

# INFO 247 Final Project:

## What Happened to Tech Labour Market?

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Link to website demo: <https://whereareroses.github.io/>

Link to Git repository: <https://github.com/whereareroses/whereareroses.github.io>

### 1. Goals

In this post-pandemic world, tech industries are experiencing extreme conditions, which resulted in massive layoffs we are observing. Layoffs in the tech industry are a complex and multifaceted issue, and their impact can vary depending on the specific company, sector, and economic conditions. We aim to present a well-rounded view of the global layoff status, and a domestic (US specific) visualization. We also would like to see if the market suggests companies are hiring in lieu of the dreading status quo.

In this project, we are trying to utilize some open datasets (e.g. Layoff.fyi) and create informative, meaningful, and interactive visualizations for people to better understand the scale of the layoffs and hiring, companies involved, their economic status, geographic locations, etc. On the other hand, we would like to shed light on the major industries and some top companies that are hiring in order to provide guidance on where are more "secure" for people to work nowadays.

### 2. Related Work

#### 2.1 Harris

##### 2.1.1 Dot Map

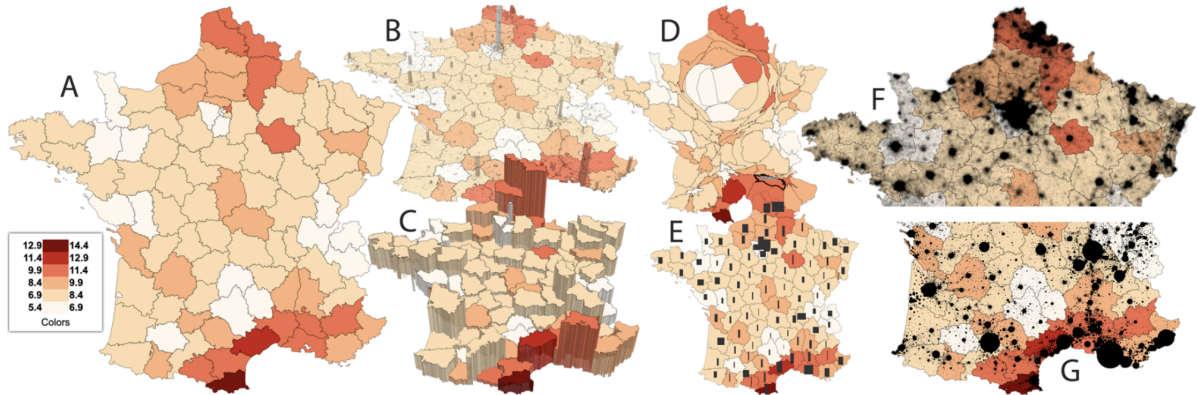


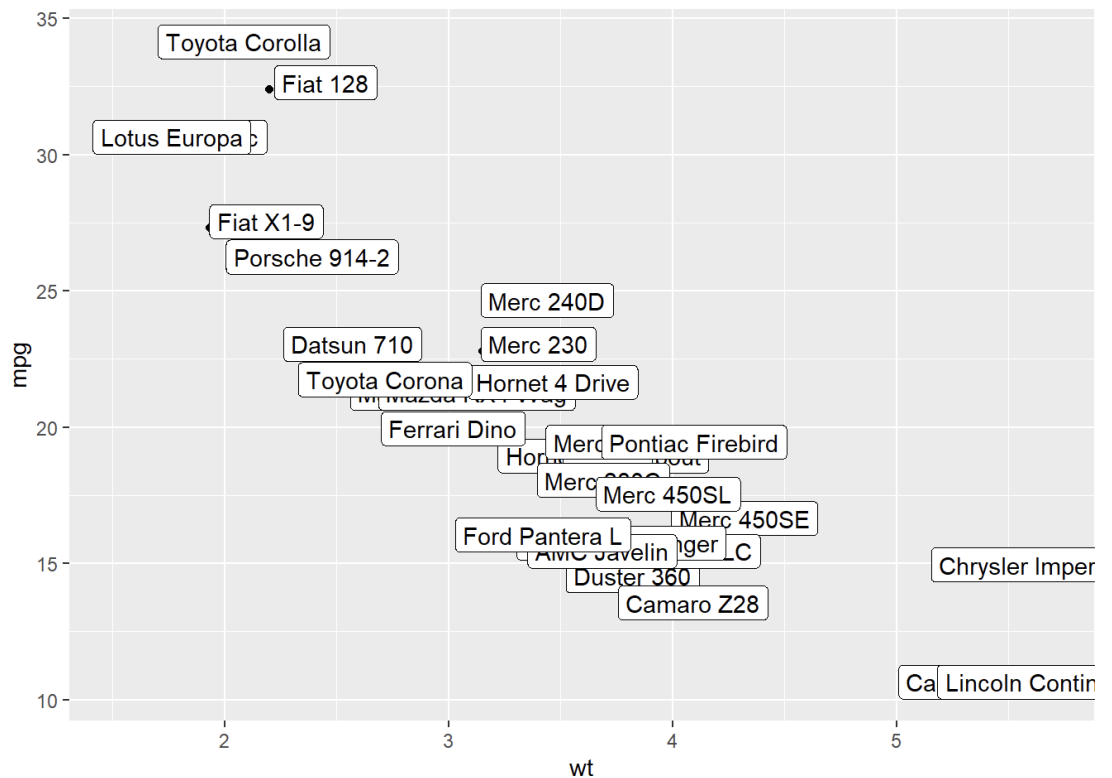
Fig. 1. Choropleth map (A) augmented with 3D extrusion (C), contiguous cartogram (D), and rectangular glyphs (E) at the same level of granularity and with 3D extrusion (B), Heatmap (F) and dot map (G) at a finer level of granularity.

