	Afghanistan	B11	Inflows of foreign population by nationality	TOT	Total	AUS	Australia	2018	2018	3783		
AFG	Afghanistan	B11	Inflows of foreign population by nationality	TOT	Total	AUS	Australia	2019	2019	2207		
AFG	Afghanistan	B11	Inflows of foreign population by nationality	TOT	Total	AUS	Australia	2020	2020	2229		
AFG	Afghanistan	B12	Outflows of foreign population by nationality	TOT	Total	AUS	Australia	2000	2000	1		
AFG	Afghanistan	B12	Outflows of foreign population by nationality	TOT	Total	AUS	Australia	2001	2001	3		
AFG	Afghanistan	B12	Outflows of foreign population by nationality	TOT	Total	AUS	Australia	2004	2004	61		
AFG	Afghanistan	B12	Outflows of foreign population by nationality	TOT	Total	AUS	Australia	2005	2005	123		
AFG	Afghanistan	B12	Outflows of foreign population by nationality	TOT	Total	AUS	Australia	2006	2006	100		
AFG	Afghanistan	B12	Outflows of foreign population by nationality	TOT	Total	AUS	Australia	2007	2007	66		
AFG	Afghanistan	B12	Outflows of foreign population by nationality	TOT	Total	AUS	Australia	2008	2008	77		

Table 2 Original Dataset

There was plenty of data that was not required in the dataset for the project. Specifically, the country code, VAR, YEA, and gender, was not required to describe the difference in immigration between each year, in the line chart. Therefore, a modified dataset was created with these attributes removed. The modified dataset is shown below.

Modified dataset

CO2	Country of birth/nationality	Variable	COU	Country	Year	Value
AFG	Afghanistan	Inflows of foreign population by nationality	AUS	Australia	2000	887
AFG	Afghanistan	Inflows of foreign population by nationality	AUS	Australia	2001	456
AFG	Afghanistan	Inflows of foreign population by nationality	AUS	Australia	2002	660
AFG	Afghanistan	Inflows of foreign population by nationality	AUS	Australia	2003	1015
AFG	Afghanistan	Inflows of foreign population by nationality	AUS	Australia	2004	1340
AFG	Afghanistan	Inflows of foreign population by nationality	AUS	Australia	2005	3463
AFG	Afghanistan	Inflows of foreign population by nationality	AUS	Australia	2006	3465
AFG	Afghanistan	Inflows of foreign population by nationality	AUS	Australia	2007	2560
AFG	Afghanistan	Inflows of foreign population by nationality	AUS	Australia	2008	2033
AFG	Afghanistan	Inflows of foreign population by nationality	AUS	Australia	2009	1696
AFG	Afghanistan	Inflows of foreign population by nationality	AUS	Australia	2010	1618
AFG	Afghanistan	Inflows of foreign population by nationality	AUS	Australia	2011	2030
AFG	Afghanistan	Inflows of foreign population by nationality	AUS	Australia	2012	1623
AFG	Afghanistan	Inflows of foreign population by nationality	AUS	Australia	2013	2178
AFG	Afghanistan	Inflows of foreign population by nationality	AUS	Australia	2014	5686
AFG	Afghanistan	Inflows of foreign population by nationality	AUS	Australia	2015	3323
AFG	Afghanistan	Inflows of foreign population by nationality	AUS	Australia	2016	3197
AFG	Afghanistan	Inflows of foreign population by nationality	AUS	Australia	2017	3566
AFG	Afghanistan	Inflows of foreign population by nationality	AUS	Australia	2018	3783
AFG	Afghanistan	Inflows of foreign population by nationality	AUS	Australia	2019	2207
AFG	Afghanistan	Inflows of foreign population by nationality	AUS	Australia	2020	2229
AFG	Afghanistan	Outflows of foreign population by nationality	AUS	Australia	2000	1
AFG	Afghanistan	Outflows of foreign population by nationality	AUS	Australia	2001	3
AFG	Afghanistan	Outflows of foreign population by nationality	AUS	Australia	2004	61

Table 3 Modified dataset. The country code, VAR, YEA, and gender attributes have been removed.

Data Processing

Line Chart Data Processing

The line chart compares the migration of 10 different ethnicities to Australia between the years of 2008-2020. The modified dataset included data where individuals migrated to Australia from multiple different countries. If the data from each of these countries was to be displayed on a line chart, the viewer would become overwhelmed by the number of countries (lines) on the line chart. To mitigate this risk, the modified dataset was further reduced to only include migrants from 10 different countries (China, HongKong, India, Nepal, NewZealand, SouthAfrica, United Kingdom, Vietnam). The attributes CO2, Country of Birth/Nationality, Variable and COU were removed. The modified dataset was then separated into ten different csv files to represent the ten different countries. Modification of the dataset was implemented using filters with Excel.

 China.csv
 HongKong.csv
 India.csv
 Nepal.csv
 NewZealand.csv
 Pakistan.csv
 Philippines.csv
 SouthAfrica.csv
 UnitedKingdom.csv
 Vietnam.csv

Figure 1 The modified dataset was separated into 10 different csv files for each country. The 10 different files are show below.

These are the csv files that were used for Pakistan and China. The eight other csv files for each country follow a similar format. The attributes CO2, Country of Birth/Nationality, Variable and COU have been removed from the modified dataset.

Pakistan

Country	Year	Value
Pakistan	2008	1881
Pakistan	2009	1972
Pakistan	2010	1799
Pakistan	2011	1845
Pakistan	2012	3891
Pakistan	2013	3612
Pakistan	2014	5669
Pakistan	2015	8019
Pakistan	2016	6958
Pakistan	2017	6819
Pakistan	2018	6286
Pakistan	2019	4651
Pakistan	2020	3814

China

nationality	Year	Value
China	2008	20694
China	2009	22297
China	2010	24525
China	2011	28718
China	2012	25308
China	2013	27898
China	2014	27122
China	2015	27924
China	2016	29077
China	2017	29277
China	2018	25712
China	2019	25464
China	2020	18798

Table 4 CSV files for Pakistan and Pakistan

Bar Chart Data Processing

The dataset (newData) is derived from the original dataset described in table 1. Using excel, the country code, VAR, YEA, and gender attributes were removed. Four attributes (nationality, variable, year and value) were selected from the original dataset. Additionally, only the ten countries (China, HongKong, India, Nepal, NewZealand, SouthAfrica, United Kingdom, Vietnam) were included in the nationality field. Filters were also applied in Excel to only select data from 2008- 2016.

newData			
nationality	Variable	Year	Value
China	Inflows of foreign population by nationality	2008	20694
China	Inflows of foreign population by nationality	2009	22297
China	Inflows of foreign population by nationality	2010	24525
China	Inflows of foreign population by nationality	2011	28718
China	Inflows of foreign population by nationality	2012	25308
China	Inflows of foreign population by nationality	2013	27898
China	Inflows of foreign population by nationality	2014	27122
China	Inflows of foreign population by nationality	2015	27924
China	Inflows of foreign population by nationality	2016	29077
China	Inflows of foreign population by nationality	2017	29277
China	Inflows of foreign population by nationality	2018	25712
China	Inflows of foreign population by nationality	2019	25464
China	Inflows of foreign population by nationality	2020	18798
China	Outflows of foreign population by nationality	2008	2651
China	Outflows of foreign population by nationality	2009	2456
China	Outflows of foreign population by nationality	2010	3001
China	Outflows of foreign population by nationality	2011	3213
China	Outflows of foreign population by nationality	2012	2666
China	Outflows of foreign population by nationality	2013	2451
China	Outflows of foreign population by nationality	2014	2211
China	Outflows of foreign population by nationality	2015	2200
China	Outflows of foreign population by nationality	2016	2100
Hong Kong, China	Inflows of foreign population by nationality	2008	1806
Hong Kong, China	Inflows of foreign population by nationality	2009	1561

Figure 2 The data used for the pie chart.

