Swinburne University of Technology

The Migration Hot-Spots of Australia

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2024 Semester 1
Word Count: 2667

Mercury link: https://mercury.swin.edu.au/cos30045/s104177513/assign2/index.html

Contents

1. Introduction

A) Background and Motivation

The essay explores the migration patterns of Australia, both inward and outward, which are influenced by the significant impact that migration has on sociological, economic, and global factors. The exploration aims to analyse the several important aspects of migration, such as its impact on policy making, cultivating empathy, and promoting social cohesion. It strives to understand the intricate nature of both individual and community experiences related to migration, with the ultimate goal of creating a more inclusive, fair, and integrated society.

B) Visualisation purpose

Upon observing the data visualisation of human migration to Australia, viewers will acquire the ability to respond to a range of inquiries, including:

- What are the overarching patterns in migration to Australia throughout different historical periods?
- The primary countries of origin for migrants going to Australia are:
- The demographic composition of migrants to Australia refers to the characteristics and distribution of individuals who have migrated to the country.
- Is there a correlation between international migration and inter-state migration in Australia?

The visualisation has the ability to offer policymakers a comprehensive comprehension of migration patterns and trends, so empowering them to formulate more efficacious immigration policies. Moreover, it has the potential to augment public consciousness and comprehension of the intricacies of migration, cultivating empathy and backing for migrant populations. Moreover, the visualisation can enhance academic research by offering a thorough depiction of migration dynamics, therefore serving as a significant asset for academics and researchers. Lastly, it can foster discourse and cooperation among parties involved, resulting in inventive approaches to tackle migration-related issues and advance social integration.

C) Project schedule:

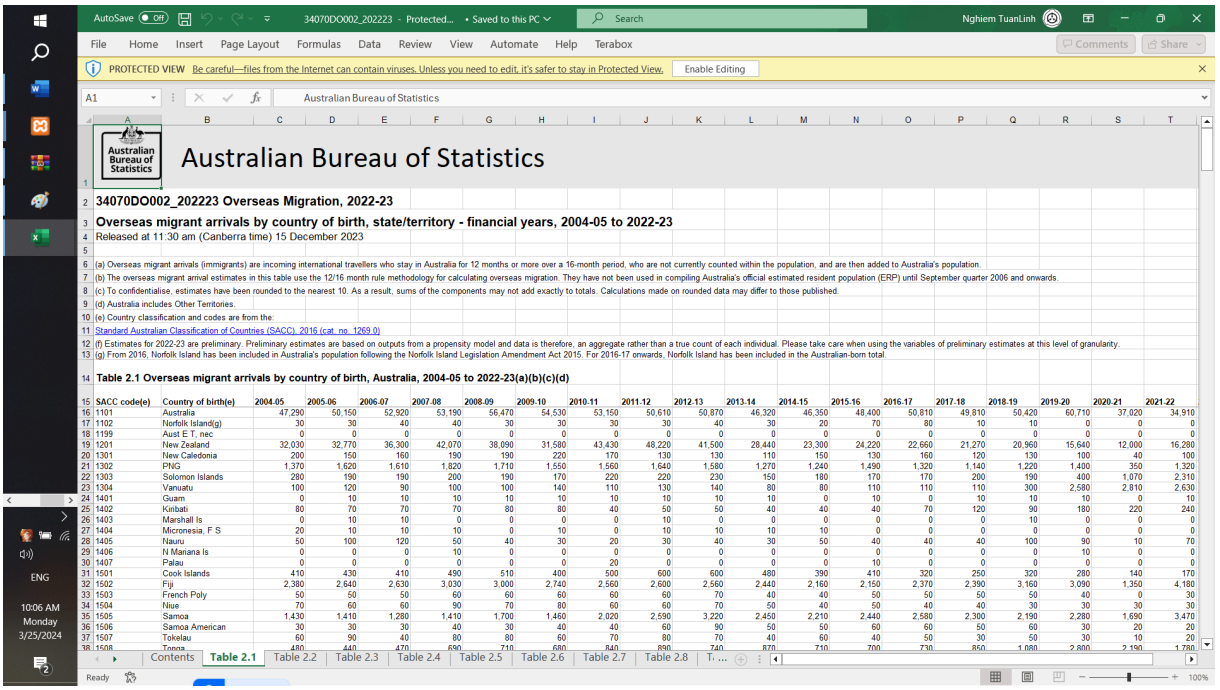
🗓️Week	📍Objectives
1	● Get to know each other and connect to github. ● Getting familiar with the D3 Javascript Data drawing library ● Create a private Github repository with contributors.(Hai Anh)
2	● Discuss the main problem and decide on topics (Hai Anh) ● Having an overview vision on the topic's obstacles. (Tuan Linh)
3	● Divide the topic into small questions to draw data. (Tuan Linh) ● Start finding data in reliable sources (Hai Anh)

4	• Compile and select data (Hai Anh) • Start writing the introduction of the website and introducing the topic(Tuan Linh)
5	• Draft out the structure of the website through Figma • Cleaning Data
6	• Start on the basic structure of the website • Start draft out the process book
7	• Normalise the data and Finalise what to use in the assignment
8	• Start the preparation for the project stand up • Draft out more details in the process book
9	• Complete HTML and CSS structure codes • Finish the content design of the process book
10	• Complete the first line chart map in javascript with the dataset from reliable source • Finish the introduction and data parts in the process book
11	• Complete the second stacked bar chart map in javascript with the dataset from reliable source • Finish the requirements and visualisation design in the process book
12	• Finalise the website with the choropleth map function properly from those 2 reliable datasets for heat map and set points for navigation ease • Finalising the process book

2. Data

A) Data Source

The first dataset offers extensive information on the arrivals of overseas migrants, classified by their country of birth and state/territory. The dataset covers the period from the financial years 2004-05 to 2022-23. This dataset provides a comprehensive analysis of migration patterns within Australia, revealing the sources of migrants and their dispersion across various regions of the country for a period of almost twenty years. The dataset enables an examination of migration patterns at both the national and regional levels by classifying arrivals according to their country of birth and geographic location within Australia. This abundant repository of data serves as a valuable asset for comprehending the demographic makeup of Australia's migrant population and the spatial patterns of migration movements over time.