One of the key contributors that we attempt to study about layoff is **location**, which leads us to think that a map-like visualization (e.g. choropleth) may work well in presenting the layoff distribution to users intuitively. However, choropleth has its own limitations in terms of the difficulty in normalizing data into accurate representations in smaller area level such as cities, regions and misrepresenting the magnitudes of quantitative information we aim to study about.

In order to alleviate the limitations, one source where we drew inspiration from for our choropleth is the study "An Evaluation of Visualization Methods for Population Statistics Based on Choropleth Maps" that highlights the importance of using appropriate color schemes, classification methods, and cartographic techniques to enhance the accuracy and effectiveness of choropleth maps. Here, we iterated our original choropleth that looks similar to A that simply emphasized the high-level data per state into a version that looks similar to G - dot map that highlights the cities that have more severe layoff situations.

<https://arxiv.org/pdf/2005.00324.pdf>

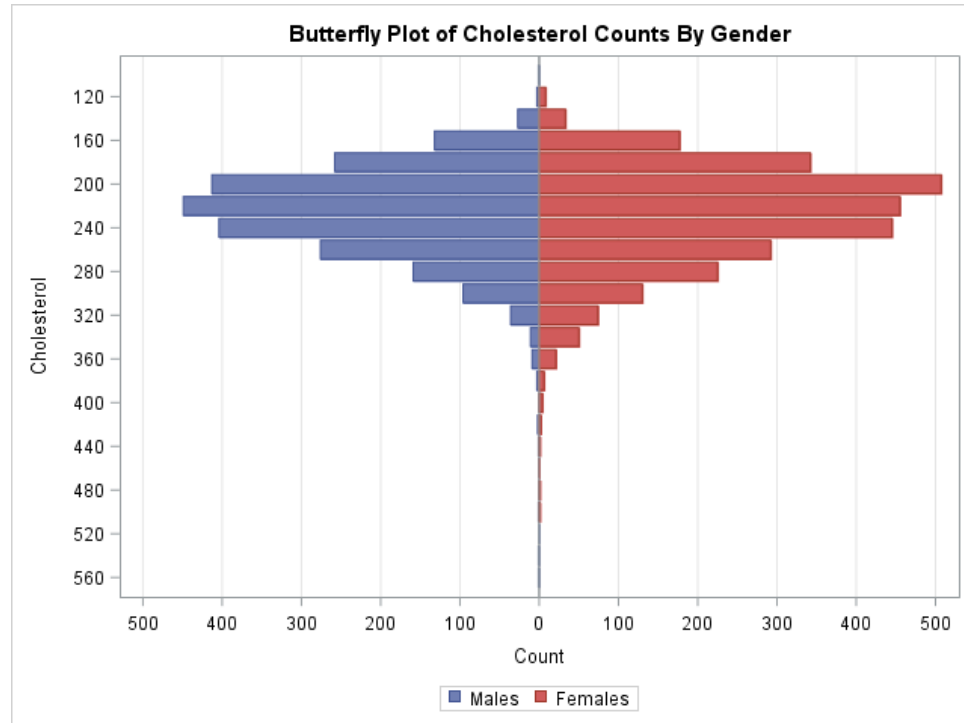
## 2.2.2 Scatterplot with Customized Symbols



In the attempt of creating a vivid timeline of major tech corporations that experience layoff, we considered using a scatterplot that lined up all the major companies' events and represented the magnitudes of layoff on the vertical axis. We attempted to visualize each individual company using symbols in order to provide readers a clear first impression of being able to see the list of companies whose layoff got spotlighted in the news. The R scatterplot gallery shown above provides a set of customized labels of each dot within the scatterplot, which show the coordinates of each individual car and provide a strong impression to readers with textual information about the cars. We were inspired by this and would like to make the impression even stronger by inserting the company logos as symbols within our scatterplot.