Pie Chart Data Processing

The dataset is from the modified dataset (refer to table 3). The CO2, COU variables have been removed from the dataset. The dataset has been filtered to only include variable data for the Acquisition of Australian Nationality.

pieData			
nationality	Variable	Year	Value
Philippines	Acquisition of Australian Nationality	2008	3841
Philippines	Acquisition of Australian Nationality	2009	3453
Philippines	Acquisition of Australian Nationality	2010	4505
Philippines	Acquisition of Australian Nationality	2011	4051
Philippines	Acquisition of Australian Nationality	2012	5592
Philippines	Acquisition of Australian Nationality	2013	9090
Philippines	Acquisition of Australian Nationality	2014	11628
Philippines	Acquisition of Australian Nationality	2015	8996
Philippines	Acquisition of Australian Nationality	2016	8333
Philippines	Acquisition of Australian Nationality	2017	9112
Philippines	Acquisition of Australian Nationality	2018	4921
Philippines	Acquisition of Australian Nationality	2019	9267
Philippines	Acquisition of Australian Nationality	2020	12838
Nepal	Acquisition of Australian Nationality	2008	440
Nepal	Acquisition of Australian Nationality	2009	298
Nepal	Acquisition of Australian Nationality	2010	550
Nepal	Acquisition of Australian Nationality	2011	520
Nepal	Acquisition of Australian Nationality	2012	589
Nepal	Acquisition of Australian Nationality	2013	1384
Nepal	Acquisition of Australian Nationality	2014	1810
Nepal	Acquisition of Australian Nationality	2015	2401
Nepal	Acquisition of Australian Nationality	2016	2959
Nepal	Acquisition of Australian Nationality	2017	2402
Nepal	Acquisition of Australian Nationality	2018	1665

Figure 3 Filter applied to only include data for the Acquisition of Australian Nationality.

Requirements

Must Have Features

1. The visualisations must demonstrate **the inflow of immigrants into Australia from different countries**. Users must be able to discern change in immigration patterns in Australia.
2. The visualisations **must compare the inflow and outflow of immigrants in Australia**.
3. The visualisations must demonstrate the number of **foreign individuals who have changed their nationality to Australian (Acquisition of Australian Nationality by foreign Population)**.
4. To demonstrate the impact of inflow/outflow of immigrants in Australia, **a minimum of two complementary visualisations should be created**. These tables should

complement each other. For example, a bar chart demonstrating the outflow of migrants in Australia, and a line chart demonstrating the rate inflow of migration from 2005-2010 in Australia, would allow users to compare the inflow and outflow in Australia.

5. The visualisations must include **colour coding and a scale**. This will allow the audience to easily distinguish between the migration patterns of each country.

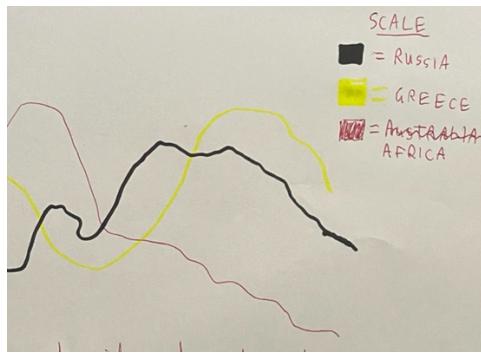


Figure 4 Must show colour coding.

6. The user must be able to view **migration over a period of time**. This is essential, for the user to gain a broad perspective of migration. An **X-axis and a y-axis** should be implemented.
7. **Data:** The visualisations must display the inflow/outflow of migrant populations.
8. **A scale and title should be implemented in the line chart:** This will allow users to easily discern the country represented by each colour on the visualisations. Users will also be able to determine the data shown on each of the visualisations with the title.

Optional Features

The visualisations may provide interactivity. However, some features provided may be optional as they are not required to demonstrate migration patterns.

1. The line chart may provide an opportunity to **select and view the data at a singular point in time (mouseover text)**. For example, if a single point on a line was selected, then the number of migrants and country would appear on the line. The figure below is an example of the interactivity that may be optional in the line chart.

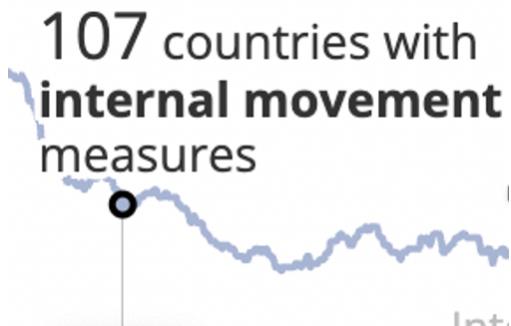


Figure 5 Line Chart Interactivity. Source:(2023). Iom.int. <https://worldmigrationreport.iom.int/wmr-2022-interactive/>

2. The line chart may **change colour** as the mouse hovers over the line.

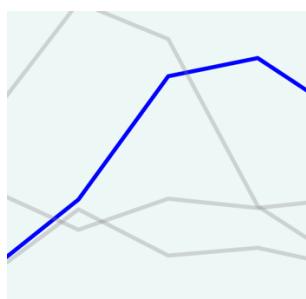


Figure 6 Colour of lines may change as a line is hovered over.

3. **Checkboxes:** **Checkboxes** to select and deselect from the line chart are optional. For example, deselecting a check box may cause a line to disappear on the line chart.
4. **Data:** The data presented may display the Acquisition of Australian Nationality by foreign Population, however this is not essential.

Visualization Design

The design process

Initially the team considered displaying a comparison between the rate of migration and the number of conflicts in the visualisations. The team hoped to outline a relationship between high immigration and a high number of crises in a given year. However, data describing the number of given conflicts in a year were difficult to find. In finalising the design, the team decided to only display the inflow/outflow of migrants into Australia instead.

Sketch no.1 Chloropleth

In the initial phases of development, it was considered that the data could be displayed on a graphical chloropleth. However, the design was never implemented due to the high level of complexity that was required.

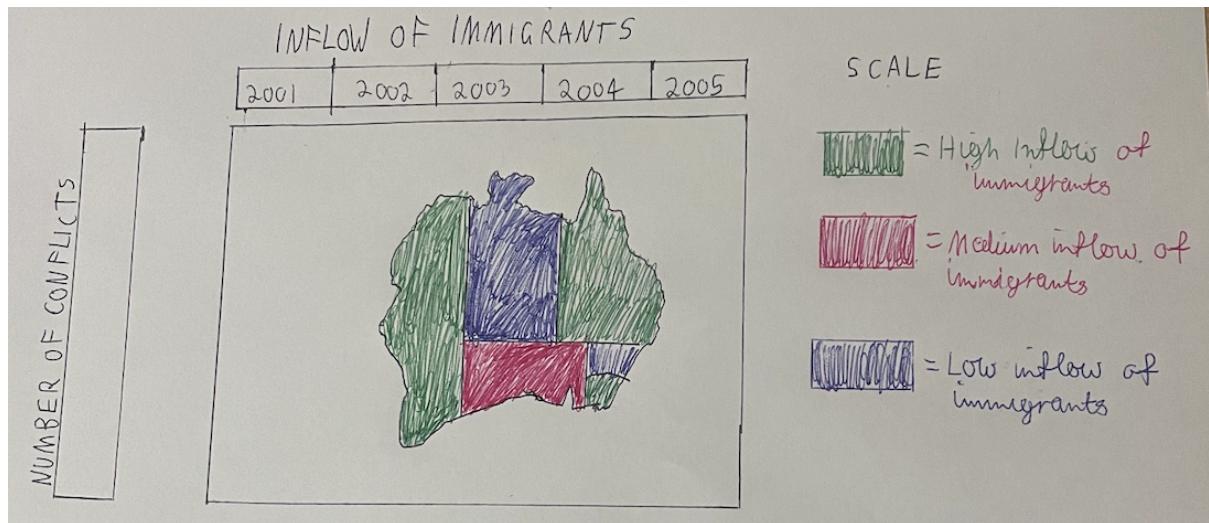


Figure 7 Chloropleth

Different colours could be used to represent the migration rate.

