

Beyond Borders: A Data-Driven Exploration for International Residents Seeking Their Ideal American Home

Ivy Tirok, Maggie Mano, Roy Onyando
Final Project Book
COMPSCI171 - Data Visualization

Initial Proposal

Title: Beyond Borders: A Data-Driven Exploration for International Residents Seeking Their Ideal American Home

Abstract: Embark on an extraordinary, personalized journey with "Beyond Borders," an interactive, visualization tool designed to assist international students and newcomers in finding the perfect state for them. It is always difficult to navigate the unfamiliar terrain of a new country. "Beyond Borders" strives to redefine the relocation experience by providing a comprehensive and user-friendly solution. Users will answer a simple set of questions reflecting their wishes and priorities of which our matching algorithm will select a state or states that align with these chosen preferences. Following that, users can dive into a captivating journey through their matched state(s), where user-friendly visualizations will reveal details about that location such as age, racial and socioeconomic breakdowns for that state. The narrative does not stop there as users will then be able to observe comprehensive comparisons, contrasting their chosen state against others across the nation. In this step, users will be able to discover insights on crime rates, minimum wage, housing prices, poverty metrics, and climate considerations and see how their match compares with other states. "Beyond Borders" emerges as not just a tool but a guide, helping pave the path toward the ideal home for its user and thus fostering a sense of comfort and confidence in the face of the unknown.

Team members: Roy Onyando, Ivy Tirok, Maggie R. Mano

Team Agreement

- We will communicate via iMessage
- We will meet on Wednesdays after class (3.30pm) in Harvard Yard
- We will collaborate on the project using a Git repository
- Coding will be completed asynchronously but each team member will be involved in the technical aspects of the project
- We will maintain a milestone tracker with goals assigned to individual members. This will ensure that the work and work hours is split evenly

Signatures: Ivy Tirok, Roy Onyando, Maggie Mano

Date: Oct 29, 2023

Final Group Proposal

Project Information

Title: Beyond Borders: A Data-Driven Exploration for International Residents Seeking Their Ideal American Home

Team Name: Farm Force

Names	Email Addresses
Roy Onyando	onyandoonyando@college.harvard.edu
Ivy Tirok	Ivy Tirok
Maggie R. Mano	maggiemano@college.harvard.edu

Background and Motivation

The inspiration for "Beyond Borders" stems from our collective understanding of the challenges faced by international students and newcomers when choosing a place to live in the United States. We all come from foreign countries and have never lived in the US outside campus therefore our decisions of states to settle in might not be fully be informed to meet our preferences.

Thus, this idea was born out of a shared desire to alleviate the stress and uncertainties of moving to a new country, where cultural nuances, varying lifestyles, and unfamiliar territories can be daunting. Our motivation is to create a tool that combines data-driven insights with a personalized touch, fostering a sense of comfort and confidence in making such a significant life decision.

Related Work

- The factors used when deciding where to live in the US in this article provide a good reference for us when making the visualizations and choosing what factors to focus on in our webpage.
<https://realestate.usnews.com/real-estate/articles/how-to-decide-where-to-live>
- This website has a similar idea in that it too makes use of visualizations to emphasize to its users how to make the decision of where to live.
<https://medium.com/@justinmilner/when-you-can-live-anywhere-how-do-you-choose-e947cd2666df>
- Zillow has the option to make your home search more personalized in order to find more relevant matches for you. This is very similar to what we want to do except make it more data heavy. <https://www.zillow.com/>

Potential Charts and Visualizations

The potential chart ideas and their respective goals highlight the questions we aim to answer with our project.

- Heatmap of Happiness: A geographic heat map visually represents the happiness indices across various U.S. states.
 - Goal: To provide an at-a-glance view of the happiness distribution, aiding users in understanding which states have generally higher or lower reported happiness.
- Stacked Bar Chart of Demographic Distribution: A bar chart illustrates the distribution of age groups, ethnicities, and income levels within the selected state.
 - Goal: To visually depict the demographic makeup of the potential residence, facilitating a quick comparison between age groups, ethnicities, and income levels.
- Interactive Crime Rate Map: An interactive map displays crime rates in various cities within the chosen state. Users can click on specific areas to view detailed crime statistics and trends.
 - Goal: To offer an interactive exploration of crime rates, allowing users to assess the safety of different cities within the state.
- Bubble Chart for Cost of Living: A bubble chart visually represents the cost of living in different cities within the state. Bubble size represents the population, and color intensity indicates the cost of living.
 - Goal: To showcase variations in the cost of living across cities within the state, helping users identify areas with a more affordable lifestyle.
- Line Chart for Minimum Wage Trends: A line chart illustrates the historical trends of minimum wage in the selected state over a specified time period.
 - Goal: To visually communicate changes in minimum wage over time, offering insights into the state's labor market dynamics.
- Radar Chart for Cultural Amenities: A radar chart visually represents the availability of cultural amenities (such as museums, theaters, parks) in the selected state.
 - Goal: To create a comprehensive overview of the state's cultural and recreational opportunities, allowing users to identify areas with diverse amenities.
- Comparison of Housing Prices: A bar chart compares median housing prices in different regions of the state, providing a visual comparison of affordability.
 - Goal: To enable users to assess how housing prices vary across regions within the state and how they compare to national averages.
- Treemap of Education Metrics: A treemap visually presents education metrics such as literacy rates and school quality, with each rectangle representing a specific metric category.
 - Goal: To offer a visual breakdown of the state's education landscape, facilitating easy comparison of key metrics.
- Weather Trends Line Chart: A line chart showcases historical weather trends for the state, presenting temperature and precipitation patterns over a specified timeframe.
 - Goal: To provide insights into the typical weather patterns, helping users understand the climate and its potential impact on their preferences.

Data

World Population Review: <https://worldpopulationreview.com/>

United States Census Bureau: <https://data.census.gov/>

Kaggle: <https://www.kaggle.com/datasets/mathchi/violent-crime-rates-by-us-state>

Data Cleanup

- **Do you expect to do substantial data cleanup?** Yes, although the data we are likely to find will be clean, we want to combine a lot of the data together to make it easier to use so we don't have too many csv files. We will be using
- **How will data processing be implemented?** We will split any data processing work. Initially, data will be collected from multiple sources and then stored in csv files for ease of access. Once collected, the data will undergo a cleaning process if needs be. Following this, data processing will involve careful analysis to derive meaningful insights.

Project Map

Discussion

Audience

1. International Students and Newcomers

Our primary audience consists of international students and newcomers planning to move to the United States. These individuals, including international students, recent immigrants, and those unfamiliar with the U.S., can benefit significantly from the "Beyond Borders" project. The tool is designed to provide personalized insights and data-driven guidance to facilitate a smoother decision-making process when choosing an ideal state for residence. By offering comprehensive visualizations and comparisons, the project aims to empower international students and newcomers to make informed decisions about their new home.

2. Human Resources and Relocation Specialists

This audience comprises professionals in HR and relocation services who assist individuals in their transition to a new location. Human Resources specialists, relocation experts, and those responsible for guiding individuals through the relocation process can leverage the tool to enhance their services. "Beyond Borders" offers valuable information that can be utilized by HR professionals to provide better advice and support, ensuring a better experience for individuals relocating to the United States.

3. Urban Planners and Policymakers

This audience includes government officials, policymakers, and urban planners involved in regional development and city planning. This group can benefit from the project's visualizations, gaining insights into demographic trends, economic factors, and cultural amenities. Policymakers and urban planners can use the data-driven information to make informed decisions about regional development, resource allocation, and city planning.

Target Audience

The target audience, policymakers, and government officials in the agricultural and economic sectors are likely to possess a varied degree of knowledge and interests.

- Knowledge:

- *Expertise:* The audience is diverse, ranging from those with limited knowledge about the United States to individuals who have conducted in-depth research. Their familiarity with U.S. culture, geography, and opportunities may vary significantly, however, they probably have not seen so many metrics and factors side by side when evaluating a state.

- *Understanding of Data:* Most users are expected to have basic to intermediate familiarity with data visualizations, but not an advanced level of understanding. The project will present information in a way that is easily comprehensible, considering potential language barriers as well.
- Interests:
 - *Cultural Fit:* They are primarily interested in finding a state that aligns with their lifestyle, values, and cultural preferences. Since they are moving to a new reality and country, they would want to prioritize whether they would fit in and be accepted wherever they choose to live.
 - *Practical Concerns:* Practical aspects such as job opportunities, cost of living, safety, and educational facilities are also huge when looking for a place to live.
- Visualization Literacy:
 - *Basic to Intermediate:* International students and newcomers might have a varied level of visualization literacy. However, in order to be accessible to every possible client, the visualizations may have to be more simple and easy to interpret.
 - *Preference for Clear, Actionable Insights:* They would likely appreciate visualizations that are clear considering potential language barriers. Visualizations should rely on universally understandable graphical representations and it is probably best to accompany them with detailed descriptions.
- Level of Detail:
 - *Simplified Visuals:* Visualizations should be straightforward, offering clear and easily interpretable information to accommodate users with varying levels of familiarity with data representations.
 - *Personalized Insights:* The project aims to provide highly personalized insights, ensuring users can easily understand how their preferences align with the characteristics of specific states.
 - *Practical Recommendations:* Information should be presented in a manner that facilitates actionable decisions, such as recommending states that best match their preferences and priorities.