<https://bookdown.org/content/b298e479-b1ab-49fa-b83d-a57c2b034d49/correlation.html>

### 2.2.3 Butterfly Plot



The last related work is a butterfly plot for comparing distributions. This is a SAS Sample that shows how to create a butterfly chart for counts of cholesterol by gender. The butterfly chart is a comparative bar chart because the distribution shown is for a discrete variable ("gender") which clearly effectively creates a contrast by putting the values for males and females side by side where viewers are able to detect any differences horizontally. Meanwhile, since our objective variable (counting pre/post-IPO companies by date) is also discrete, we believe a butterfly chart will help us compare two values of a variable in an intuitive way.

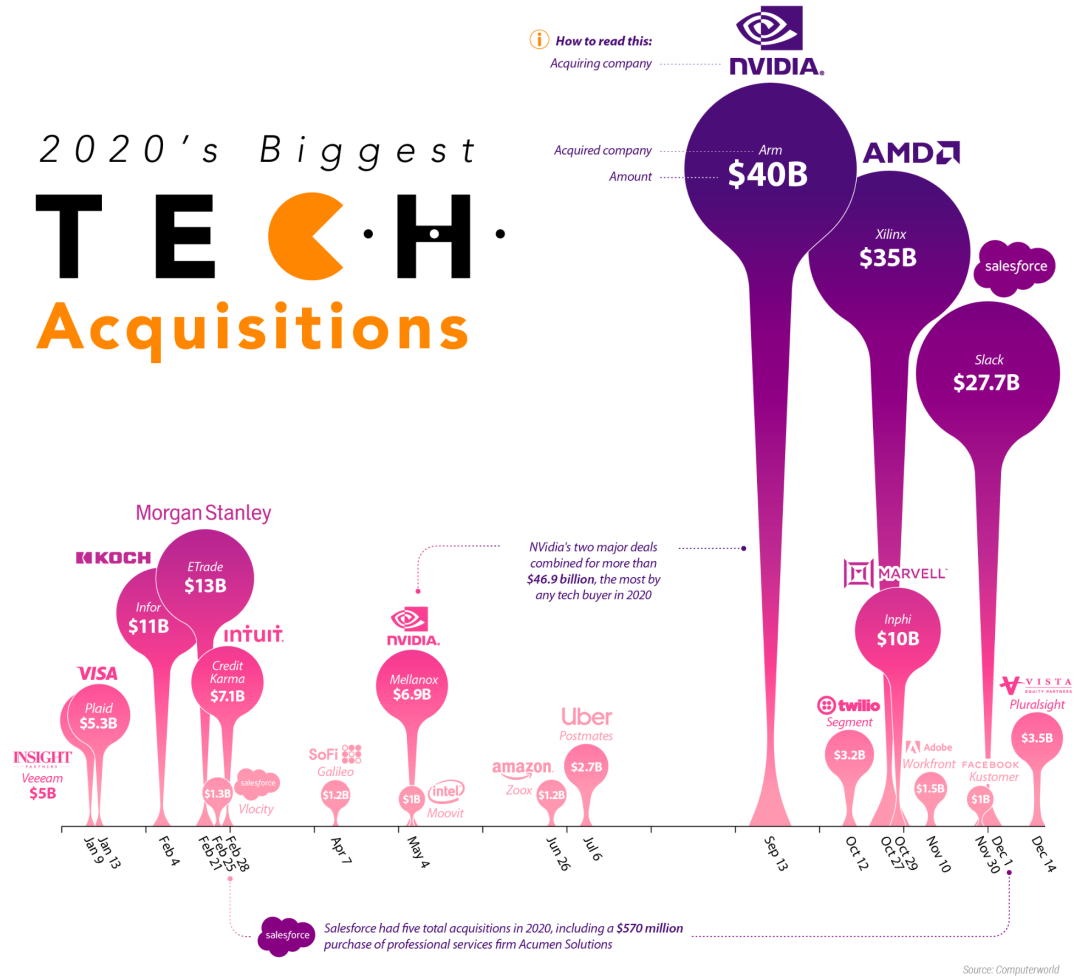
<https://blogs.sas.com/content/iml/2018/05/23/butterfly-plot.html>