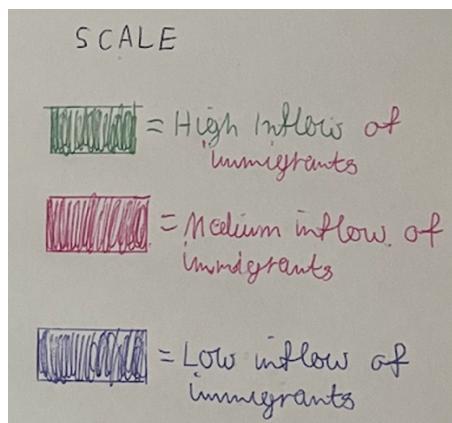


Figure 8 Scale

Additionally, an accompanying bar representing the number of crisis in a year could be included. This would allow the audience to compare the rate of migration with the number of conflicts.

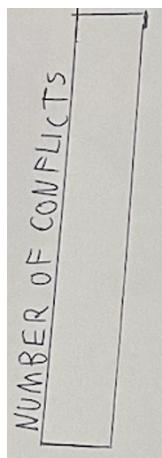


Figure 9 Accompanying bar

Similarly, to visualisation no.1 a tab selection would allow users to easily select between the different years.

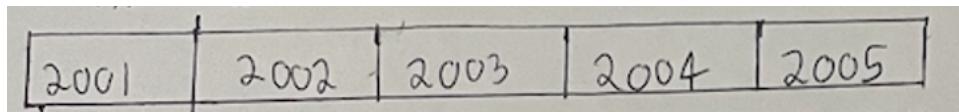


Figure 10 Tab Selection

Sketch No.2 Bar Chart

The team considered displaying the data in a bar chart. The x-axis would be used to display the countries, whilst the Y-axis would represent the number of migrants into Australia. The bars would be coloured differently so that each country could be easily distinguished.

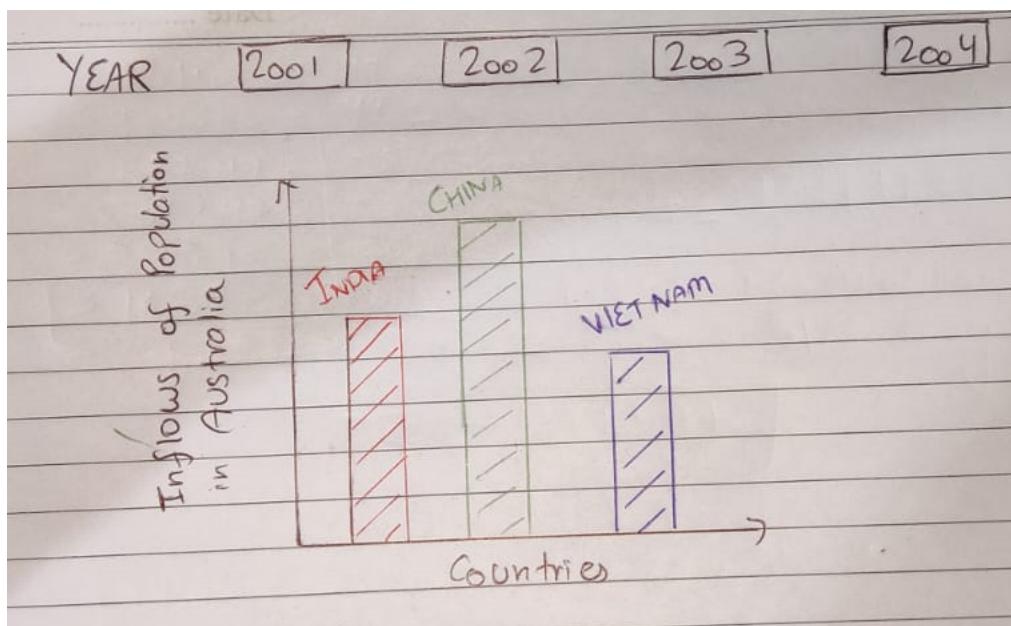


Figure 11 Bar Chart

In the beginning of the design phase, the team attempted to build this bar chart. However, upon discussion with the tutor, the team realised that the bar chart did not allow the viewer to easily compare the inflow of migrants between each year. This is because the data for the current selected year would disappear when users selected a different year with the tab icon shown below.

YEAR	2001	2002	2003	2004
------	------	------	------	------

Figure 12 Tab Selection

Instead, the team realised that a line chart would be the best way to compare the number of immigrants into Australia from different countries based on year. This is because unlike the bar chart, the line chart was able to display all the available data in a single visualisation, allowing the user to easily compare the data. The team also realised that the tab selection may not be the most effective to display data.

Design idea no.3 Line chart

The line chart design easily allowed the viewers to compare the number of migrants immigrating to Australia from different countries. The colour coding in the design would allow the audience to distinguish between the different countries quickly/easily. The design would suit a wide range of audience members who require a simplistic visualisation to describe the data. After the initial design, the team began building the line chart.

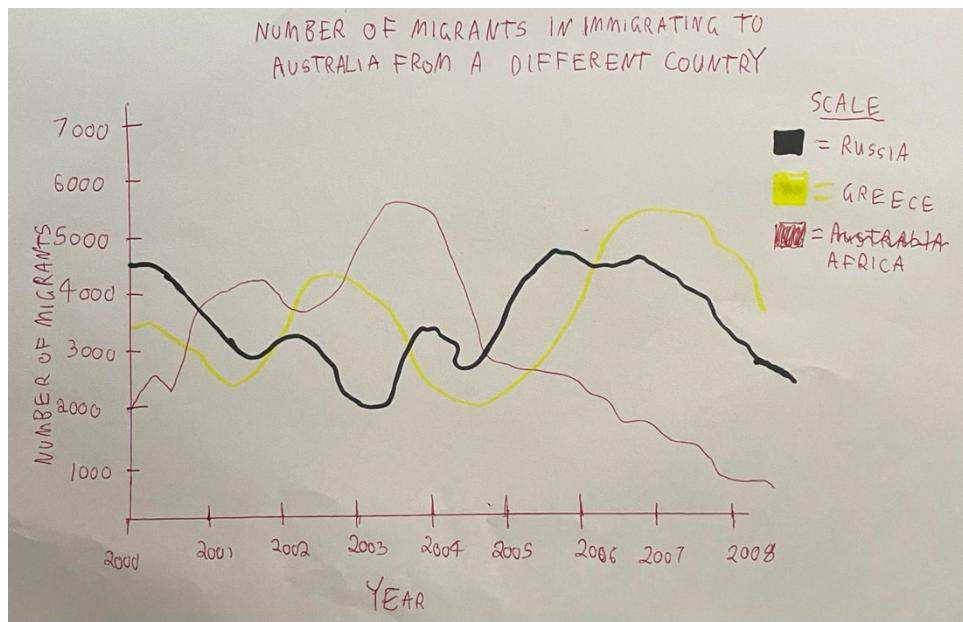


Figure 123 Line Chart

Finalisation of design

The line chart effectively displayed the number of migrants immigrating to Australia from different countries. However, the line chart was unable to compare the inflows of foreign population with the acquisition of nationality by country. In consultation with the tutor, the team decided to implement a secondary visualisation that interacted with the line chart. The visualisation would allow users to select different years and countries on the chart as shown below.