Australian Bureau of Statistics

34070DO002_202223 Overseas Migration, 2022-23

Overseas migrant arrivals by country of birth, state/territory - financial years, 2004-05 to 2022-23

Released at 11:30 am (Canberra time) 15 December 2023

(a) Overseas migrant arrivals (immigrants) are incoming international travellers who stay in Australia for 12 months or more over a 16-month period, who are not currently counted within the population, and are then added to Australia's population.

(b) The overseas migrant arrival estimates in this table use the 12/16 month rule methodology for calculating overseas migration. They have not been used in compiling Australia's official estimated resident population (ERP) until September quarter 2006 and onwards.

(c) To confidentialise, estimates have been rounded to the nearest 10. As a result, sums of the components may not add exactly to totals. Calculations made on rounded data may differ to those published.

(d) Australia includes Other Territories.

(e) Country classification and codes are from the:

Standard Australian Classification of Countries (SACC), 2016 (cat. no. 1269.0)

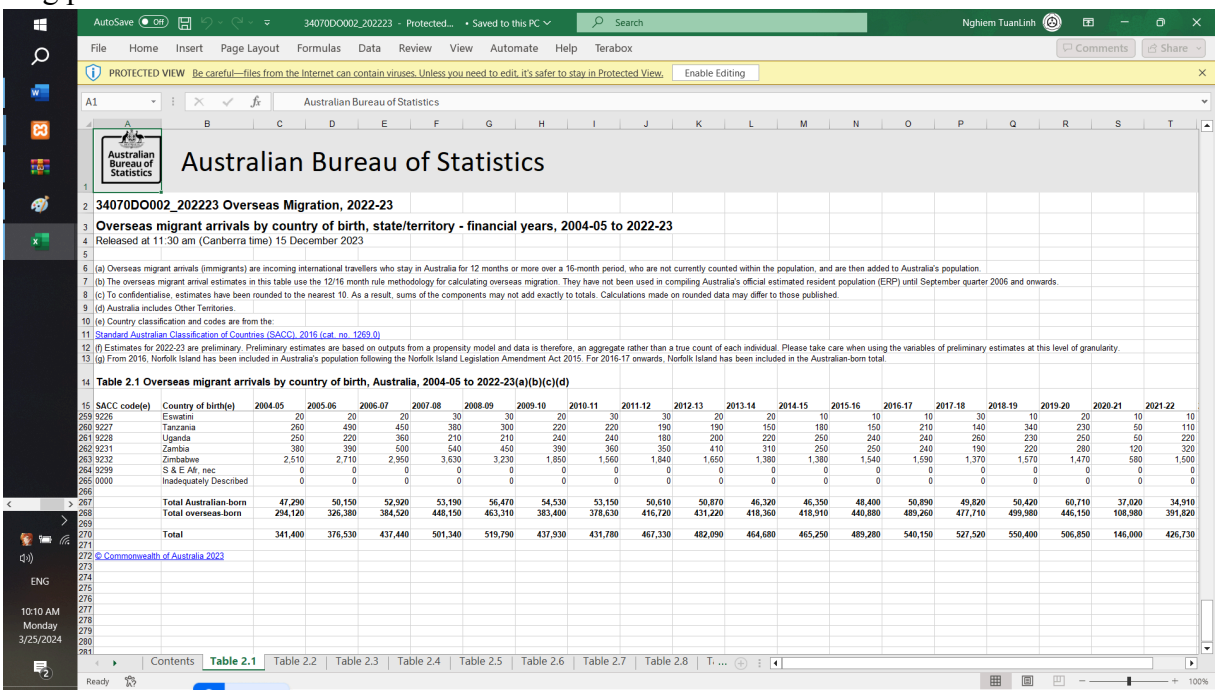
(f) Estimates for 2022-23 are preliminary. Preliminary estimates are based on outputs from a propensity model and data is therefore, an aggregate rather than a true count of each individual. Please take care when using the variables of preliminary estimates at this level of granularity.

(g) From 2016, Norfolk Island has been included in Australia's population following the Norfolk Island Legislation Amendment Act 2015. For 2016-17 onwards, Norfolk Island has been included in the Australian-born total.