## 2.2 Jannie

### 2.2.1 Tech Mergers and Acquisitions Infographics

<https://www.visualcapitalist.com/visualizing-biggest-tech-mergers-and-acquisitions-of-2020/>

# 2020's Biggest TECH Acquisitions



[f](#)
[v](#)
[t](#)
[@visualcap](#)
[visualcapitalist.com](#)

COLLABORATORS RESEARCH + WRITING Raul Amoros | DESIGN VC

When I was researching relevant information in the tech market sector, I came across this infographic that inspired me to create the layoff timeline chart. This infographic, "Visualizing the Biggest Tech Mergers and Acquisitions of 2020" from Visual Capitalist, showcases the most significant tech deals of the year. The chart displays the deals in a visually appealing manner, making it easy to understand the size and scope of each transaction.

As I was researching relevant information in the tech market sector, you were inspired by the way the data was presented. The infographic provided a clear, concise, and easy-to-follow overview of the tech mergers and acquisitions that occurred in 2020. It utilized different color density,

company icons, size of the bubble to indicate the scope of the mergers and arranged them along the timeline in 2020. In particular, I was inspired by the use of timelines to illustrate the deals. The timelines helped to show the sequence of events and the duration of each deal. I realized that this was an excellent way to present information about layoffs in the tech industry.

With this inspiration in mind, I decided to create a layoff timeline chart. The chart would show the companies that had recently laid off employees, the percentage of employees affected, and the dates of the layoffs. By presenting this information in a timeline format, you would be able to show how the layoffs were spread out over time and how they affected different companies.

### 2.2.2 ADP® National Employment Report

<https://adpemploymentreport.com/>

#### Change by Establishment Size

##### Small



##### Mid-sized



##### Large



The ADP Employment Report is a comprehensive report that provides insights into the current state of the job market in the United States. I came across this report when conducting preliminary research into this problem space. The report covers a wide range of industries and job categories, providing data on employment trends and job growth. As I was reviewing

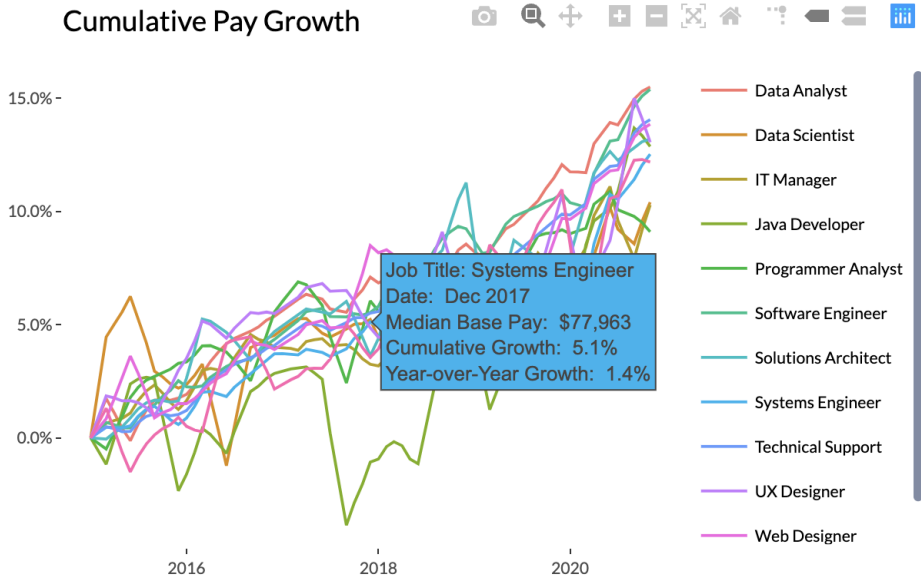
the report, I was struck by how the data are visualized in a very clear and straightforward way even if the problem space is multi-faceted. I was inspired by the way the report separated companies by different levels of maturity, such as small businesses and large enterprises. This approach made it easy to understand how job growth varied across different company sizes and industries.

As I was creating visualizations for layoff data, I realized that this same approach could be applied. By separating companies by different levels of maturity, I would be able to provide a more nuanced view of the layoff scales across different industries and company sizes.

For example, I grouped startups and early-stage companies together and called them "Pre-IPO" companies to show how layoffs affect young companies differently than established enterprises. Alternatively, in our later hiring graph, we also grouped companies by employee size to show the hiring situation in larger companies versus smaller ones. This would help readers to better understand how layoffs vary across different types of companies and industries, and provide a more nuanced view of the impact of layoffs on the job market.