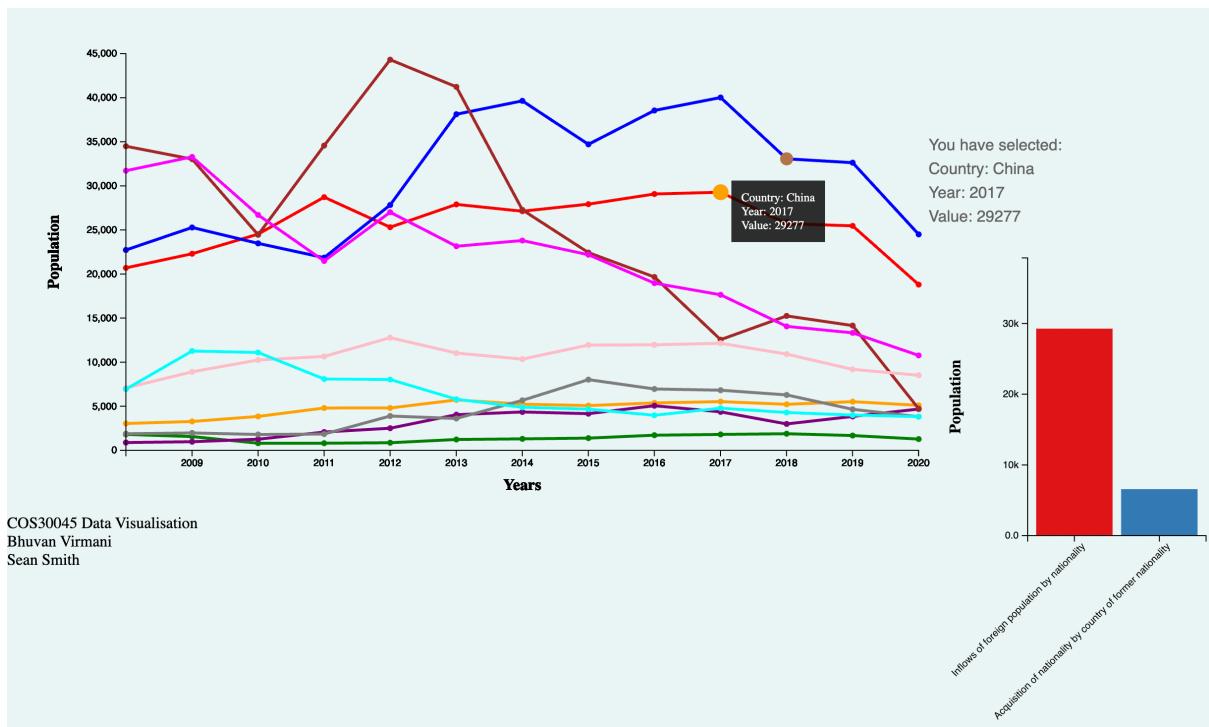


Figure 14 The team decided that the selection of the user would impact the data displayed on the line chart. E.g., If the user selected 2017, the data for 2017 would be displayed in the bar chart.

The line chart and bar chart provided comparisons between the inflow and outflow of migrants. However, the team decided that there should be a visualisation that depicted the number of migrants from a foreign population that acquired an Australian identity (the number of migrants who changed their nationality to Australian).

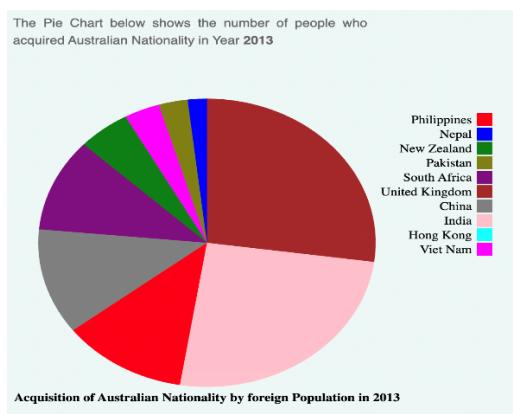


Figure 15 Pie Chart

Validation

Upon initial testing the team realised that users were unaware of how to view the bar charts. This was because the webpage would load without a bar chart. Users would then view the data without inspecting the various bar charts.

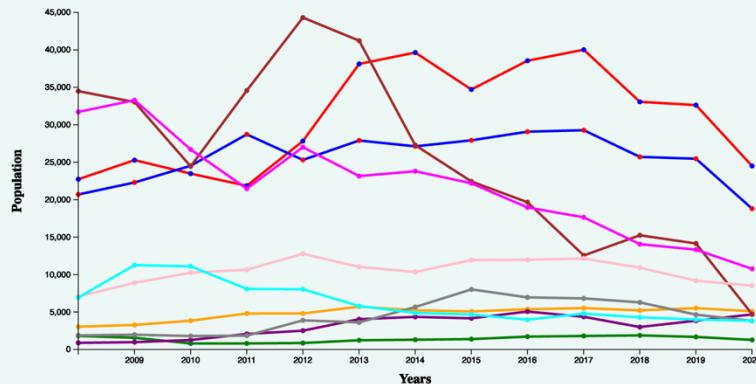
Migration in Australia

Migrants from around the world travel to seek permanent/semi-permanent residence in Australia. This visualisation depicts the fluctuations of migrant populations entering Australia from 10 different countries. These countries are China, HongKong, India, Nepal, NewZealand, Pakistan, Phillipines, SouthAfrica, UnitedKingdom and Vietnam.

Since 2008, the population of these migrants seeking residency has increased, however in 2012 the inflow of migrants into Australia from countries such as China, New Zealand and the United Kingdom has began decrease. Opposingly, to this observation, the inflows of migrant populations since 2008 from Hong Kong, South Africa, Nepal and Pakistan have remained constant.

The line graph below depicts the inflow of migrants into Australia from different countries.

Key Point: Inflow of migrants refers to the number of migrants entering the country.



COS30045 Data Visualisation

Figure 16 Webpage would initially load without bar chart. So users would be unaware that there were bar charts available to view.

Additionally, users were unaware that if a circle was selected, a bar chart comparing the inflow and outflow by nationality was available. To solve these issues, text was provided to notify the viewer that they could select the circles on the line chart to view the bar charts.

Select the circles on the line chart to view the relevant bar chart.

Figure 17 Users were unaware that if a circle was selected a bar chart was displayed.

Initially titles to graphs were not included. Users were unable to discern the information that the line chart and bar charts were displaying.

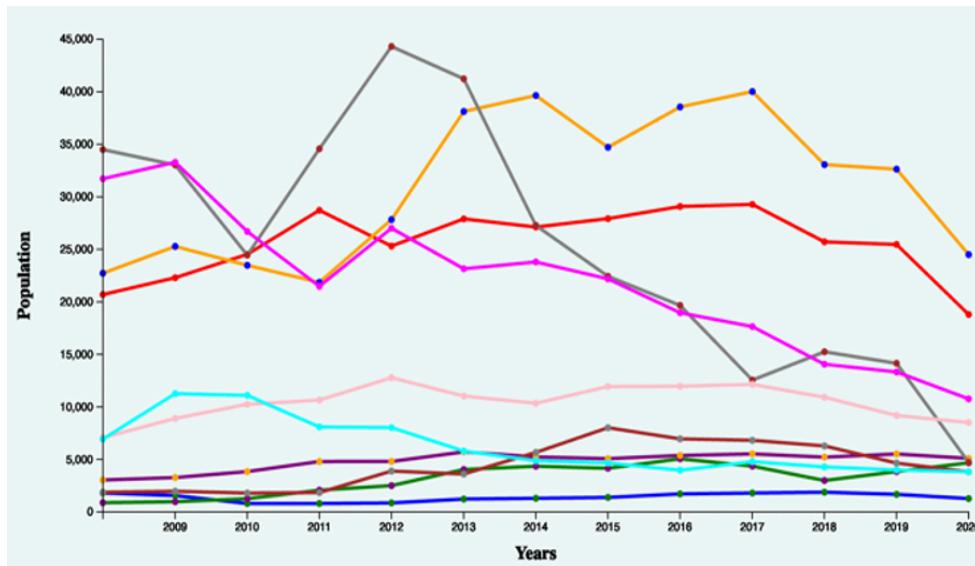


Figure 18 There was no text clearly outlining the data that the line chart is displaying.

A title was added so that users were able to quickly discern the type of data depicted on the line chart.