Table 2.1 Overseas migrant arrivals by country of birth, Australia, 2004-05 to 2022-23(a)(b)(c)(d)

SACC code(e)	Country of birth(e)	2004-05	2005-06	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22
1101	Australia	47,290	50,150	52,920	53,190	56,470	54,530	53,150	50,610	50,870	46,320	46,350	48,400	50,810	49,810	50,420	60,710	37,020	34,910
1102	Norfolk Island(g)	30	30	40	40	30	30	30	30	40	30	20	70	80	10	10	0	0	0
1199	Aust E T, nec	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1201	New Zealand	32,030	32,770	36,300	42,070	38,090	31,580	43,430	48,220	41,500	28,440	23,300	24,220	22,660	21,270	20,960	15,640	12,000	16,280
1301	New Caledonia	200	150	160	190	190	220	170	130	130	110	150	130	160	120	130	100	40	100
1302	PNG	1,370	1,620	1,610	1,820	1,710	1,550	1,560	1,640	1,580	1,270	1,240	1,490	1,320	1,140	1,220	1,400	350	1,320
1303	Solomon Islands	280	190	190	200	190	170	220	220	230	150	180	170	170	200	190	400	1,070	2,310
1304	Vanuatu	100	120	90	100	100	140	110	130	140	80	80	110	110	110	300	2,580	2,810	2,630
1401	Guam	0	10	10	10	10	10	10	10	10	10	0	10	0	10	10	10	0	10
1402	Kiribati	80	70	70	70	80	80	40	50	50	40	40	40	70	120	90	180	220	240
1403	Marshall Is	0	10	10	0	0	0	0	10	0	0	0	0	0	0	10	0	0	0
1404	Micronesia, F S	20	10	10	10	0	10	0	10	10	10	10	0	0	0	0	0	0	0
1405	Nauru	50	100	120	50	40	30	20	30	40	30	50	40	40	40	100	90	10	70
1406	N Mariana Is	0	0	0	10	0	0	0	0	0	0	0	0	0	0	0	10	0	0
1407	Palau	0	0	0	0	0	0	20	0	0	0	0	10	0	0	0	0	0	0
1501	Cook Islands	410	430	410	490	510	400	500	600	600	480	390	410	320	250	320	280	140	170
1502	Fiji	2,380	2,640	2,630	3,030	3,000	2,740	2,560	2,600	2,560	2,440	2,160	2,150	2,370	2,390	3,160	3,090	1,350	4,180
1503	French Poly	50	50	50	60	60	60	60	60	70	40	40	50	50	50	50	40	0	30
1504	Niue	70	60	60	90	70	80	60	60	70	50	40	50	40	40	30	30	30	30
1505	Samoa	1,430	1,410	1,280	1,410	1,700	1,460	2,020	2,590	3,220	2,450	2,210	2,440	2,580	2,300	2,190	2,280	1,690	3,470
1506	Samoa American	30	30	30	40	30	40	40	60	90	50	50	60	60	50	60	30	20	20
1507	Tokelau	60	90	40	80	80	60	70	80	70	40	60	40	50	30	50	30	10	20
1508	Tonga	480	440	470	690	710	680	840	890	740	870	710	700	730	850	1,080	2,800	2,190	1,780

The second provides a comprehensive summary of the number of people leaving the country to live abroad, organised by their country of birth and the state or territory they are from. The dataset covers the period from the financial years 2004-05 to 2022-23. This dataset offers significant insights into the migration patterns originating from Australia, specifically identifying the sources of departing migrants and their destinations within Australia during various time periods. The dataset allows for an analysis of outbound migration trends and their regional impacts by organising departures according to the country of birth and geographic location within Australia. This resource is crucial for comprehending the patterns of emigration from Australia and the demographic characteristics of departing migrants over a long period of time.



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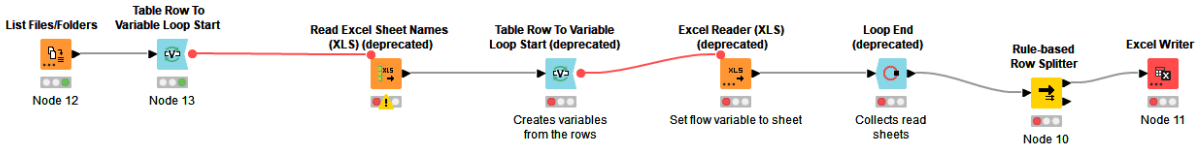
9226	Eswatini	20	20	20	30	30	20	30	30	20	20	10	10	10	30	10	20	10	10
9227	Tanzania	260	490	450	380	300	220	220	190	190	150	180	150	210	140	340	230	50	110
9228	Uganda	250	220	360	210	210	240	240	180	200	220	250	240	240	260	230	250	50	220
9231	Zambia	380	390	500	540	450	390	360	350	410	310	250	250	240	190	220	280	120	320
9232	Zimbabwe	2,510	2,710	2,950	3,630	3,230	1,850	1,560	1,840	1,650	1,380	1,380	1,540	1,590	1,370	1,570	1,470	580	1,500
9299	S & E Afr, nec	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0000	Inadequately Described	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Total Australian-born	**47,290**	**50,150**	**52,920**	**53,190**	**56,470**	**54,530**	**53,150**	**50,610**	**50,870**	**46,320**	**46,350**	**48,400**	**50,890**	**49,820**	**50,420**	**60,710**	**37,020**	**34,910**
	Total overseas-born	**294,120**	**326,380**	**384,520**	**448,150**	**463,310**	**383,400**	**378,630**	**416,720**	**431,220**	**418,360**	**418,910**	**440,880**	**489,260**	**477,710**	**499,980**	**446,150**	**108,980**	**391,820**
	Total	**341,400**	**376,530**	**437,440**	**501,340**	**519,790**	**437,930**	**431,780**	**467,330**	**482,090**	**464,680**	**465,250**	**489,280**	**540,150**	**527,520**	**550,400**	**506,850**	**146,000**	**426,730**

B) Data Processing

The procedure of cleaning up the tables is crucial in order to eliminate unnecessary information and ensure that the data is in line with the project's specifications. This guarantees that the tables are streamlined for effective programming and data processing. An essential component of the cleansing entails implementing a uniform naming convention for state names in all tables, facilitating simpler and more consistent code. The tables are simplified in order to recover the original values, so confirming the accuracy of the data. The year, state, and country information is stored to give context and facilitate analysis. This methodology enables us to comprehensively comprehend the dataset while preserving its original structure.