### 2.2.3 Glassdoor Job Market Report

<https://www.glassdoor.com/research/job-market-report/>



This is another interactive visualization of the job market situation that I found during the research phase. The Glassdoor Job Market Report is an annual report that provides insights into the current state of the job market in the United States. The report covers a wide range of industries and job categories, providing data on employment trends, salary trends, and job satisfaction. I was intrigued by the way the report used interactive annotation boxes to provide additional context and insights into the data. These boxes allowed the user to hover over a specific data point and receive additional information about that point, such as job title, median base pay and cumulative growth.

As I was working on my own data visualization of layoff percentages vs. companies' funds raised, I realized that adding interactive annotation boxes could help make my scatterplot more readable and reduce clutter. By using these boxes, I could provide additional context and insights into the data without cluttering the chart with too much text.

For example, I could add an annotation box that would provide additional information about a specific data point, such as the name of the company, the industry, and the number of employees affected by the layoff. This would allow users to quickly understand the impact of the layoff on the company and the industry. And because my y-axis is layoff employee percentage, adding additional information will help users understand the situation better and provide additional insights into the impact of layoffs on the tech industry.

## **2.3 Shubham:**

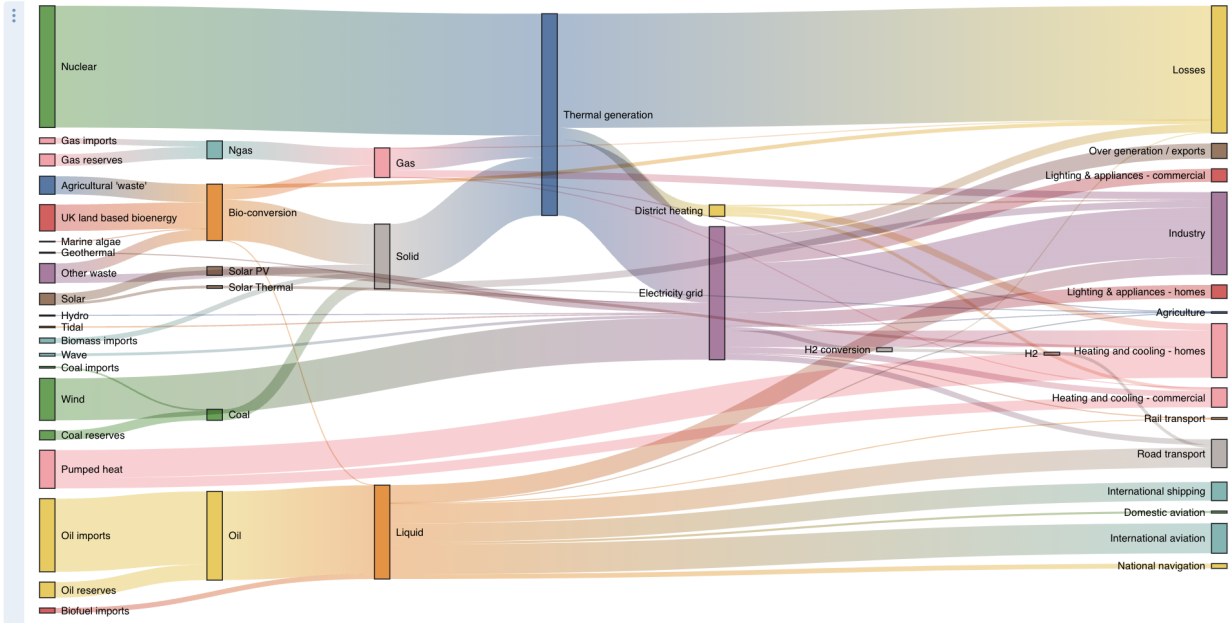
### **2.3.1 Finding the right kind of Sankey chart:**

As I was exploring the implementation of sankey chart for the hiring data, I was trying to figure out a sample d3 code from the internet.

<https://observablehq.com/@d3/sankey>

This particular link contains a static Sankey chart.