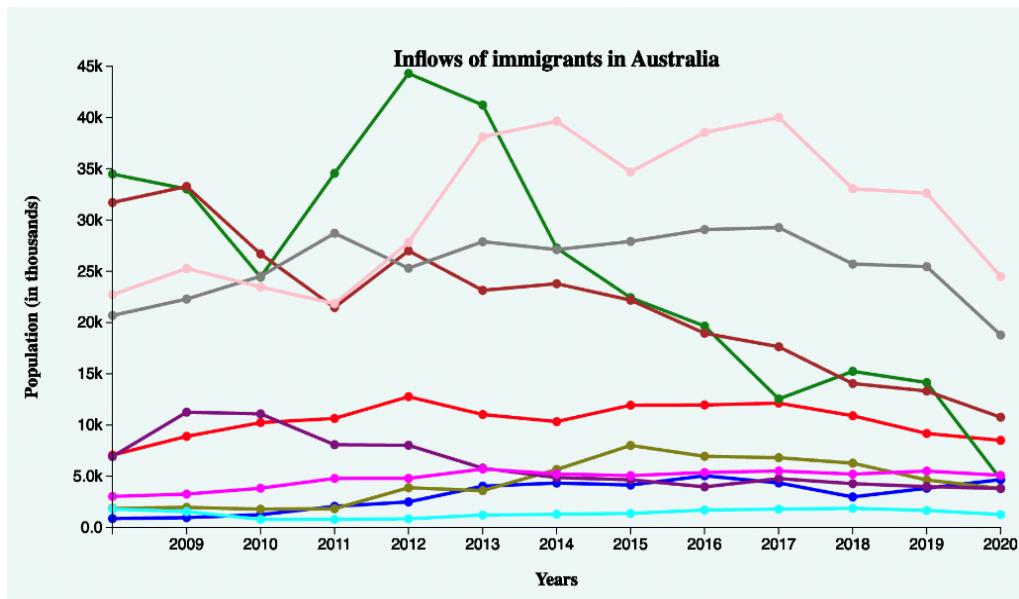


Figure 19 Added Title

Additionally, the bar chart text was difficult to read as it was too small. Visually impaired users would struggle to view text this small. Therefore, the text size needed to be increased.

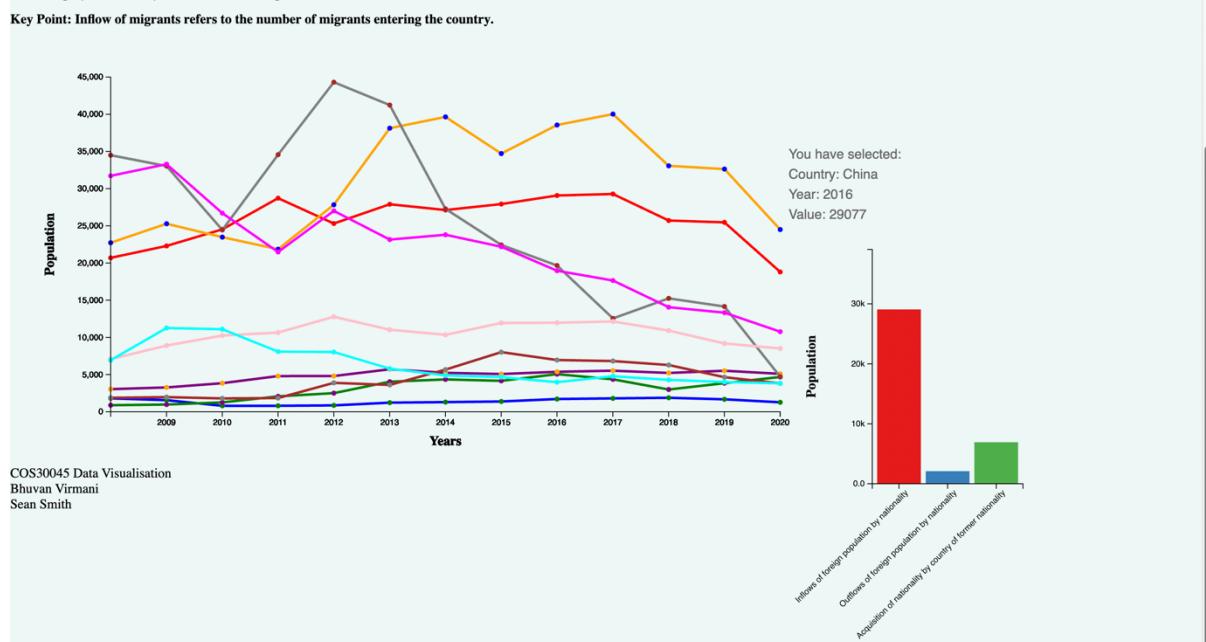


Figure 2013 Increased Font

Finally, users found the line chart confusing because it displayed too many lines. Upon redesign, the team decided to include checkboxes. These checkboxes allowed users to choose the number of countries that were displayed on the line chart. The line graph was easier to read with fewer lines. Additionally, this also provided users with the ability to choose the number of countries they compared within the line chart.

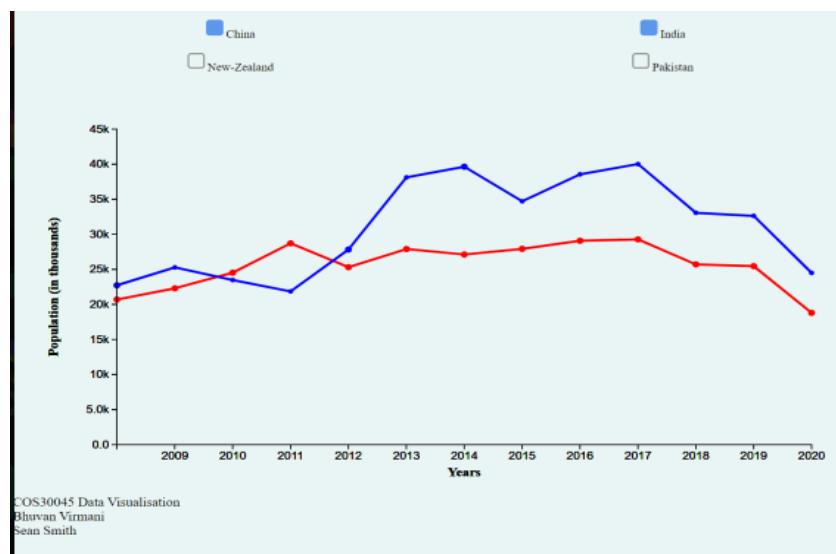


Figure 21 Added Checkboxes

Users were unaware the countries that each line on the line chart represented. A colour coded scale was implemented so users could determine the country that each line represented.

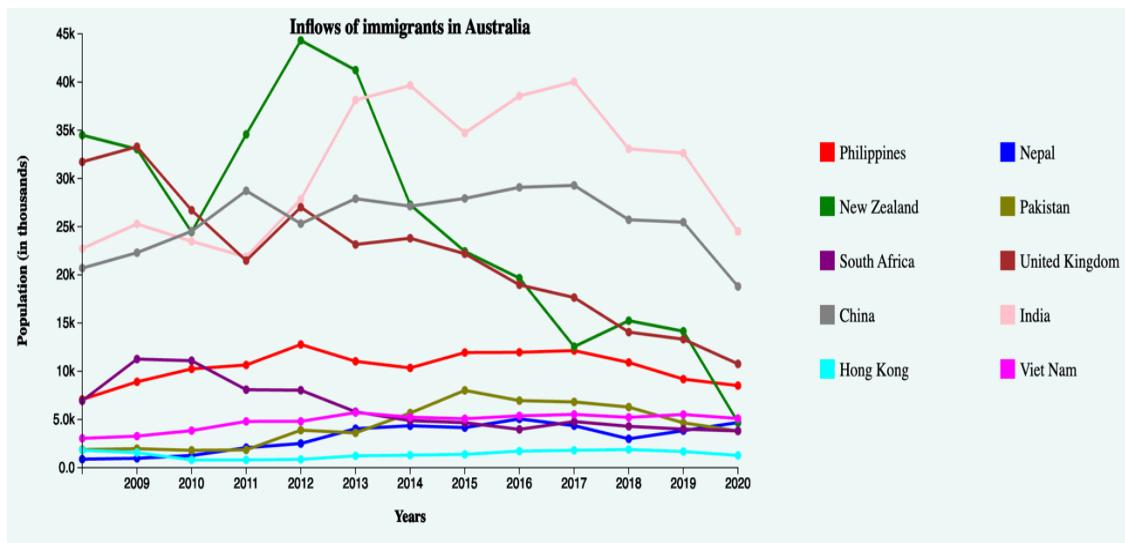


Figure 22 Colour coded scale implemented so users can determine the country that each line represents.