The databases have a similar structure, which allows for the easy extraction and processing of data from both datasets using a unified framework. A standardised strategy accelerates the data extraction process by ensuring consistent formatting and structure, encouraging consistency and accuracy across analyses. Leveraging KNIME's adaptability, the Row Filter node emerges as a critical tool in processing these datasets. Users can easily filter the data to extract relevant information customised to their analytical aims by configuring the node to target certain criteria, such as date ranges, categorical variables, or numerical thresholds. This standardised strategy not only improves workflow productivity, but it also ensures that insights derived from datasets are valid and consistent, regardless of source or content differences.

Furthermore, the datasets' structural consistency makes it easier to construct data processing workflows. With a single framework in place, modifying and optimising the data processing pipeline becomes easier and more adaptive. KNIME's versatility allows for the incorporation of additional nodes or functionalities to meet changing analytical requirements. Whether integrating information, doing calculations, or creating visualisations, the cohesive framework allows for a consistent approach to data processing. Finally, the ability to use a unified system demonstrates the effectiveness of standardised methods in successfully processing varied datasets, resulting in a more streamlined and agile analytical workflow.

3. Requirements

A) Key features

- Visualisation of how migration arrival and departure is distributed across Australia

The line graph is an effective tool for visually representing the pattern of migration arrivals and departures across Australia's states and territory from 2016 to 2023. The line graph visually displays migration trends across different locations by using the x-axis to indicate time and the y-axis to show the number of arrivals or departures. The graph displays distinct states or territories, enabling viewers to readily perceive the changes in migration patterns within each geographical region over time.

The line graph allows users to discern patterns and fluctuations in migratory activity across the states and territory of Australia. For example, they can analyse if specific areas had a steady increase or decrease in the number of people moving in or out throughout the provided period. In addition, the line graph allows readers to compare the size of migrant flows among various states and territories, thereby highlighting any discrepancies or patterns in the distribution of migration.

The line graph provides a detailed and dynamic representation of the distribution of migration arrivals and departures throughout Australia's states and territory from 2016 to 2023. The visual presentation and accessibility of data provided by this tool enable a more comprehensive understanding of regional migration trends. This, in turn, informs policy decisions, urban planning, and resource allocation at both local and national levels.

- Visualisation of country from which the immigrant came from

The Choropleth Map is a powerful visualisation tool that effectively displays the nations of origin for immigrants. This map illustrates the spatial distribution of immigration trends by using shading or colouring to indicate the varying number of immigrants originating from different regions or nations. Typically, darker shades or colours imply a greater quantity of immigrants, whereas lighter shades or colours suggest a smaller quantity. The Choropleth Map provides significant insights into the geographic diversity of Australia's immigrant population by visually representing the spread of immigrant origins.

The Choropleth Map allows users to readily identify the nations that provide the highest number of immigrants to Australia and observe how this distribution fluctuates across other regions. This visualisation allows stakeholders to identify primary source countries and comprehend the relative significance of each in influencing Australia's immigrant population. Moreover, the Choropleth Map can effectively emphasise trends or changes in immigration patterns over time, offering useful insights for policymakers, researchers, and other stakeholders seeking to comprehend the dynamics of immigration to Australia.

B) Additional features

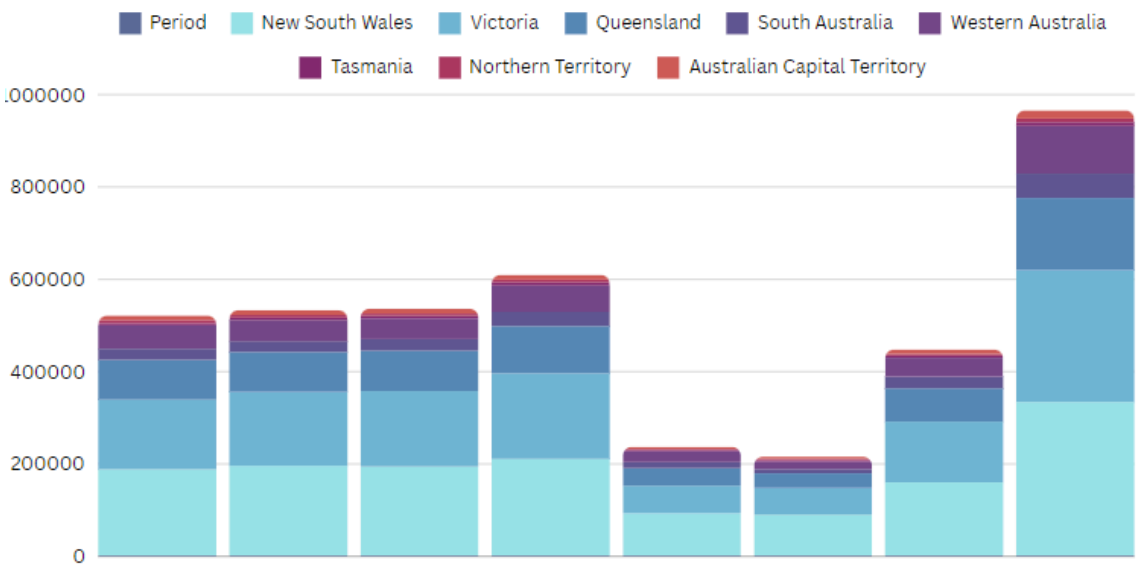
- Line transition

A transition effect was incorporated into the line graph. Upon selecting a state, a data point dot is initially displayed, which is then connected to other data points by a line. This transition effect improves the visual depiction of the data and offers a seamless and captivating experience for consumers.