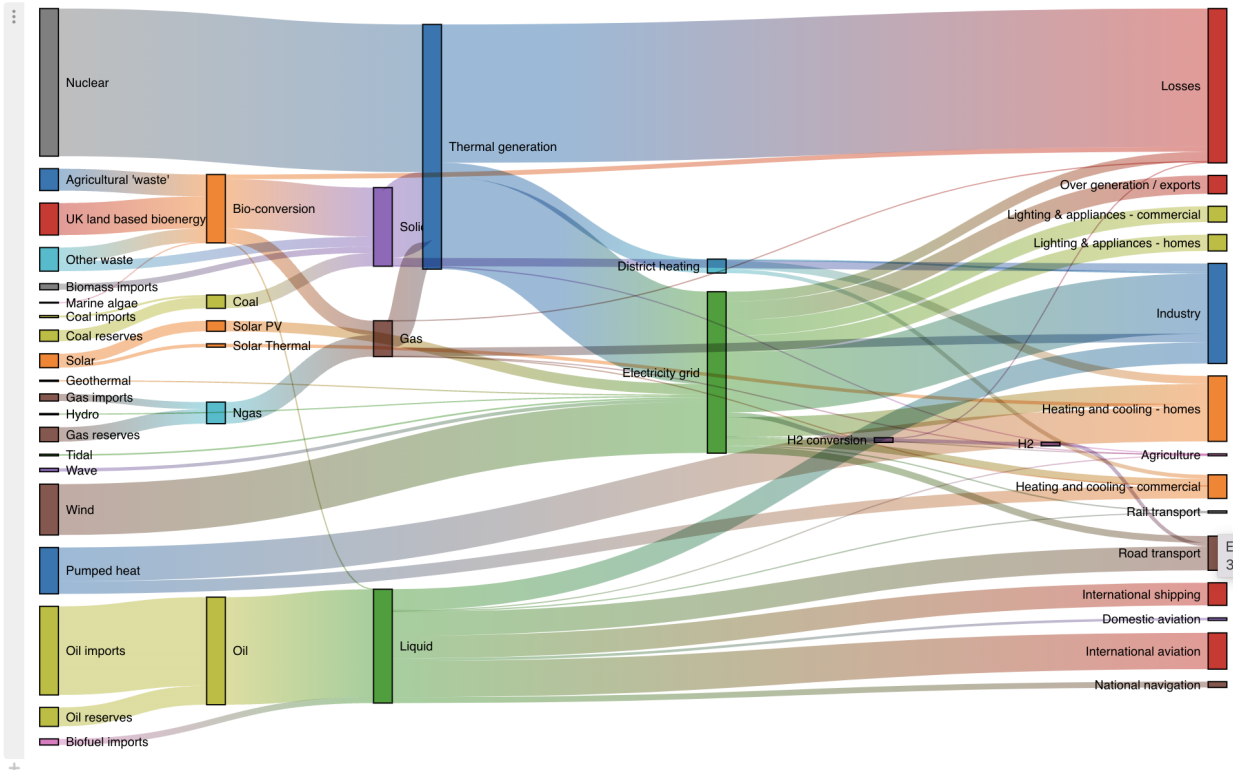
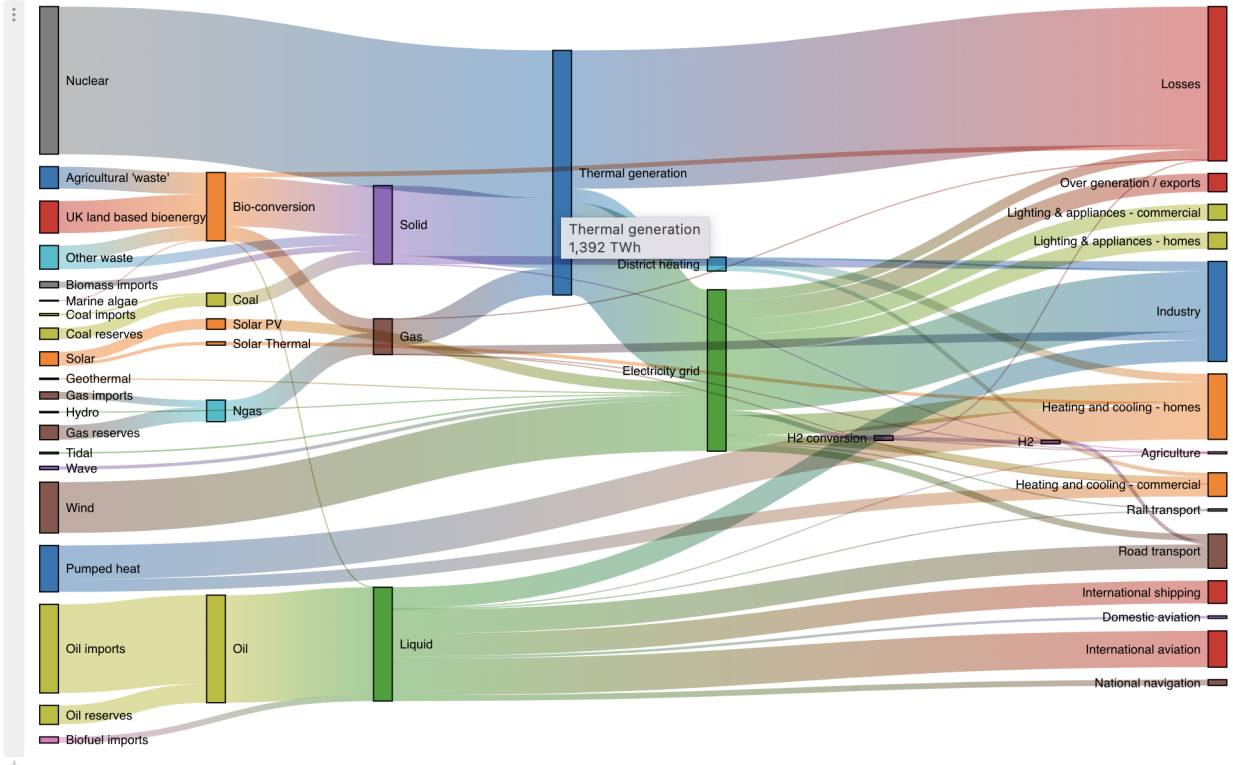