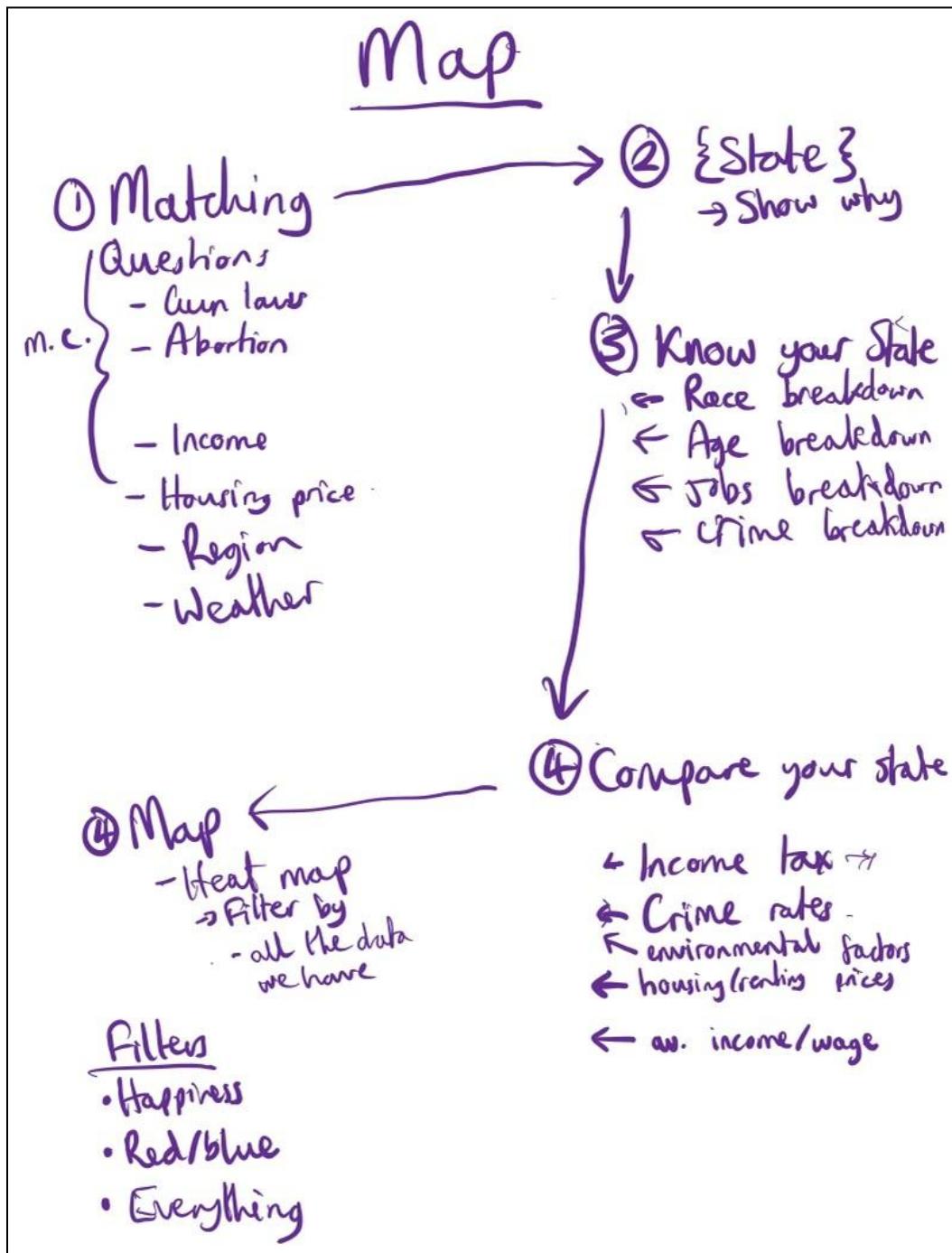
Questions

1. What industries are dominant in each state, and which states offer the best job opportunities in a particular field of study or profession?
2. How does the unemployment rate vary across different states?
3. What is the average cost of living in each state, considering factors like housing, transportation, and groceries?
4. What are the educational opportunities in the state, including the presence of universities, colleges, and quality of schools?
5. Which states have lower crime rates and are considered safer for residents?
6. What's the difference in legality of abortion in states?
7. How strict are gun laws across the US and how has gun death rates changed over time?
8. What is the spread of political affiliation across US states?
9. What is the climate like in each state, and does it align with the user's preferences for weather and environmental conditions? Have there been any significant climatic events in the state?
10. How diverse is the population in terms of ethnicity, and how inclusive is the community for newcomers?
11. How does the healthcare system in each state compare? Are there states with better healthcare access? Are individuals required to have health insurance? Are there states with better facilities?
12. How well-developed is the public transportation system in each state, and how does it impact daily commutes?
13. Which states are projected for economic growth, job market expansion, and overall development in the coming years?
14. How diverse is the population of the state? What is the age distribution?
15. Which state would best align with my preferences in general?

Data Information

We have data mainly from censuses and World Population Review where we have the states and their relative indices. The states are examples of categorical data such as: region/countries, item/crop/product. These simply state the name of their respective field. We then have various continuous variables such as poverty rates, minimum wage, population, etc. We also have discrete counts such as the breakdown counts of age, race, wtc. Then the year field is in the time category.

Drawing Board



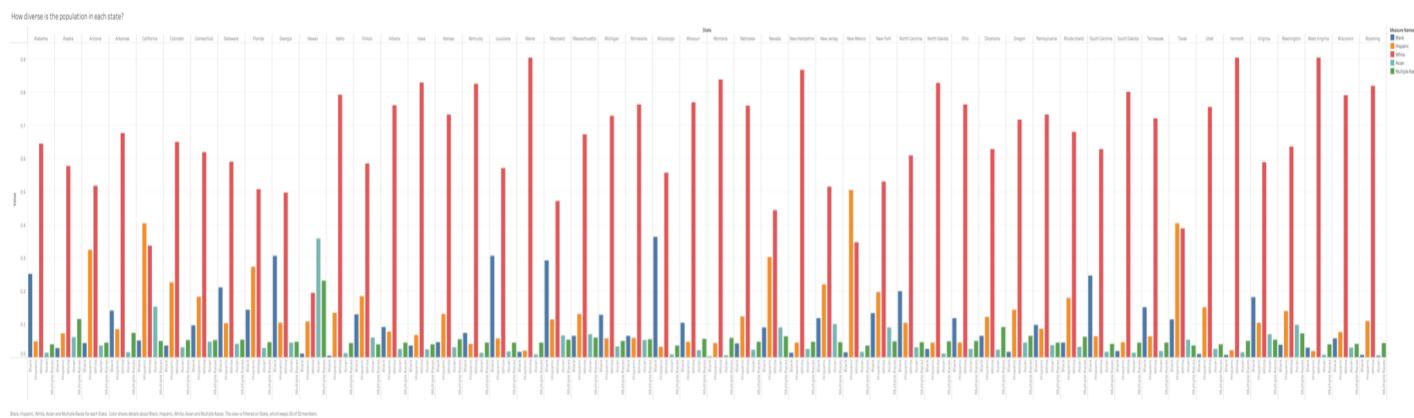
Initial Visualizations

Ivy Tirok

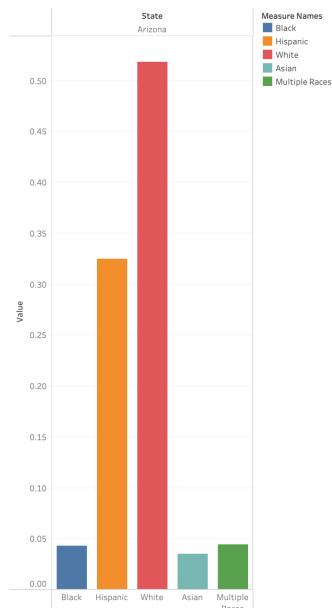
Data Sources:

<https://worldpopulationreview.com/>

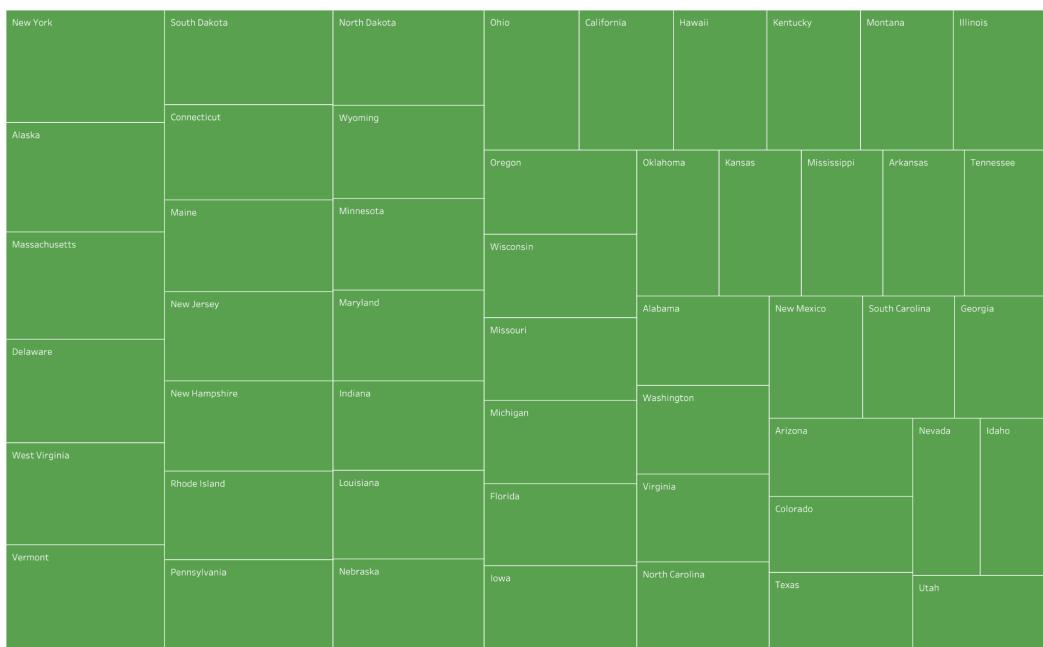
<https://www.kff.org/>



How diverse is the population in each state?