4. Visualization Design

A) Initial Designs Ideas

1) Stack bar chart

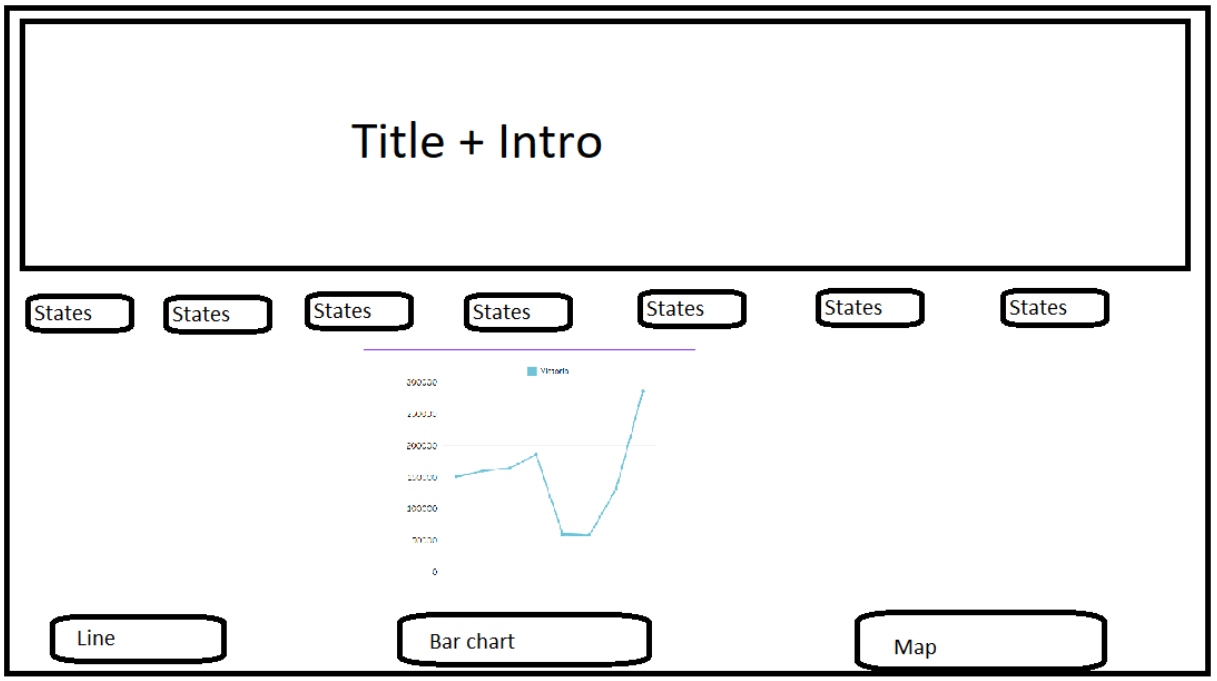


The first design proposal entailed using a stack bar chart to visually depict the migration data of Australia. The objective was to illustrate the cumulative number of migrant departures throughout the specified period, with each bar divided into distinct groups reflecting departures to different countries of origin. The objective of this approach was to offer a straightforward and precise representation of the patterns of migration from a particular location, enabling a simple comparison of the number of people leaving for various destination nations. Moreover, it was anticipated that the stack bar chart would effectively emphasise any changes or patterns in migration destinations over time, allowing stakeholders to discern significant observations and make well-informed decisions using the data.

Nevertheless, the execution of the stack bar chart faced obstacles that ultimately resulted in its discontinuation. An important problem was the intricacy of the data, namely the extensive range of categories that represented departures to various countries of birth. Consequently, the stack bar chart got excessively populated and intricate, rendering it arduous for viewers to perceive significant patterns or trends. Moreover, the limited scalability of the stack bar chart

hindered the effective visualisation of the complete dataset, particularly when trying to incorporate extra dimensions such as departures by state/territory. In the end, these difficulties caused a reevaluation of the visualisation strategy, resulting in the investigation of several techniques that are more appropriate for efficiently conveying Australia's migration data.

2) Line graph:



The initial design suggestion for showing migration data to Australia included a line graph and interactive buttons to swap between state statistics. This upgrade made it easier to evaluate and compare migration statistics between states and territories by allowing users to easily switch between several perspectives. By adding toggle buttons to the line graph, users may easily select and display migration data for certain regions, simplifying national and sub-national migration analysis. This interactive element improved visualisation by letting users tailor their study to their interests and research aims. The line graph with toggle buttons was kept to boost visualisation use and versatility. Instead of static displays, toggle buttons let users explore migration data dynamically. The display lets users select between states or regions based on their preferences and analytical needs. We ensured stakeholders could use the data to gain practical insights. Line graphs with toggle buttons were an effective and user-friendly way to display migration data to Australia, therefore they remained in the design plan.

B) Evolution of the Design

After comparing the suitable data for our visualisation, Our group mutually agreed that we should use two line charts instead of a bar chart and a line chart for an uniform comparison experience between the arrival and the departure of immigrants. As a result It has been a great choice as It shows 2 comparable charts in a correct 0 to 200,000 scale to compare between states as well as between departure and arrival. Initially we opted for a variable scale to show the amount of immigrants but after some project standups with the help of our tutor,

we have changed to a better visualisation experience as mentioned by our tutor Tung. After finishing those 2 line charts, we move to finish the heatmap or choropleth map as it's the most complicated d3 component in our website. Initially we had thought that we should use colours to represent the amount of immigrants from each state, after some brainstorming went on, We came up with an idea to also visualise lines from immigrants's countries to Australia to get a better understanding of moving patterns in and out of this country.