Similarly, users viewing the pie chart were unaware which country each colour represented. Users would have to interact with the pie chart to find the country that was represented by the colour.

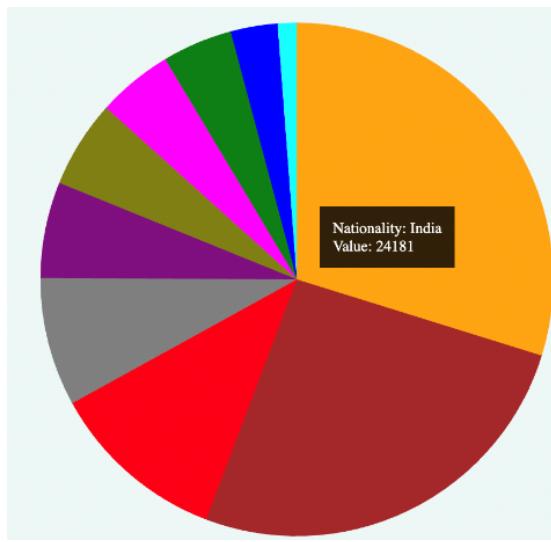


Figure 23 Users would have to interact with pie chart to find the country that was represented by the colour.

A scale was implemented so that users could find the country that was represented by the colour visually, without physically interacting with the visualisation.

The Pie Chart below shows the number of people who acquired Australian Nationality in Year 2013

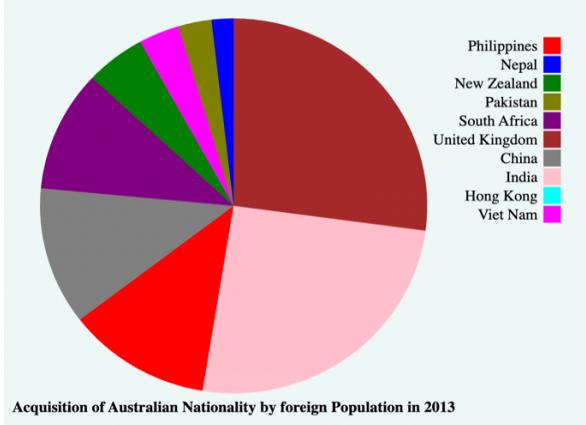


Figure 24 Users can find the colour represented by the country without physically interacting with the pie chart.

Users were unaware the data that was represented by the line chart. A title was implemented so users could determine the data represented by the line chart.

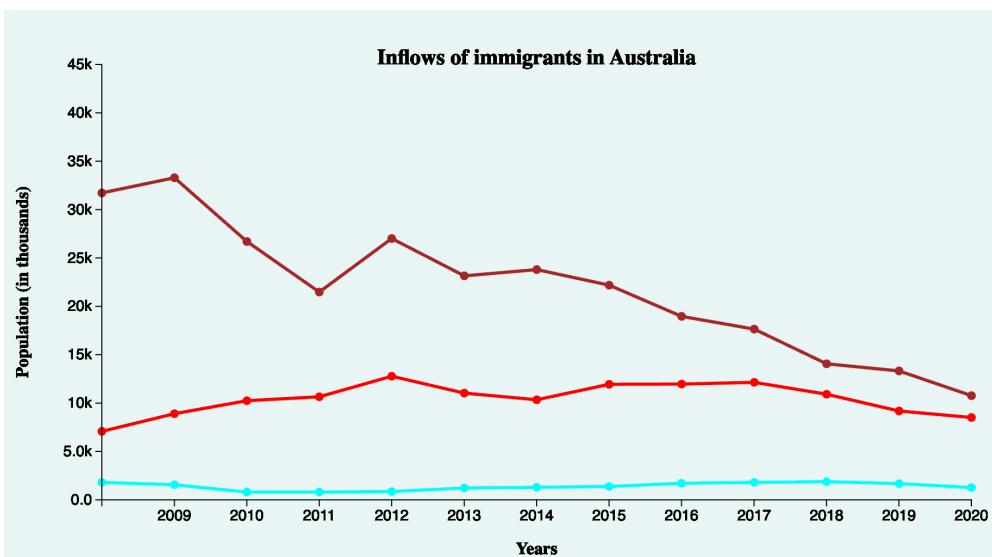


Figure 25 Title implemented so users could determine the data represented by the line chart.

The bar chart and line chart were initially placed next to each other. However, there was no space for the scale.

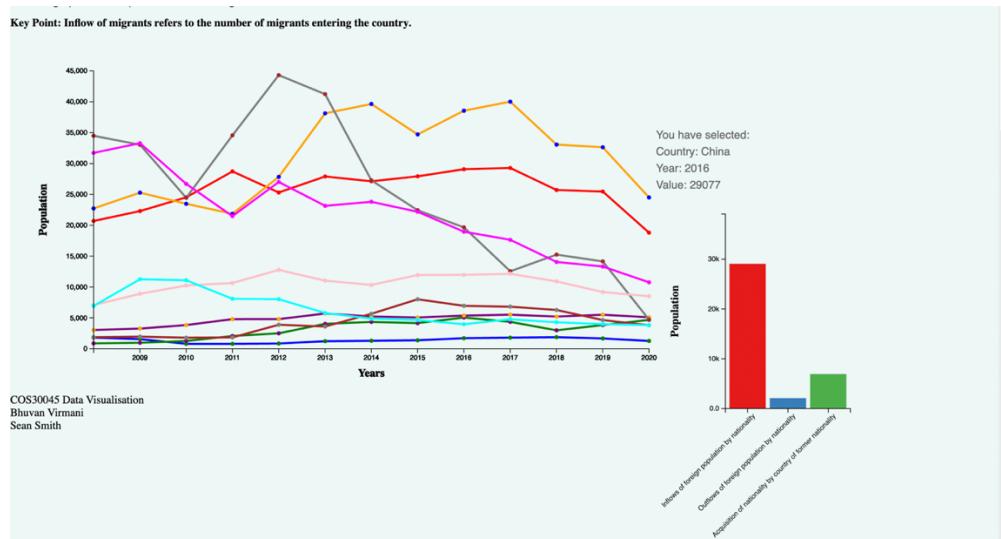


Figure 26 Bar chart and line chart placed together.

The line chart was placed lower in the webpage next to the pie chart so that users could view the scale and the line chart together.

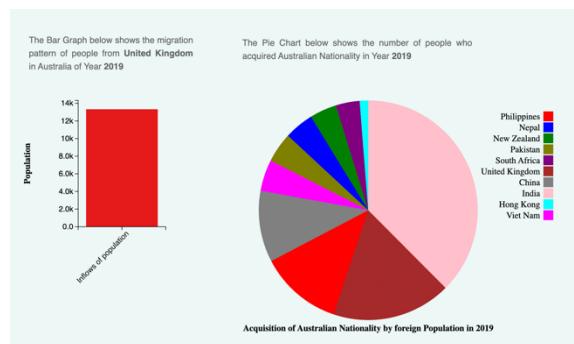


Figure 27 Bar chart placed lower in the webpage.

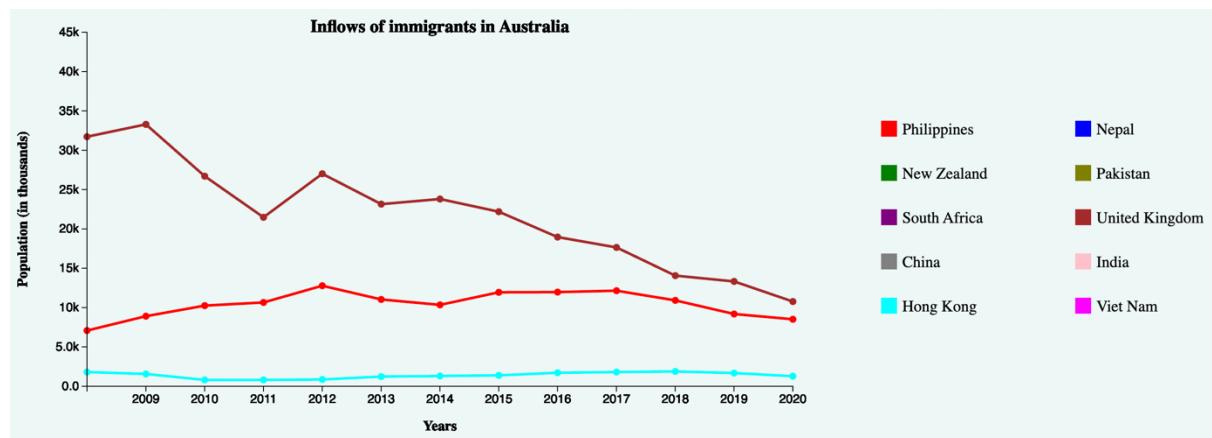


Figure 28 Line Chart and scale could now be viewed together.