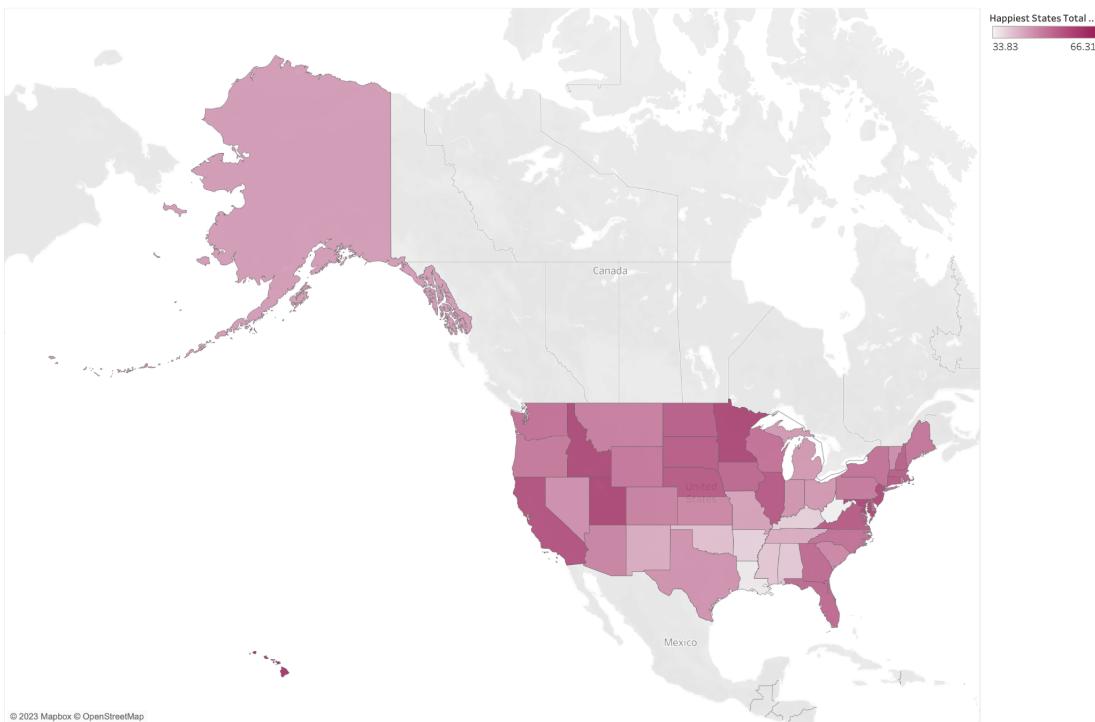


How does the healthcare system in each state compare? What are the average per capita costs to access care?



State. Size shows sum of HealthCareCostsSpendingPerCapita2020KFF. The marks are labeled by State.

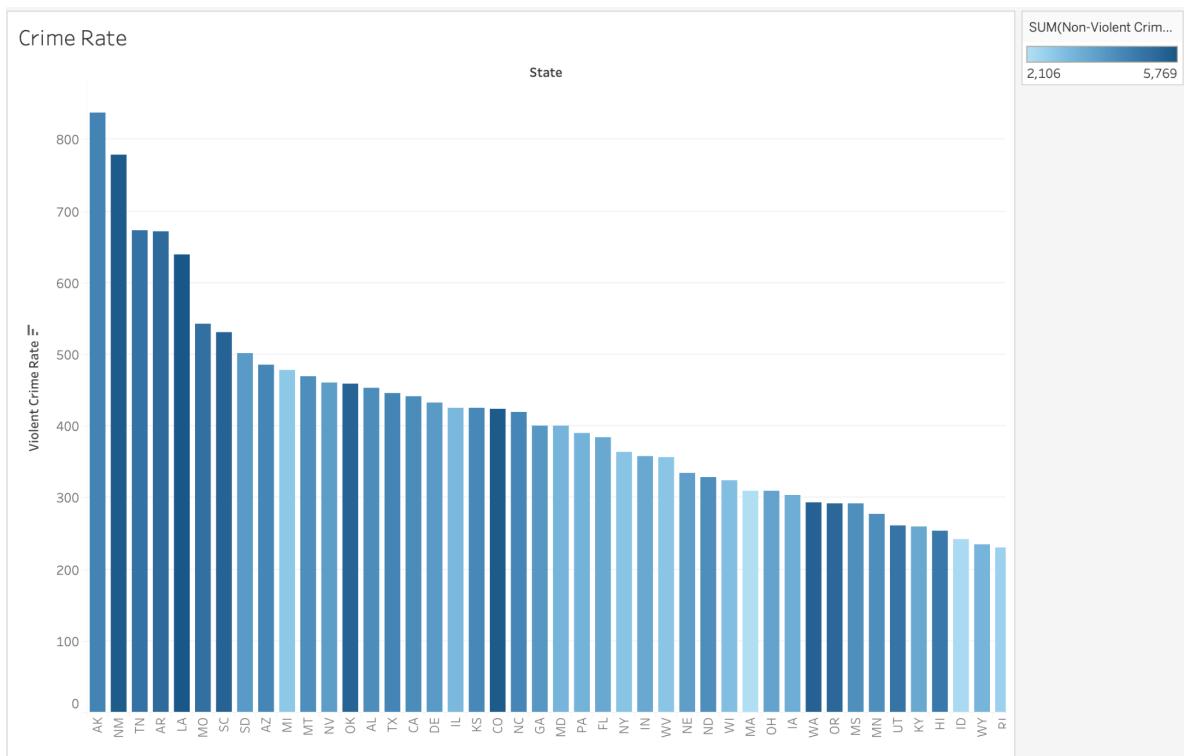
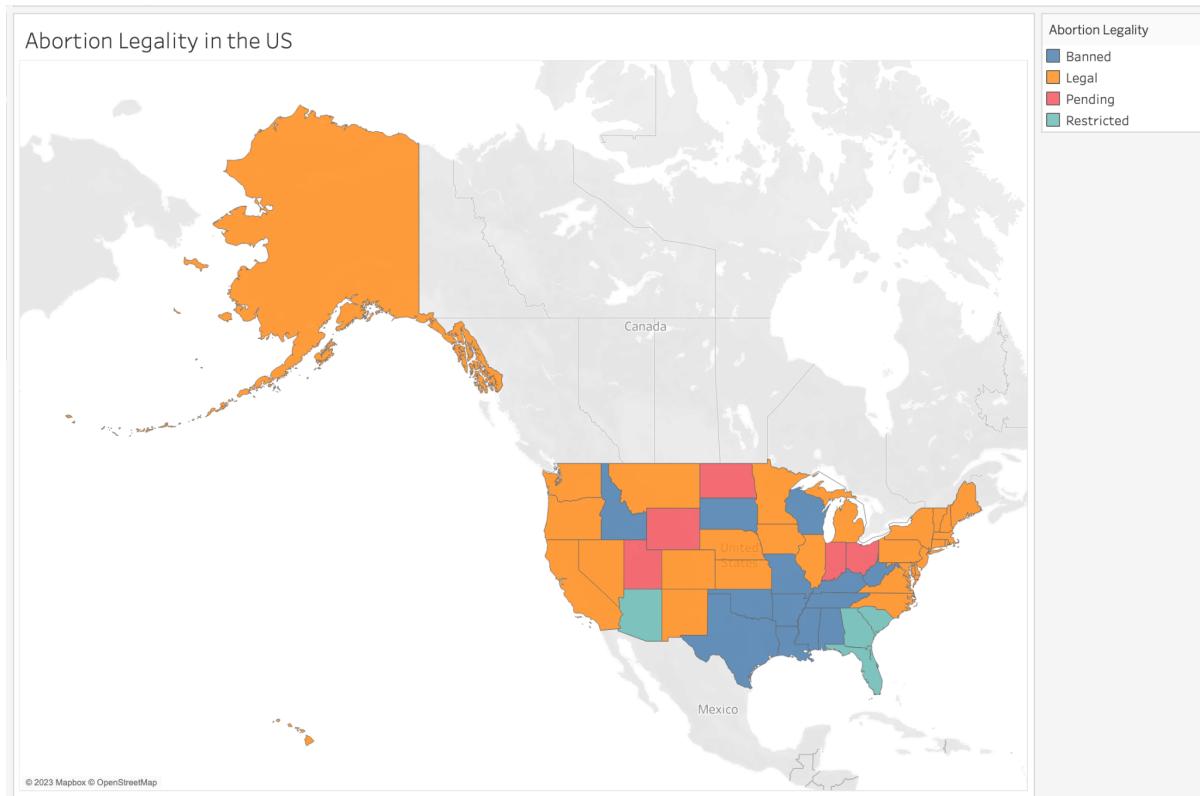
How happy are the individuals living in each state? How do they rank in terms of community, culture and work environment?