C) Visual Encoding and Idioms

A choropleth map utilises colour encoding to effectively depict the magnitude of inbound migration in each state.

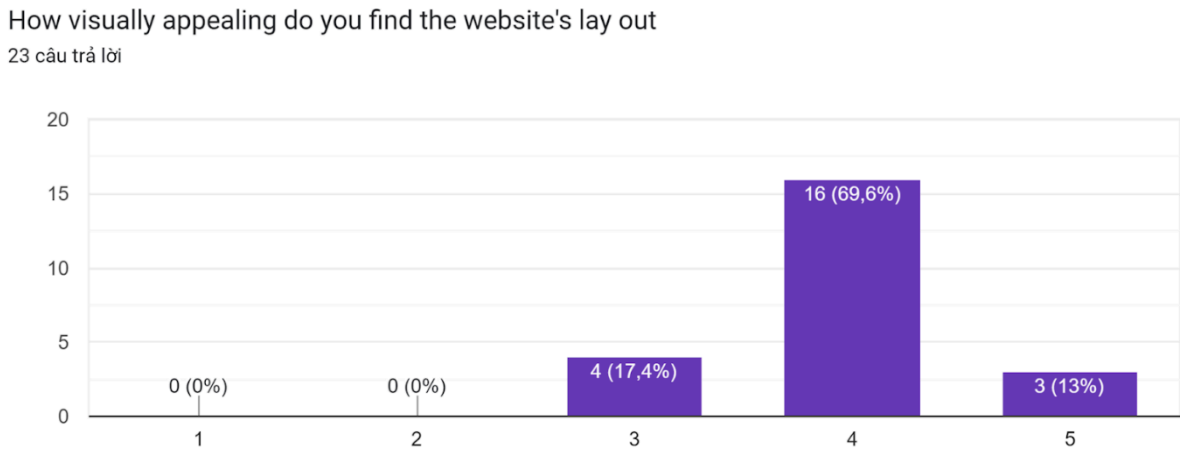
- The colour gradient facilitates a visual ranking system, allowing users to promptly discern states with greater or lesser migration quantities.
- The connection lines linking countries and states aid users in comprehending the source of migrants and visualising the movement of migration across borders.

A line graph is an appropriate option for depicting the migration patterns of various states throughout time.

- By employing lines to connect the data points, users may effectively analyse the overall trends and detect any notable alterations.
- The utilisation of dots as indicators for individual data points enables users to precisely identify certain migration flows and make comparisons across different years and states.

5. Validation

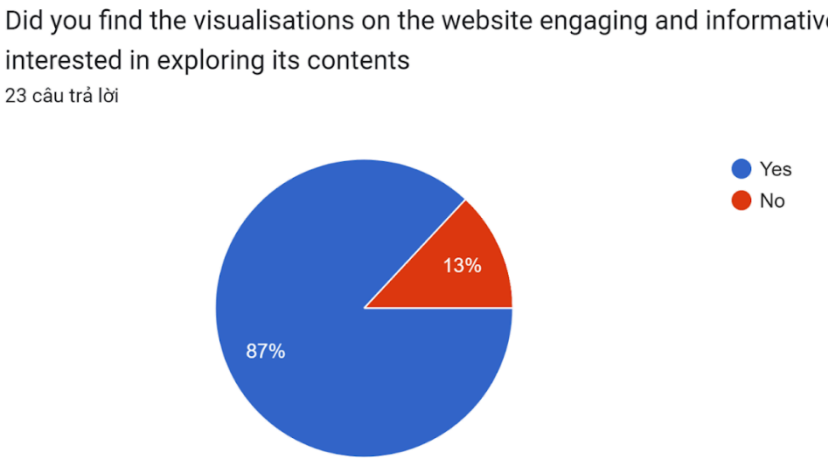
For our first user question, we asked "How visually appealing do you find our website", the response are mostly a 4 over 5 as the most common responses which indicate a fairly good visual that our website is:



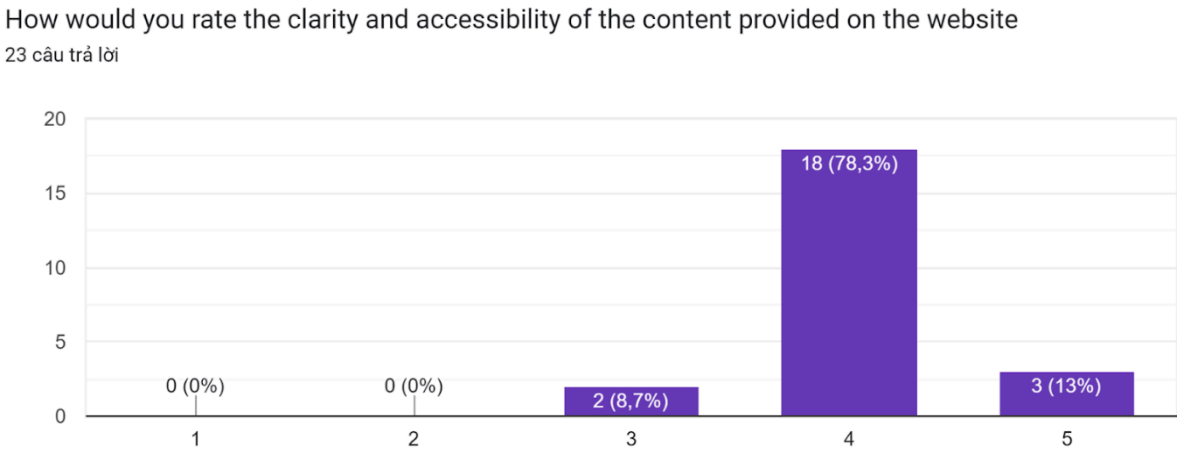
As a result we have to change our layout a little bit which involved colours changed and format.