Conclusion

The final result

The project created three visualisations. Each of these visualisations gave new insights into the inflow/outflow of immigrants in Australia. The webpage is shown below. The website could not fit in a single image. Consequently, three images have been provided to display the whole website.



Figure 29 Webpage Intro

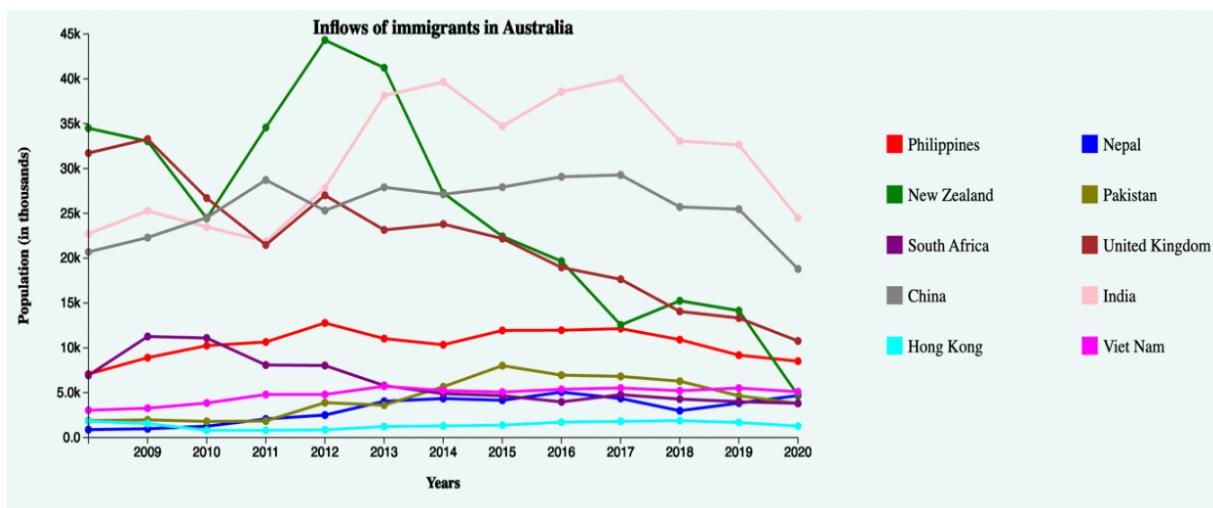
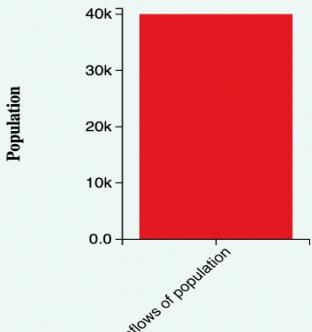


Figure 30 Line Chart

The Bar Graph below shows the migration pattern of people from **India** in Australia of Year 2017



The Pie Chart below shows the number of people who acquired Australian Nationality in Year 2017

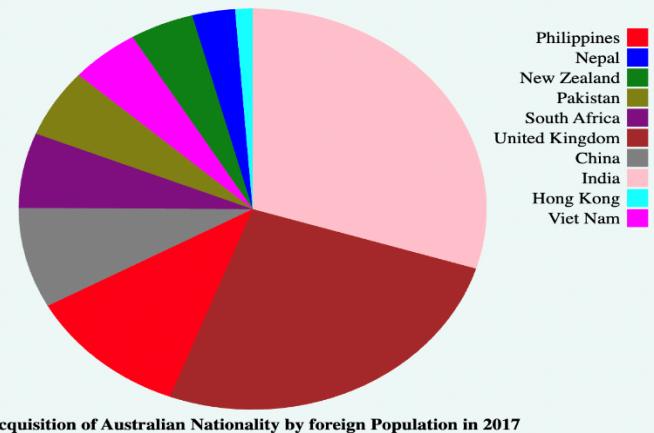


Figure 31 Bar and Pie Chart

The project was able to meet a large majority of the requirements set out in the design specifications (specified in the Must Have Features section). The following sections outline the specifications that were met. Requirements are in bold.

Design specifications achieved

Design specifications specified that...

1. The visualisation **demonstrates the inflow of immigrants into Australia from different countries**. The line chart demonstrated the inflow of immigrants into Australia.

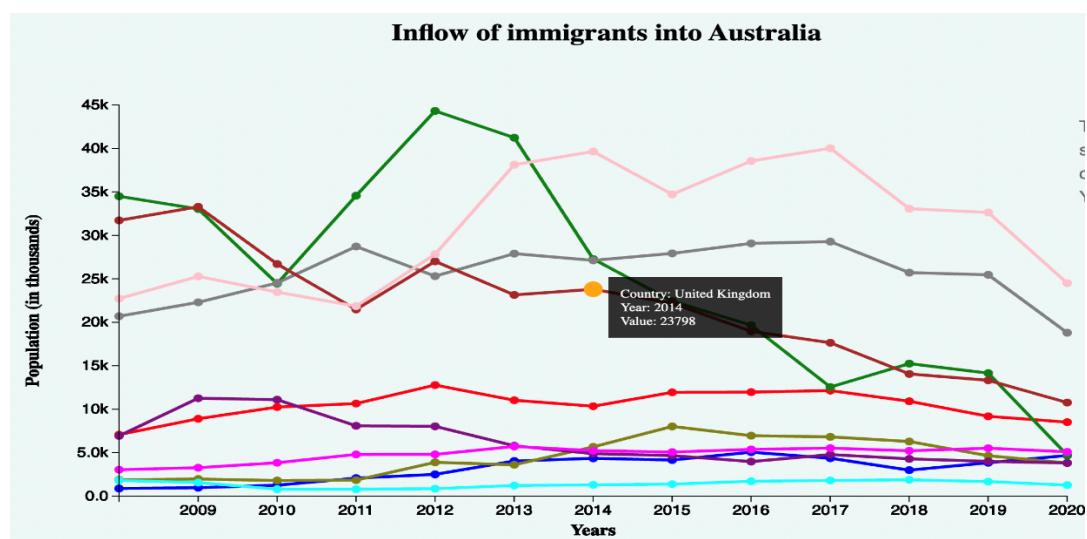


Figure 32 Line chart shows Inflows of foreign population in Australia

2. **Colour coding should be used:** The line chart implemented colour coding to distinguish between different lines (refer to figure 18).

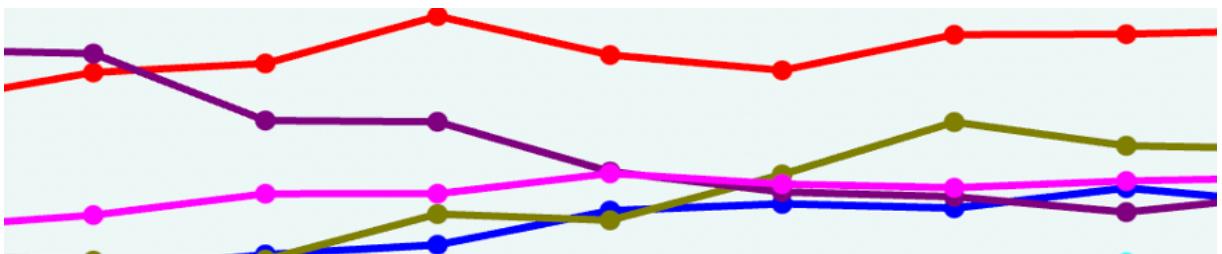


Figure 3314 Line chart used different colors to distinguish between lines

3. The website **use two visualisations**. Three visualisations were completed.
 4. **The visualisations should depict the number of individuals who have changed their nationality to Australian (Acquisition of Australian Nationality by foreign Population)**. A bar chart was implemented that met this design specification.