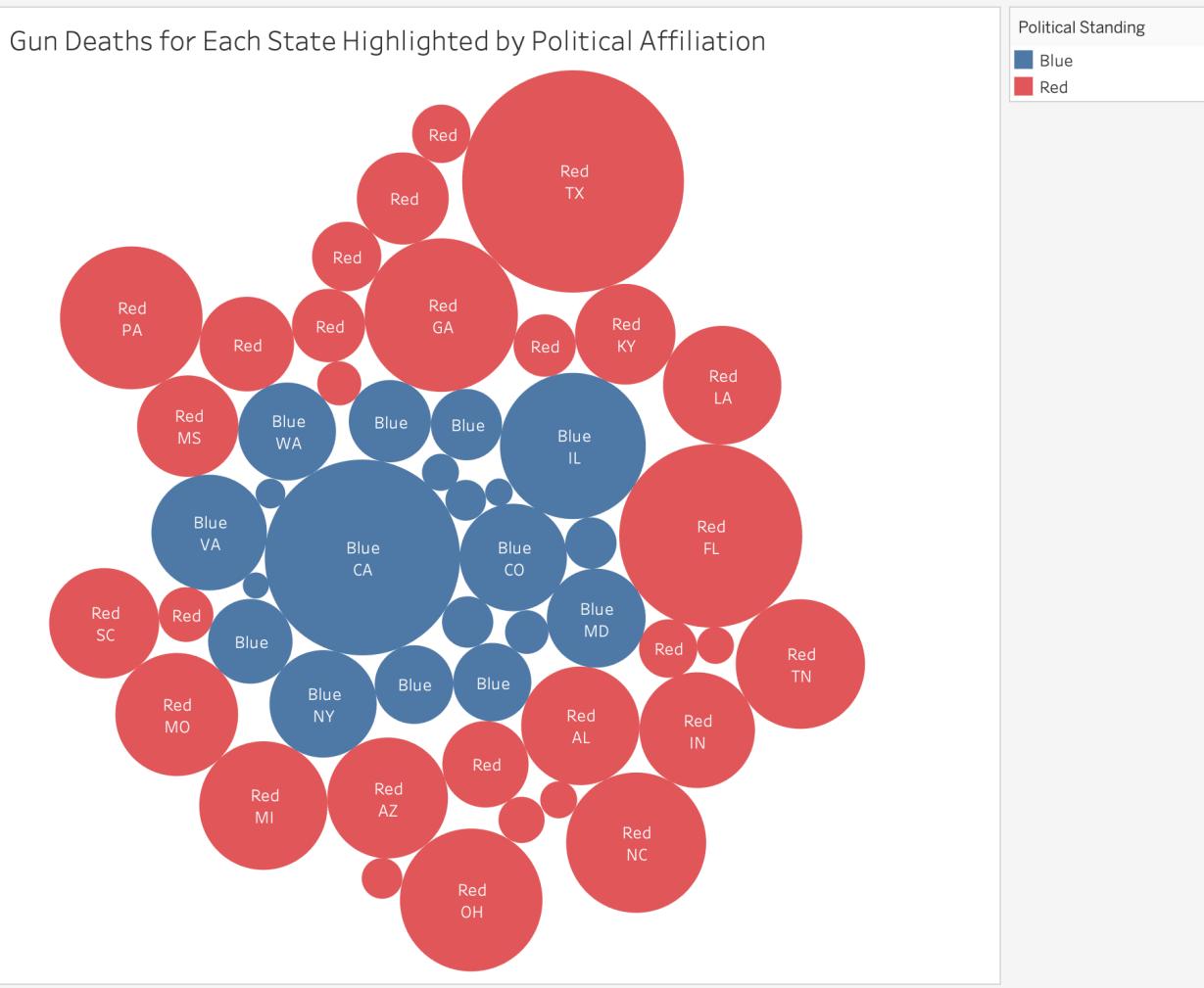
The preliminary visualizations above answer the questions related to race distribution, healthcare costs and happiness level by state. Due to design limitations on Tableau, it was difficult to create more interesting visualizations which would better answer the users questions and help them gain key insights. However, we intend to create more interactive visualizations on d3 which would be more engaging for the user.

Maggie R. Mano

Data Source: <https://worldpopulationreview.com/states>

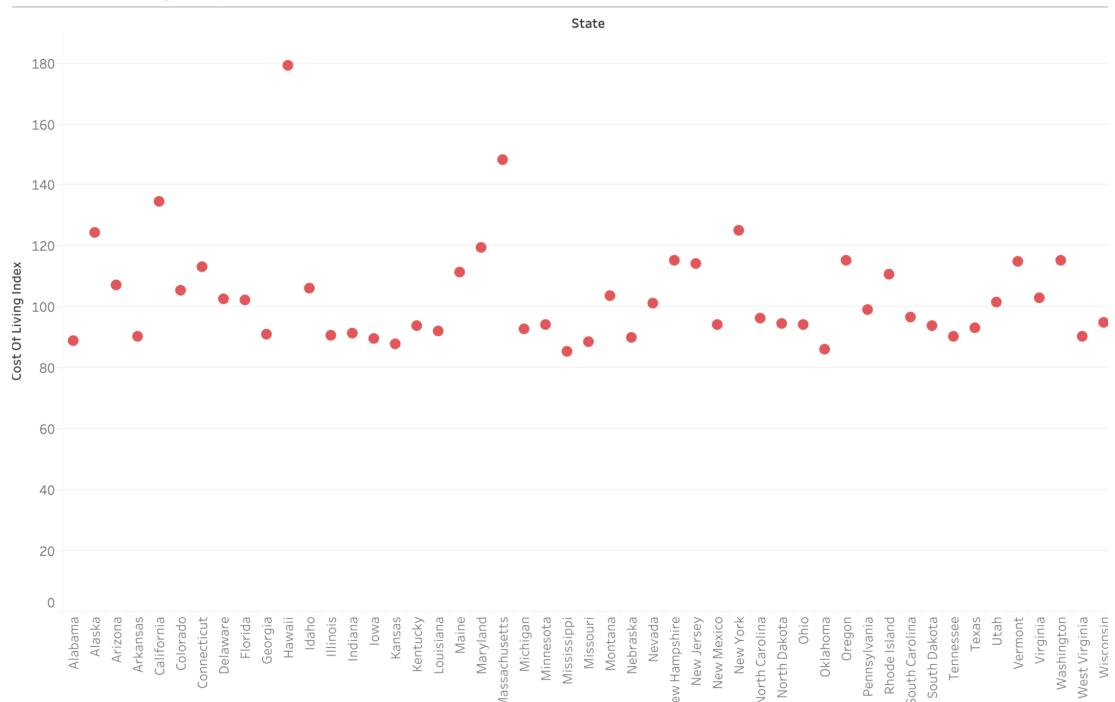


Gun Deaths for Each State Highlighted by Political Affiliation

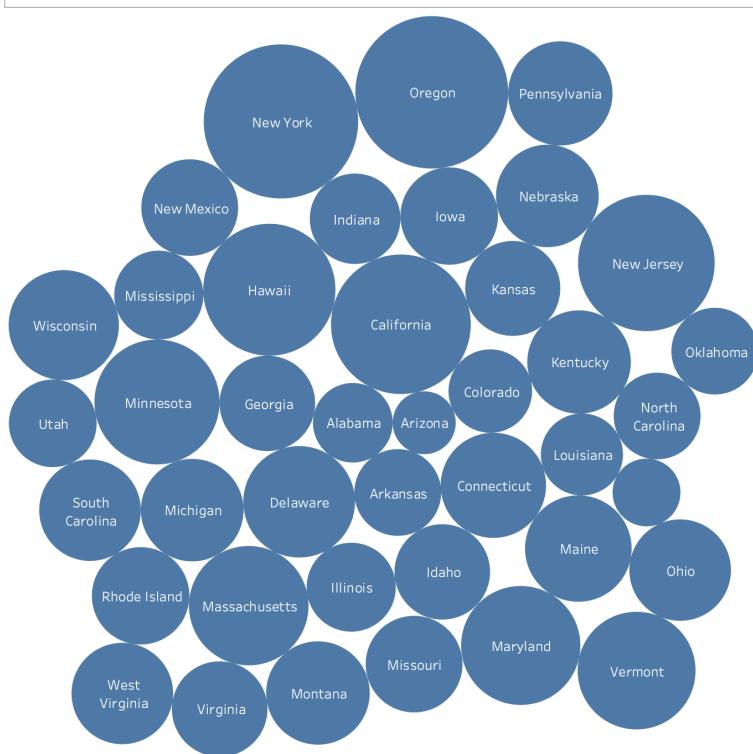


The initial visualizations above answer questions related to political affiliation with relation to gun death rates, abortion legality across the states as well as how crime rates vary across the US. The visualizations could be more user friendly such as the bubble chart which is a bit hard to interpret. However, the heat map and the bar chart are easy to interpret but the bar chart might be too bland for this project. The heat map could highlight multiple features at once so users can view various differences across states without looking at a different visualization.

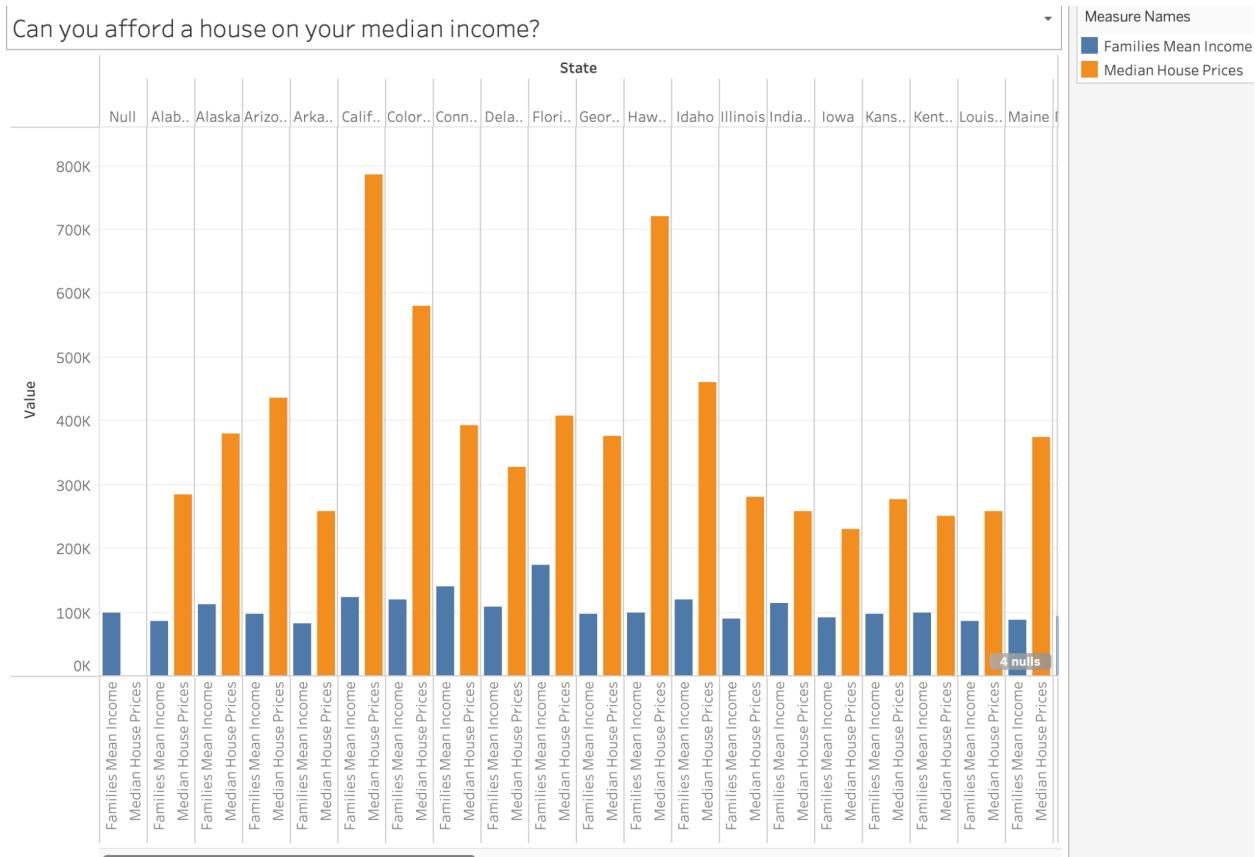
The Cost of living comparison between States.