For the follow up question we asked "Did you find the visualisations on the website engaging and informative enough to keep you interested in exploring its contents". The answers mostly were yes which means our website is really engaging and

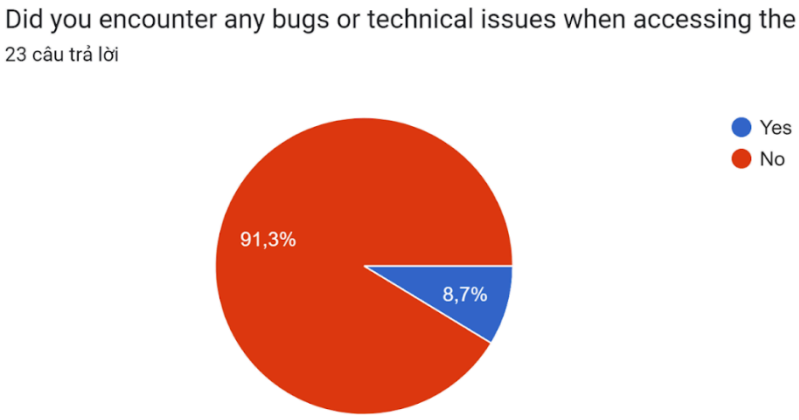
informative.



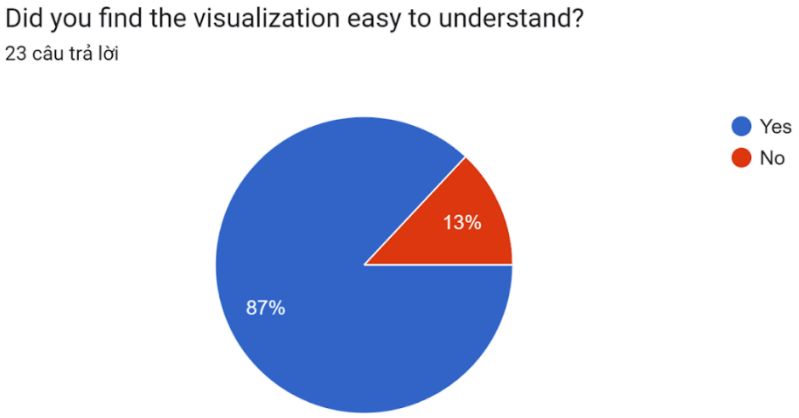
The next question we asked was “How would you rate the clarity and accessibility of the content provided on the website” to understand more about whether our content is clear or not. Most people rate a 4 over 5 which means we need to change some wordings a little to get a better user experience.



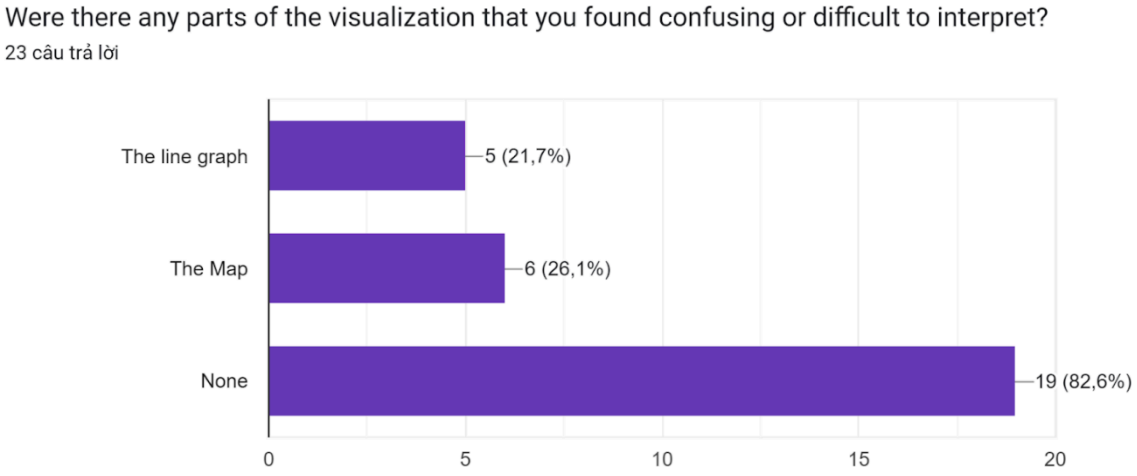
To understand more about the user bugs report, we asked “Did you encounter any bugs or technical issues when accessing the website?” The responses were some bugs were found, which is we had to fix some logic in coding.