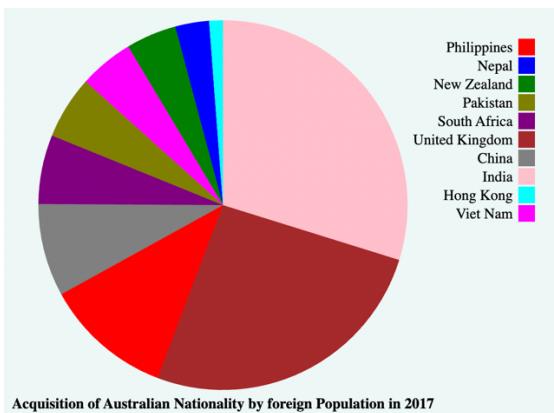


Figure 34 Acquisition of Australian Nationality by foreign Population depicted in the pie chart.

5. An **X-axis and Y-Axis** should be implemented. Migration should be shown over a period of time. Migration over time was shown by a x-axis in the line chart (Refer to table 6). Additionally, the line chart used a Y-axis (Refer to table 6).
 6. A scale and title should be included.

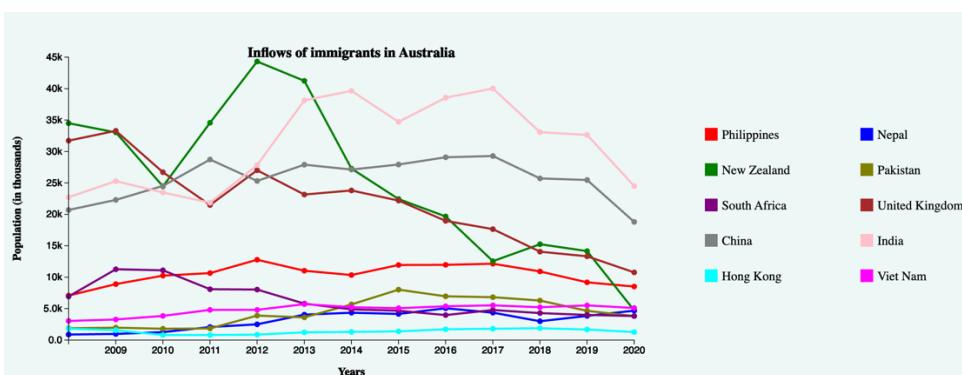


Figure 35 Both a title and a scale were designed.

Optional Features Achieved

The following section outlines optional design specifications that were achieved.

The webpage achieved

1. **Mouse over text** that allows the user to view the data at a single point in time.



Figure 36 Mouse over text. When the mouse hovers over the circle, the user can view the Country, Year and value.

2. Checkboxes to select and deselect lines from the line chart. Although this was an optional feature, the team decided this was an important feature to implement, because there were too many lines on the line chart. The checkboxes allowed the user to remove lines from the line chart.

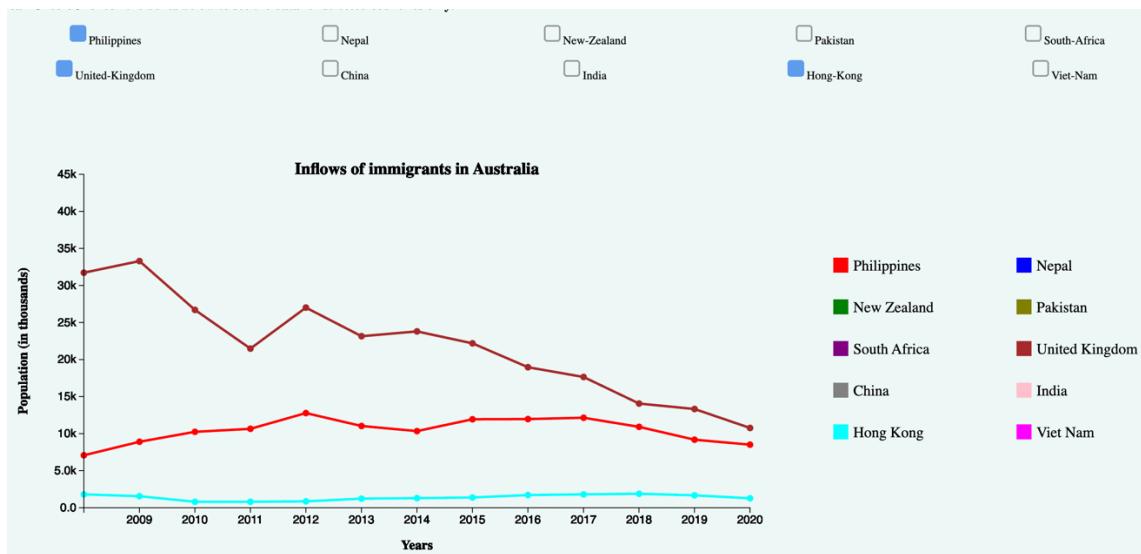


Figure 3715 Checkboxes reduced the number of lines on the line chart. Less clutter.

What did we learn?

The team learnt to implement ...

1. A line chart with checkboxes.
2. A bar chart
3. A pie chart.

- Visualisations that are interactive and display data based on selection. For example, if a user selected the country New Zealand and 2018 the bar graph would show data in the year 2018 for the country New Zealand.

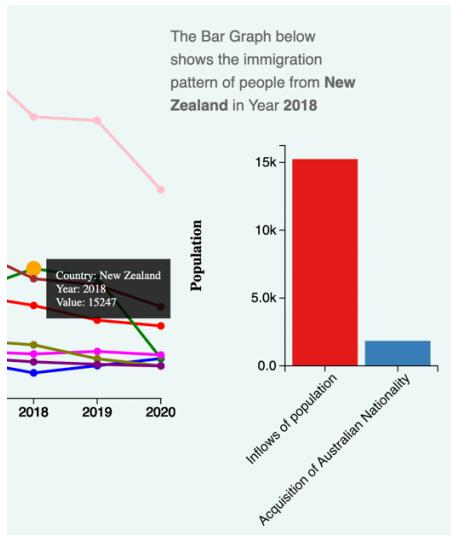


Figure 37 Visualisation

- How to load data and manipulate data from a csv file.

```
d3.csv("newData.csv").then(function (data) {
  console.log(data);
  // Filter the data based on the selected year and nationality
  var filteredData = data.filter(function (d) {
    return +d.Year === selectedData["Year"].getFullYear() &&
      d.Variable === "Acquisition of Australian Nationality";
  });
});
```

Figure 3816 The code loads the data and filters based on selected year and nationality.

- How to provide interactivity with transitions and mouse over effects.

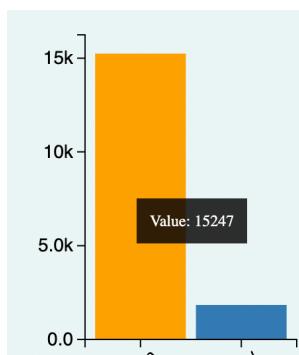


Figure 3917 The bars change colour when the users mouse hovers over.

Final thoughts

The team was able to create a webpage that educated the public about the inflows/outflows of immigrants into Australia. The visualisations could be used to educate a wide range of

audiences (e.g., media outlets, policy makers, public). Options to reduce the number of lines on the line chart are provided, to reduce and simplify the data shown. This would be ideal for researchers and media outlets who wish to convey easy to understand visualisations.

References

International Migration Database. (n.d.). Retrieved from OECD:
<https://stats.oecd.org/Index.aspx?DataSetCode=MIG>

Migrants, asylum seekers, refugees and immigrants: What's the difference? (2022, July 13).
Retrieved from International Rescue Committee:
<https://www.rescue.org/article/migrants-asylum-seekers-refugees-and-immigrants-whats-difference>