Maximum State Income Tax



Can you afford a house on your median income?



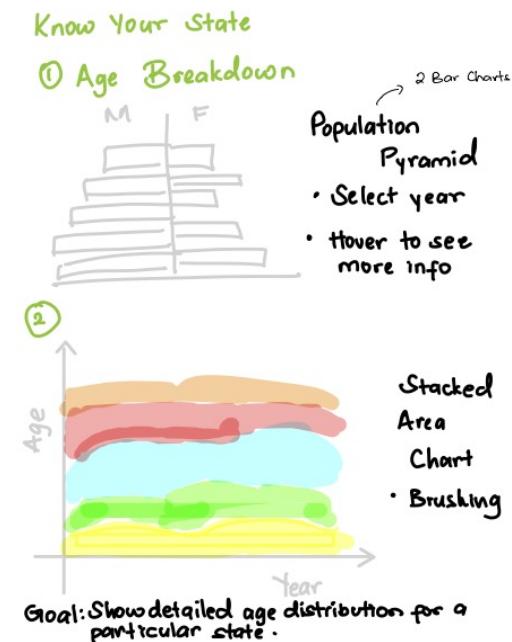
The current visualizations answer questions related to unemployment rates across the country, the average cost of living in each state and how they compare using the cost of living index, comparison between average income and median house prices, and state income tax rate percentages. I just realized the visualization for the cost of living comparison between different states is hard to connect the scatterplot dot to the state as they are too close together. The bubble chart comparison does not offer easy comparison between the states. The tree maps visualization is very clear and convenient as it correctly shows the changes by color and size.

Data, Sketches, Decide & Storyboard

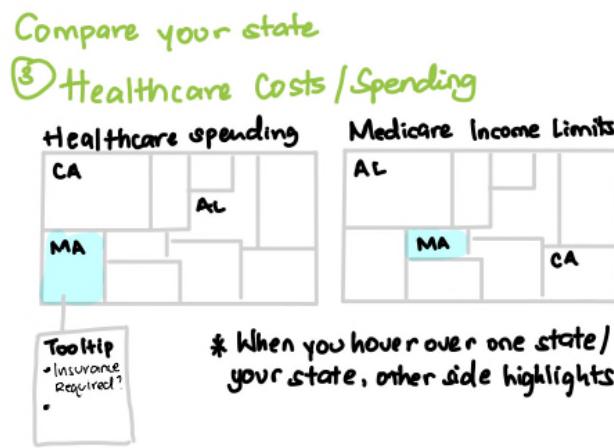
Sketches

Ivy Tirok

Questions Answered: (14) How diverse is the population of the state? What is the age distribution?



Questions Answered: (11) How does the healthcare system in each state compare? Are there states with better healthcare access? Are individuals required to have health insurance?



→ Linked visualization. Hover over one side shows corresponding side.

Goal: Show disparity between healthcare spending and medicare access / limits.

Questions Answered: (9) What is the climate like in each state, and does it align with the user's preferences for weather and environmental conditions? Have there been any significant climatic events in the state?

④ Climate.

Goal: Breakdown of climactic events by state.



Legend

- Wildfires
- Heatwave
- ...
- Earthquake
- Floods

Timeline with circles of different colors showing the different climactic events that occurred in the region
→ Sortable by color.
↳ Animated

Questions Answered: (15) Which state would best align with my preferences in general? (Main question of the project)

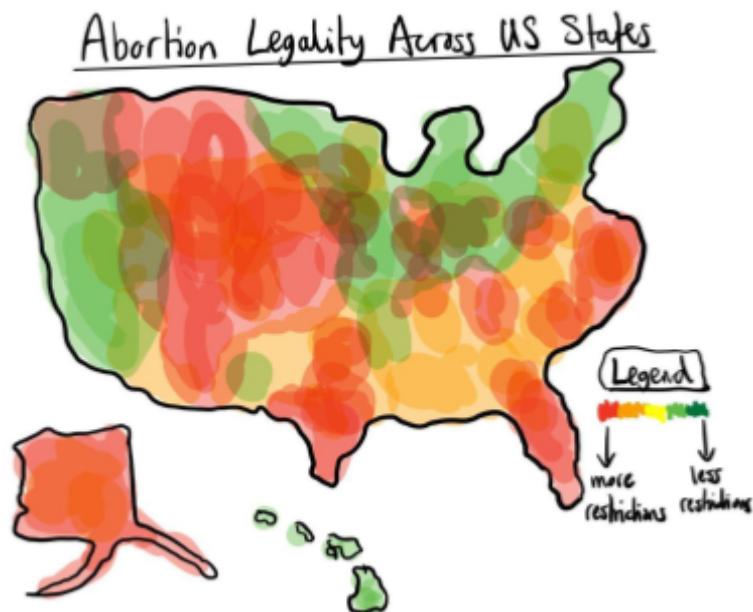
⑤ Pick a State

Have a radar map with 5/6 diff categories. Users can drag the map around and are given a state.



Maggie Mano

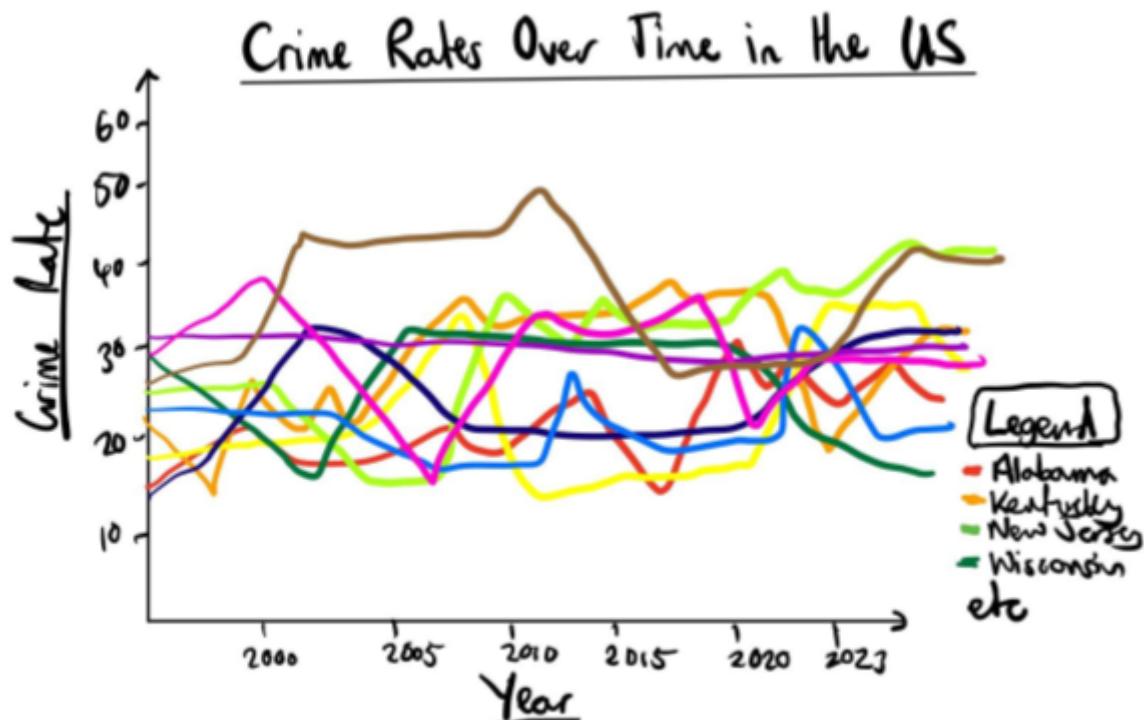
Sketch 6



Sketch 6: Abortion Legality Chloreopath Map

Question answered: 6. What's the difference in legality of abortion in states?

Sketch 7

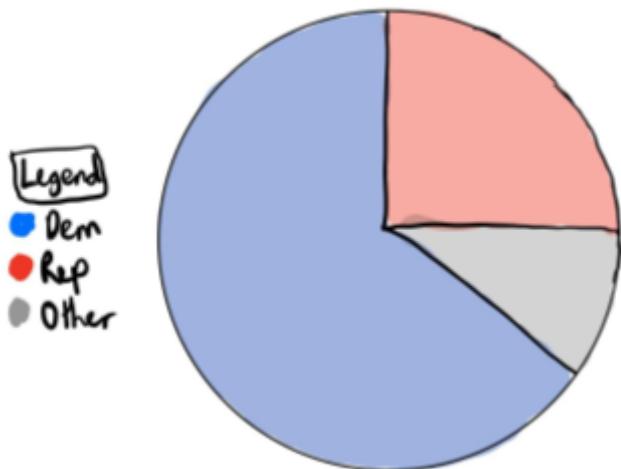


Sketch 7: Crime Rate Line Graph

Question answered: 5. Which states have lower crime rates and are considered safer for residents?