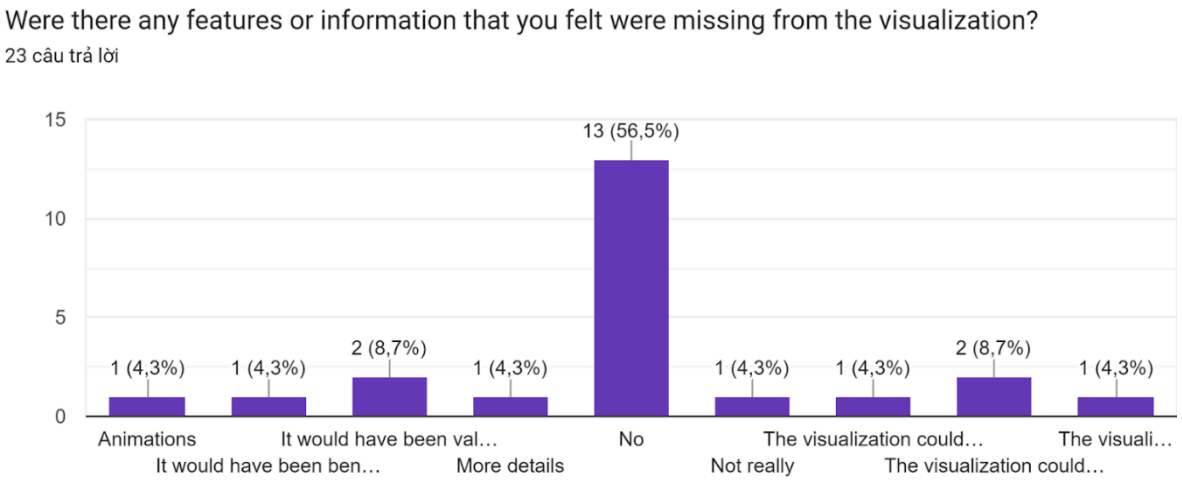
We also asked “Did you find the visualisation easy to understand?” to get a fair view about readability we got some no responses which indicated there are some parts which have many words in their opinions.



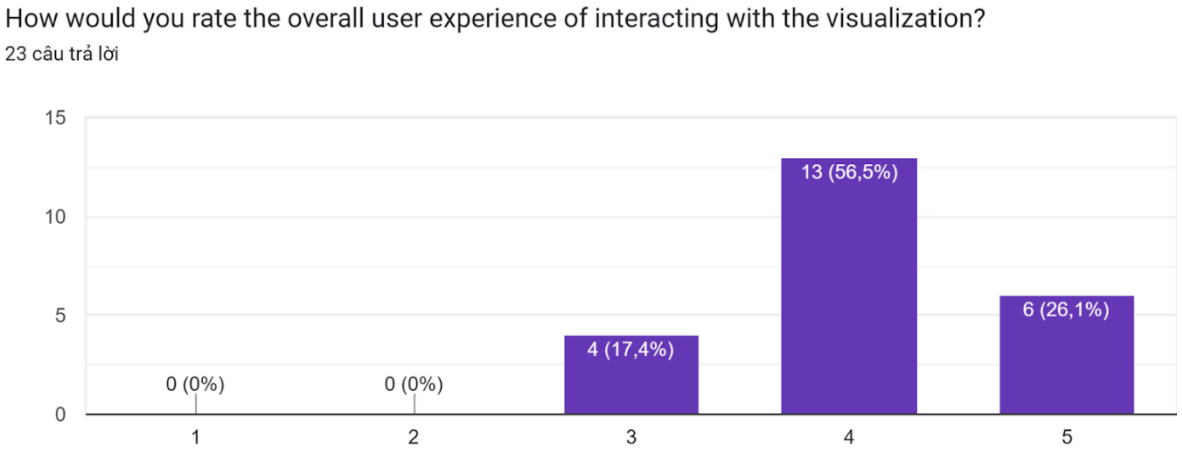
We asked “Were there any parts of the visualisation that you found confusing or difficult to interpret?” to fix any confusion about our visualisation. Those responses were mostly no but 5 people stated that the line graph is difficult to understand because of the tooltip so we fixed that too, the map has some colours unmatched which can be a confusion too.



We also asked for their opinions and we got a lot of constructive feedback which helped us a lot in improving our website. Some people pointed out that our website needs a more refined experience which we did actually change in the end.



Last but not least we asked about how they rate our website overall and the responses were mostly great which we really appreciate that a lot in building a visualisation website.



6. Conclusion

To summarise, the process of developing our website for visualising human movement has been enlightening and productive. Our objective for this project was to create an interactive platform that focuses on the patterns and trends of human migrations, specifically in Australia.

One of the main features we incorporated was a map of Australia that allows users to search for the countries of origin of immigrants. Users have the ability to easily transition to a world map that displays the relationships between countries and the accompanying patterns of

migration by selecting specific regions. This feature provided viewers with a comprehensive comprehension of the worldwide scope of human migration, while emphasising the many origins of individuals seeking new experiences and opportunities.

In addition, we incorporated a line graph and a stacked bar chart to visually represent the influx and outflow of immigrants in Australia, categorised by state. By utilising this representation, users may discern patterns and fluctuations throughout time, enabling them to scrutinise and juxtapose the migration wave across different geographies. Our objective was to enhance the comprehensibility of the material and generate significant insights into the migratory patterns of the country.

During the project, we faced difficulties and made successive design choices to enhance the user experience and efficiently convey the facts. We incorporated functionalities like tooltips, transitions, and interactive elements to augment interactivity and captivate user interest. In addition, we utilised visual encoding methods such as colour gradients, connection lines, and varying bar thickness to efficiently communicate information and aid in the understanding of data.

In summary, this project afforded us practical experience in creating and executing data visualisations. We acquired a more profound comprehension of data preparation, iterative design methodologies, visual encoding strategies, user interaction, and the significance of maintaining a balance between aesthetics and functionality. Undoubtedly, these lessons will be invaluable for future data visualisation projects, as they will provide us with the essential abilities to successfully communicate insights and create compelling data-driven narratives.

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