Sketch 8

Political Affiliation in Selected States

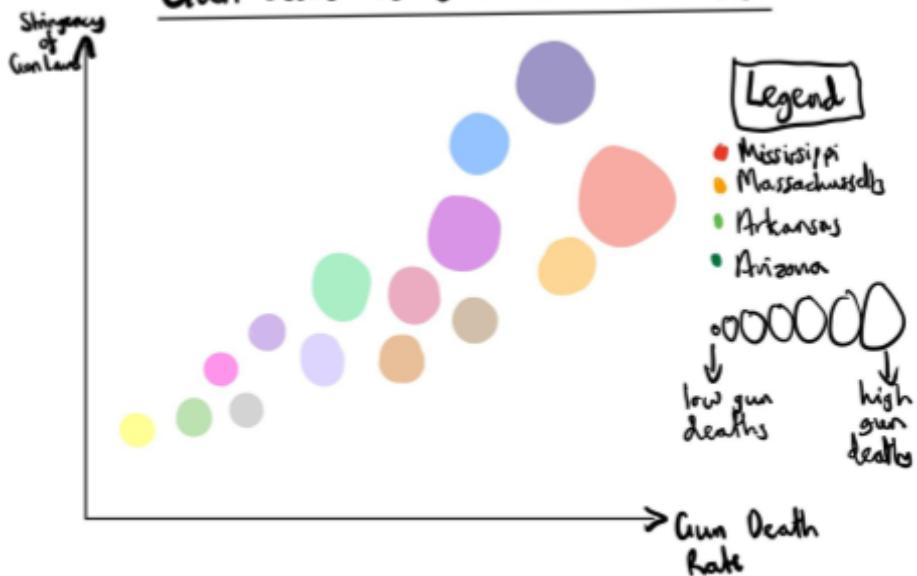


Sketch 8: Political Affiliation Pie Chart

Question answered: 8. What is the spread of political affiliation across US states?

Sketch 9

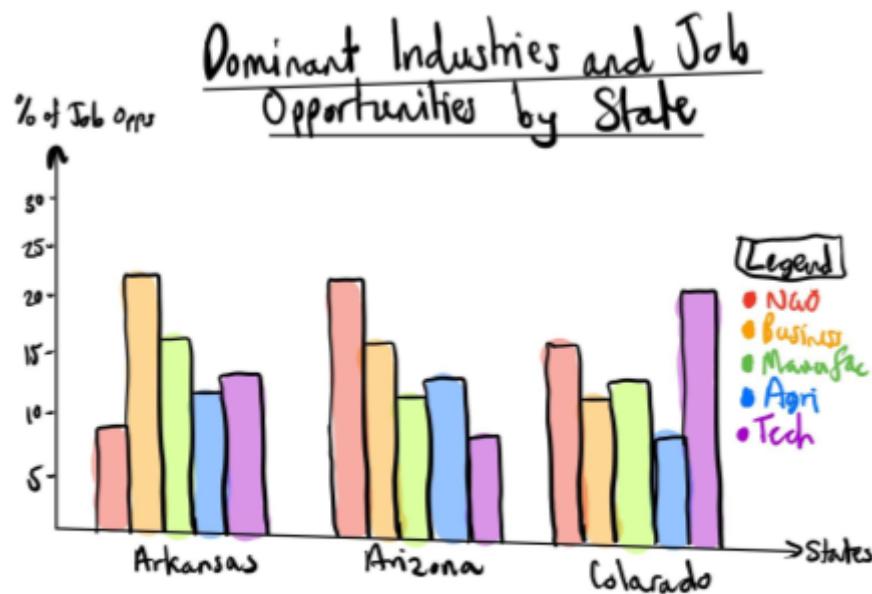
Gun Laws vs Gun Death Rates



Sketch 9: Gun Laws vs Gun Deaths Bubble Scatter Plot

Question answered: 7. How strict are gun laws across the US and how has gun death rates changed over time?

Sketch 10



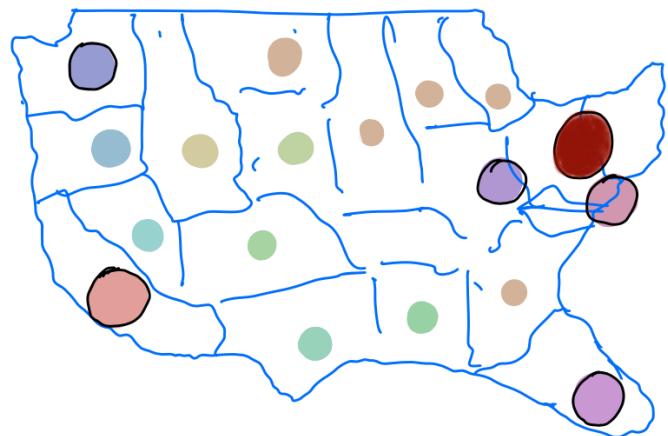
Sketch 10: Stacked Bar Chart showing Dominant Industries and Job Opportunities by State

Questions answered: 1. What industries are dominant in each state, and which states offer the best job opportunities in a particular field of study or profession? 13. Which states are projected for economic growth, job market expansion, and overall development in the coming years?

Roy Onyando

Sketch 11

1. Compare median house prices by state.



→ Bubble charts on a map that varies in size and color for distinction.

Goal is to easily compare the median house prices across the states while also placing them on the map as the people coming into the US might not be very familiar with all the states.

Question Answered: (3) What is the average cost of living in each state, considering factors like housing, transportation, and groceries?

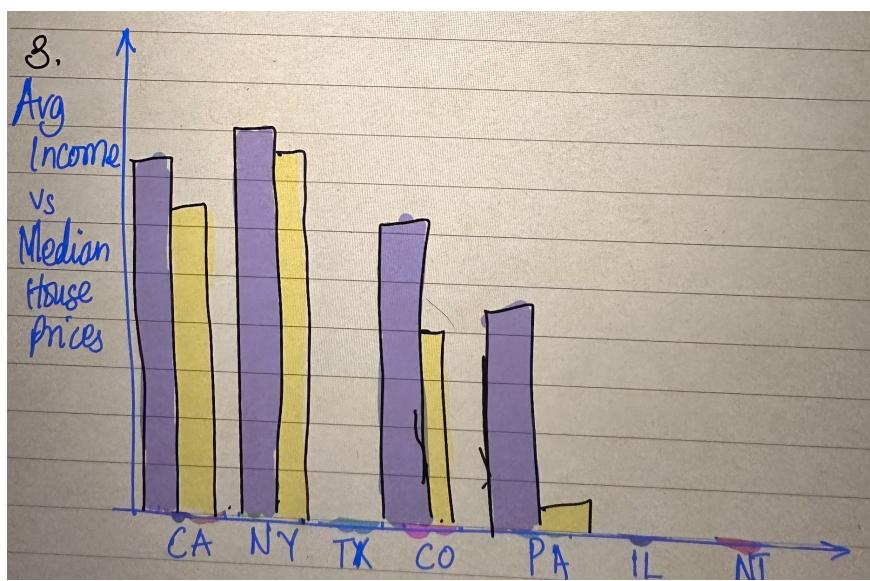
Sketch 12

Question Answered: (2) How does the unemployment rate vary across different states?



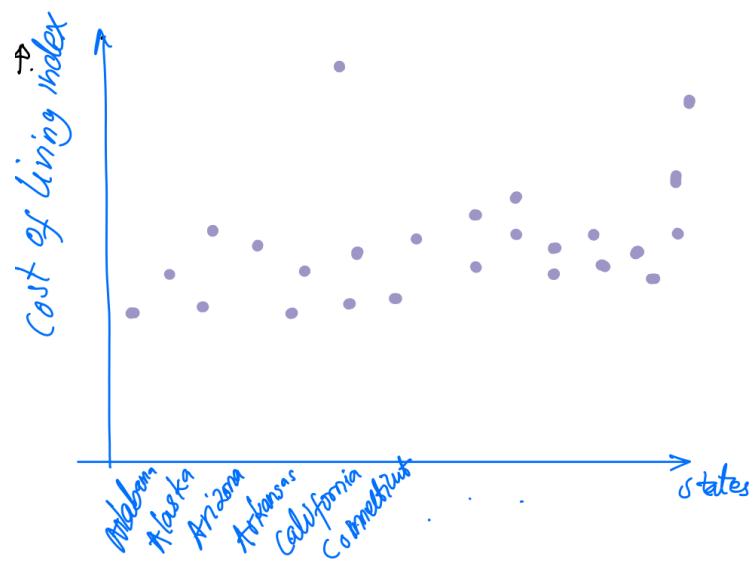
Legend
Dark red - highest unemployment
green - the lowest rate of unemployment.

Sketch 13

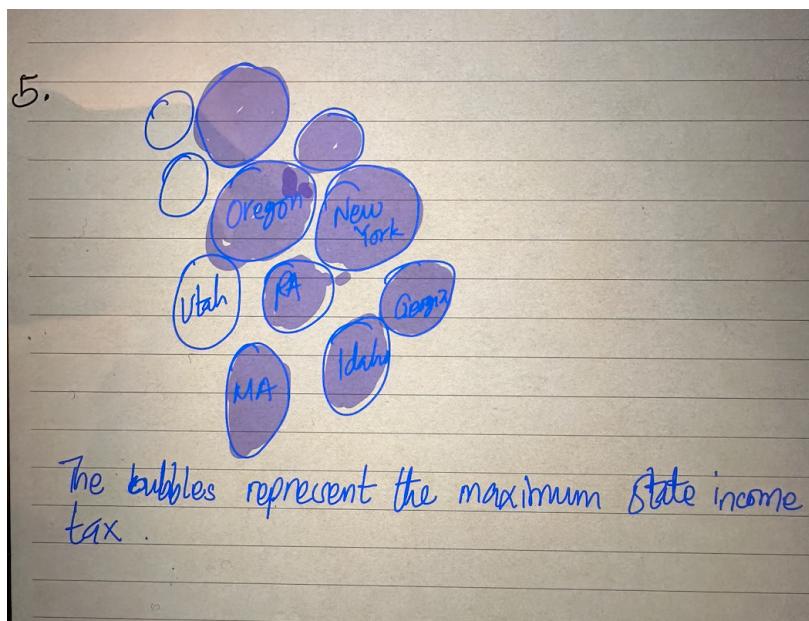


Gives a unique comparison between the median household income and the median house prices in that given state as this comparison is more understandable using familiar metrics.

Sketch 14



Sketch 15



Provides information about the maximum state income tax by percentages which offers additional perspective into the cost of living.

Decide Step

Sketch ID	Question ID	Author	No. of Votes
1	14	IT	
2	14	IT	
3	11	IT	2
4	9	IT	3
5	15	IT	3
6	6	MRM	1
7	5	MRM	
8	8	MRM	1
9	7	MRM	3
10	1, 13	MRM	1
11	2	RO	
12	3	RO	1
13	3	RO	
14	3	RO	
15	3	RO	

Final Chosen Sketches

④ Climate.

Goal: Breakdown of climactic events by state.



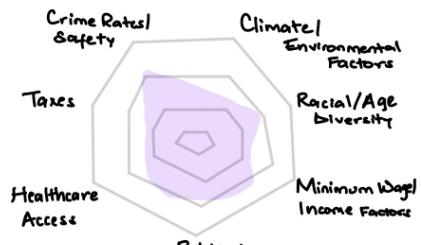
Legend

- Wildfires
- Heatwave
- Earthquake
- Floods

Timeline with circles of different colors showing the different climactic events that occurred in the region
→ Sortable by color
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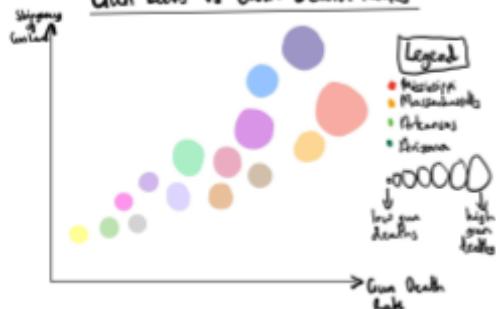
⑤ Pick a State

Have a radar map with 5/6 diff categories. Users can drag the map around and are given a state.



Based on your choice, we suggest
Learn more about
your state below.

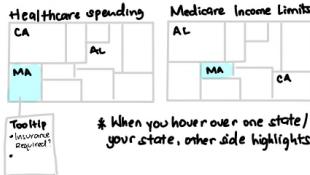
Gun Laws vs Gun Death Rates



Sketch 9: Gun Laws vs Gun Deaths Bubble Scatter Plot

⑥ Compare your state

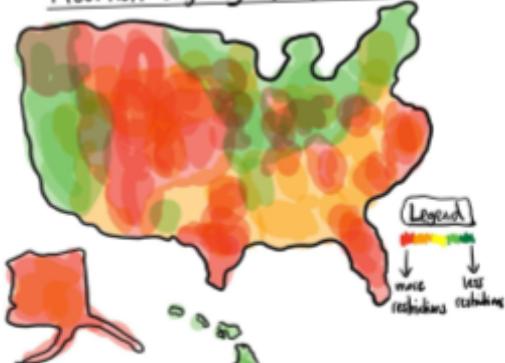
⑦ Healthcare Costs / Spending



→ Linked visualization: Hover over one side shows corresponding side.

Goal: Show disparity between healthcare spending and medicare access / limits.

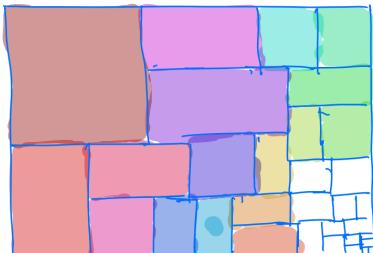
Abortion Legality Across US States



Sketch 8: Abortion Legality Choropatht Map

⑧ Unemployment rates in percentage of 1%

8.



Legend

Dark red - highest unemployment
green - the lowest rate of unemployment.

Insights

Ivy Tirok

- There is wide variation in healthcare costs vs. insurance requirements/Medicaid enrollment by state
- States with less diversity tend to have a lower happiness score index

Maggie Mano

- States that have a higher percentage of support for the Republican party tend to have less strict gun laws and more strict abortion laws.
- Gun death rates have increased dramatically over time during the 21st century across most US states.
- There are important anomalies that exist such as majority conservative/Republican states where abortion is legal like Pennsylvania. This shows why our tool is necessary because users who prefer to live in more conservative states that still have access to abortion would be shown viable state options where that applies.

Roy Onyando

- Some states have high cost of living despite having 0% state income tax such as Texas.
- The huge margin of difference between the median house price and the average income most often represents the cost of living in those specific areas e.g California's median house price being almost triple the average income is also reflective of the high cost of living in the state.

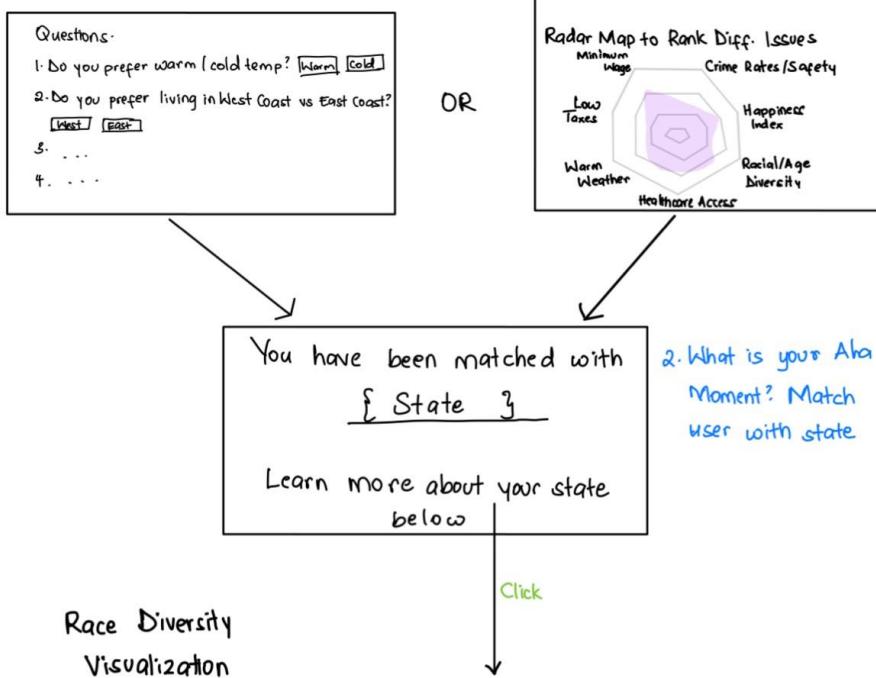
Main Insight

- There are a plethora of factors that come into play when analyzing whether a state is a good pick for you.

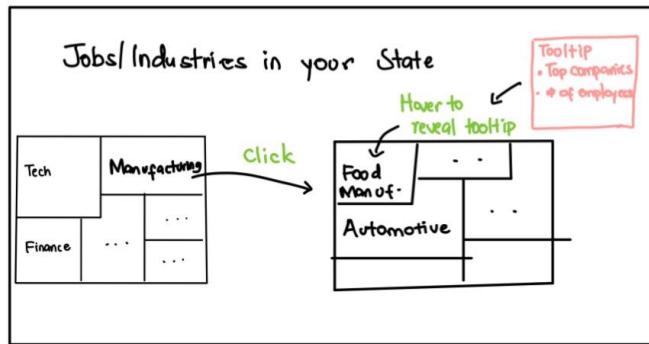
Data Storyboard Sketch

STORYBOARD

1. Where does your story begin? MATCHING STAGE

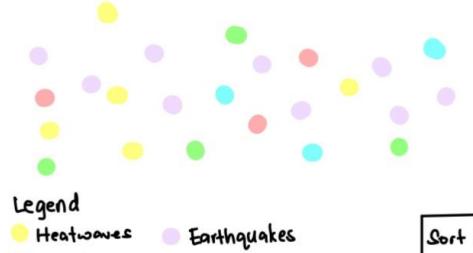


3. Select your rising insights? Learn more about your state



Example sketches
... see more on next page

Breakdown of Climactic Events



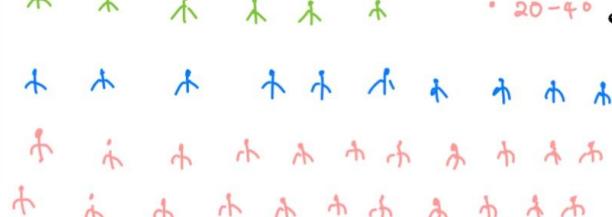
Sort by Type ↗

Click Sort all bubbles by type

Age / Race Composition

Drop down
AGE RACE

- 65+
- 40-65
- 20-40 etc.



Click

Select to view info on race composition vs age composition

4. Now that you've learnt about your state, how does it compare to others on _____ issues?

See how your state compares: Click

Health

Gun Laws vs Gun death

Environment

Taxes

Abortion

Housing Prices

Click

(Sketch) 13

Click

(Sketch 3)

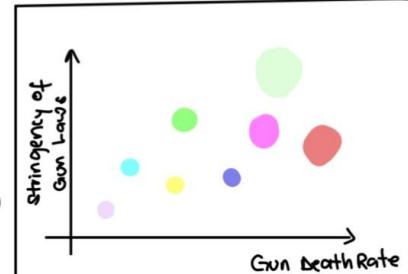
Click

(Sketch 6)

Click

(Sketch 5)

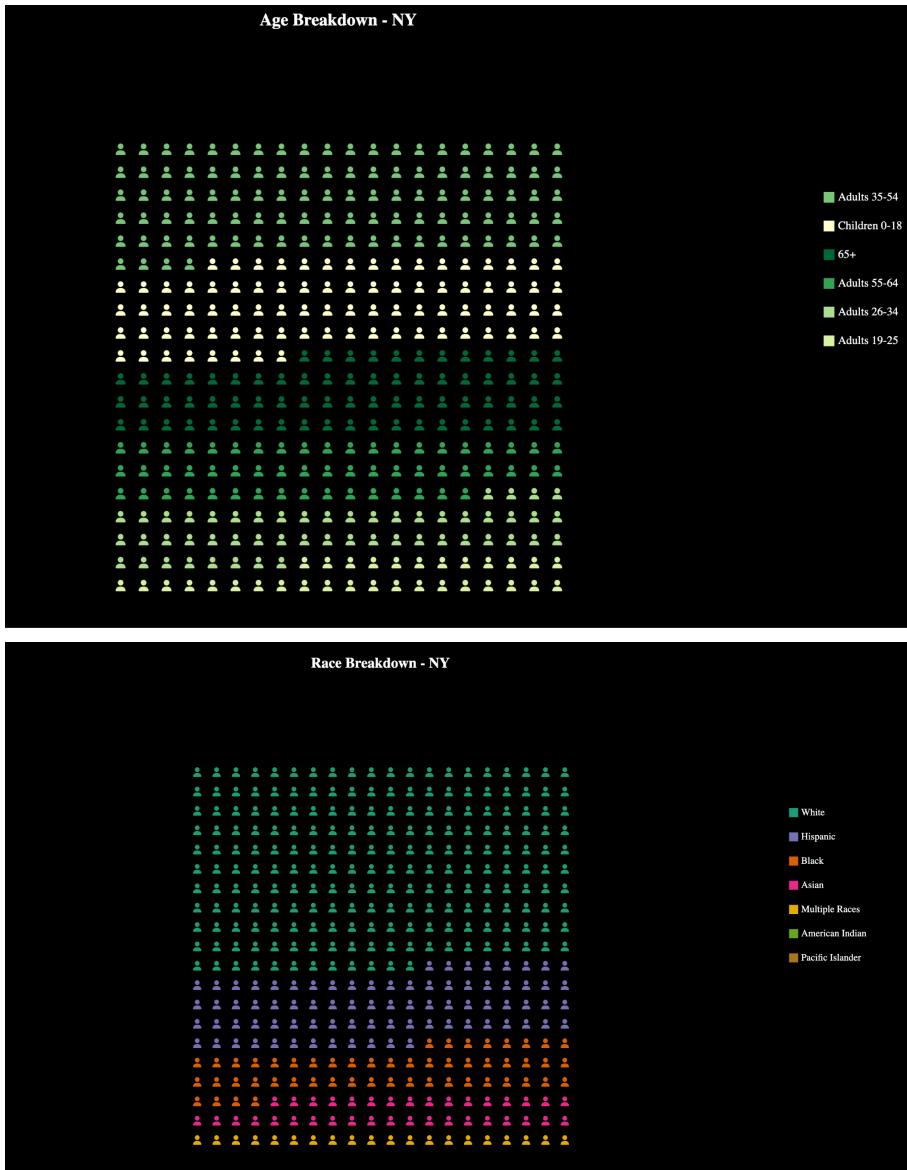
Sketch 9



Prototype V1

Innovative Vis Design

1. Age and Race breakdown heatmap with symbols



These visualizations are striking and innovative ways to illustrate race and age breakdowns for users in a way that is easy to understand and interpret. The age and race visuals have been sorted in descending order based on the number of people in that state that are in that category. For now, there is a drop down menu to sort the visualizations and update them by state. In future implementation, this will be linked to the matching function, such that when a user receives a specific state at the matching state, they will only see the information for that state.

Interactive Vis Designs

1. State radar chart matcher

State Matcher

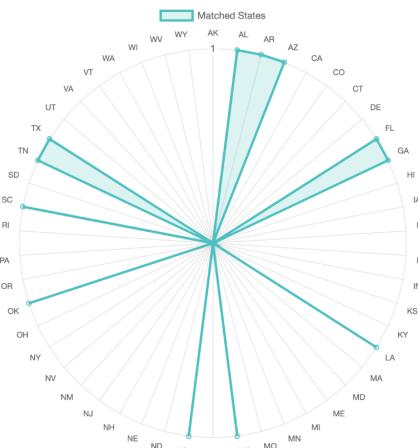
Do you prefer a red or blue state?

How important is racial diversity to you?

Do you prefer a hot or cold climate?

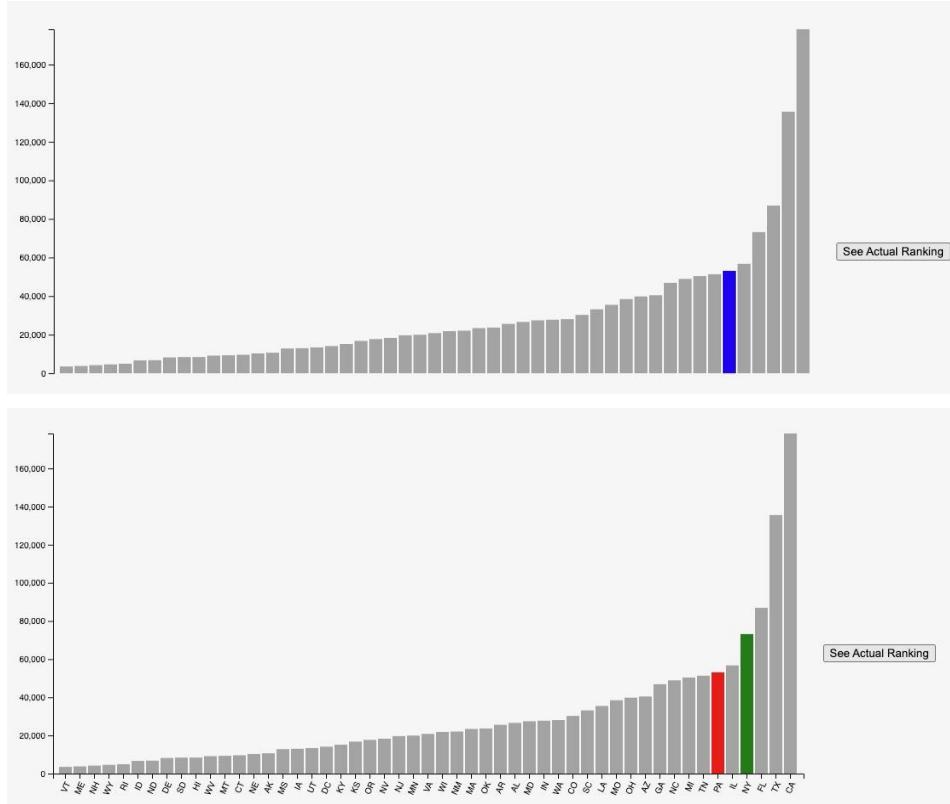
Do you care if abortion is legal in your state?

Based on your preferences, you might consider moving to: TN



This visualization is incomplete but still shows innovation where a user is shown the remaining states they have been matched with on the visualization radar chart.

2. Rank where you think your state falls



This visualization allows the user to guess where their matched state ranks compared to the other states for various metrics. This is an example of transforming a simple visualization into a both innovative and interactive visualization.

3. Treemap to see the industries in your state



This visualization enables you to see the top industries by state. There is a drop down menu to sort and update the visualization by each state. When you click on the tile, it provides additional information about the revenue generated by that industry in that state, and the rank in the size of the industry compared to other similar industries in the U.S. In the future, when you click on a specific tile, you will be able to see the top companies in that industry for each state. Additionally, this will be linked to the matching function, such that when a user receives a specific state at the matching state, they will only see the information for that state.

Think Aloud Study

CS 171 – Think-Aloud Study

Tester Name: Sraavya Sambara

Tester Email: sraavya_sambara@college.harvard.edu

General Observations from the think-aloud study:

- She generally liked the project and suggested a few edits which would make the visualizations even more effective.

What does the tester like about your data story?

- Scrolling functionality
- Engaging
- Age and race breakdown

What improvements does the tester point out?

- Lots of text on first page
- Phrasing of questions in state matcher
- Dropdown is a bit confusing
- Add more to weather dashboard
- More continuity in questions and charts
- Extra feature: Allow people to choose the state that they want
- Styling of text: bold, less
- Could add a chart for the cost of living and/or average housing prices

Was the intended key message clear to the tester? Why or why not?

- Yes, she pointed out that she understood the tool was to help people find homes in the U.S. She thought we could add more to the angle that it is for international/new residents in the U.S.

Did the tester get your next steps or call to action? Why or why not?

- N/A?

Tester Name: Autumn Dorsey

Tester Email: (Did not get)

General Observations from the think-aloud study:

She really enjoyed the visualization and liked that it was engaging. She also suggested a few things to change/add.

What does the tester like about your data story?

- Age and race breakdown + transitions
- Compare your state visualization
- Scrolling functionality

What improvements does the tester point out?

- Buggy treemap
- Too much text
- Add tooltip for the map
- Move dropdown to bottom of screen
- Label the axes in compare your state visualization
- Add a visualization for housing prices
- Add instructions for compare your state

Was the intended key message clear to the tester? Why or why not?

- Yes

Did the tester get your next steps or call to action? Why or why not?

- N/A?

Links

Milestone Tracker: [!\[\]\(240c12821e227464ff6b7614924c0018_img.jpg\) CS171 Project Milestone Tracker](#)