This seemed like a good starting point. However, I wanted to aid the visualization with some interactivity to ensure that it is easier to understand, as my data would have had quite a few nodes because of the number of industries and designations.

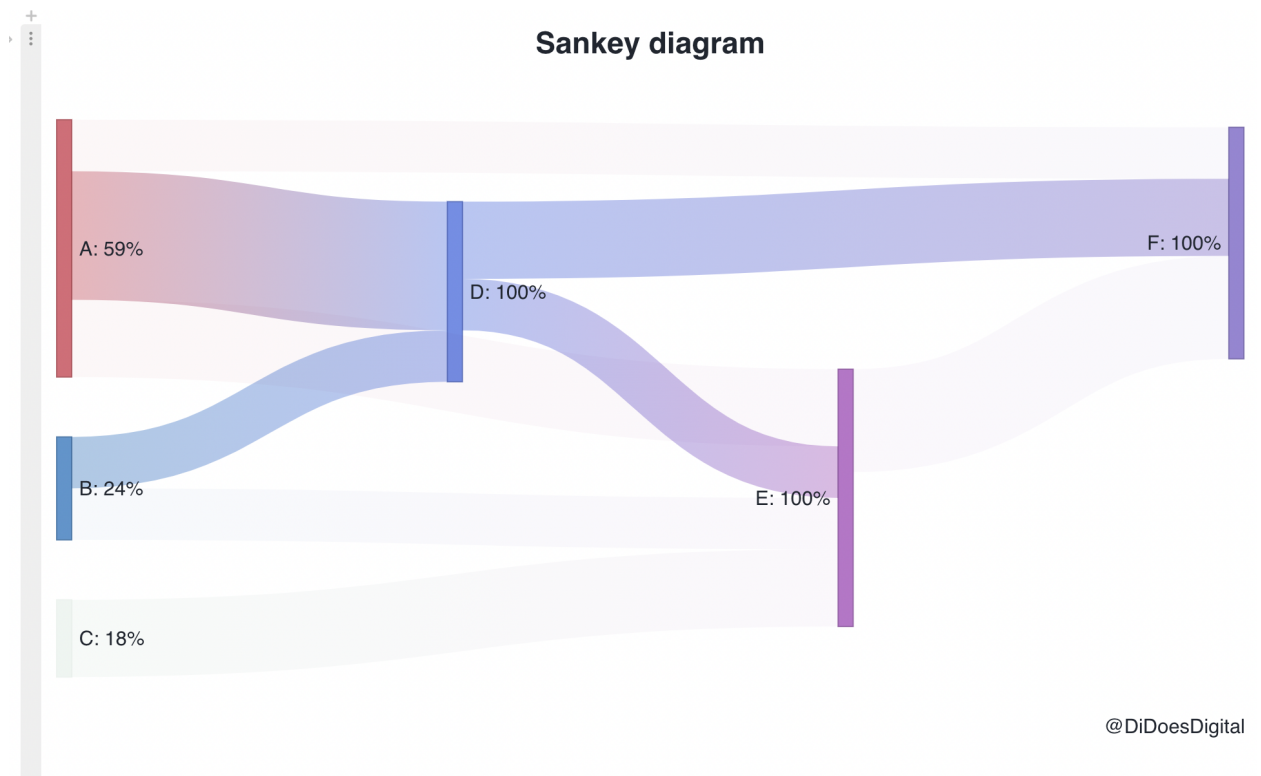
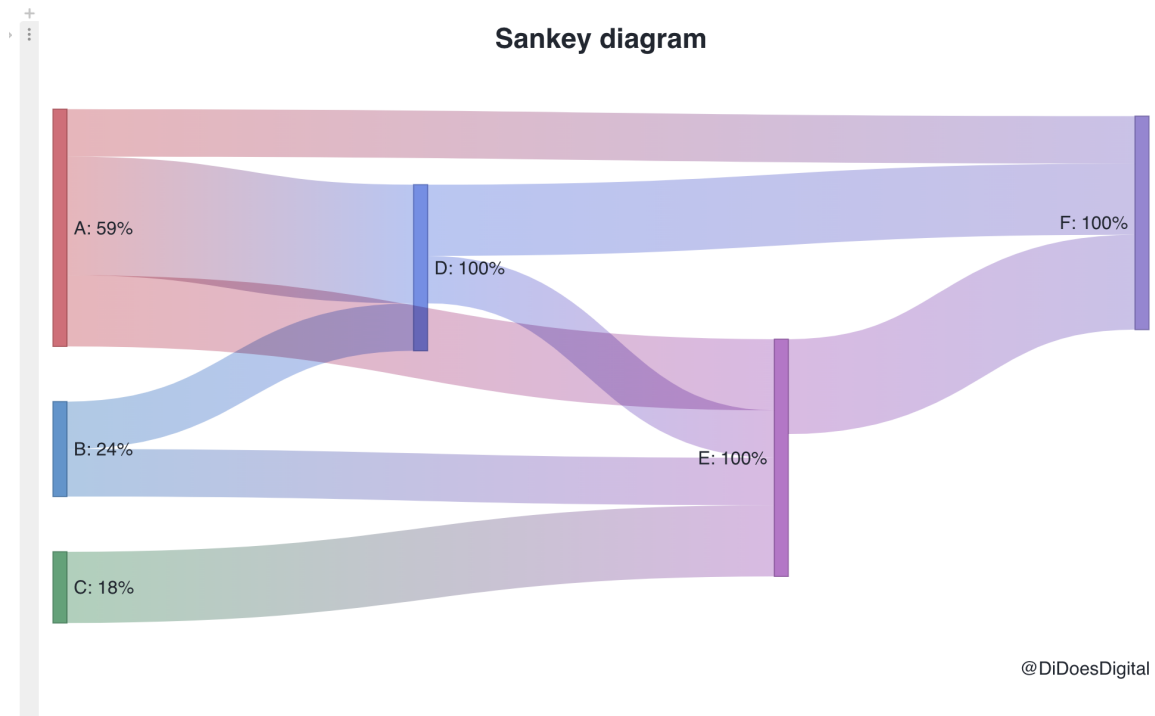
<https://observablehq.com/@mariodelgadosr/sankey-diagram-with-draggable-nodes>

Then I arrived at a variation that allowed for draggable nodes as interactivity.



While this was a good interactivity and an addition from the previous graph, it was not serving the purpose of making it easier to navigate the multiple nodes.

<https://observablehq.com/@didoesdigital/21-july-2020-d3-sankey-diagram-with-hovers-and-percentages>



Hover was the interactivity that I finalized as I believed it would substantially aid in understanding the graphs.

### 1. Understanding how to manipulate the the Sankey chart:

The d3 code above mentioned target, source, and value in the data. I couldn't make sense of it.

```
csv = `source,target,value
A,D,5
A,E,3
B,D,2
B,E,2
A,F,2
D,E,2
D,F,3
E,F,4
C,E,3
`
```

I needed to figure out what it meant. The article below helped.

<https://medium.com/@twelsh37/understanding-plotly-sankey-charting-3ee263a81549>

#### **A few key terms.**

Sankey Diagrams are pretty simple when you get your head around a few key terms. But, unfortunately, these terms come up repeatedly and are fundamental to understanding Sankeys and the flows.

**Source** — This is the starting node; no, you don't need multiple sources to get depth. More on that later.

**Target** — This is the node that the source connects to

**Value** — This is the connection flow volume. It is a number and will denote the thickness of the lines that connect the Sankey diagram.

The only other term that comes up is Label, and you can probably guess what that is for. Yes! It labels your flows.

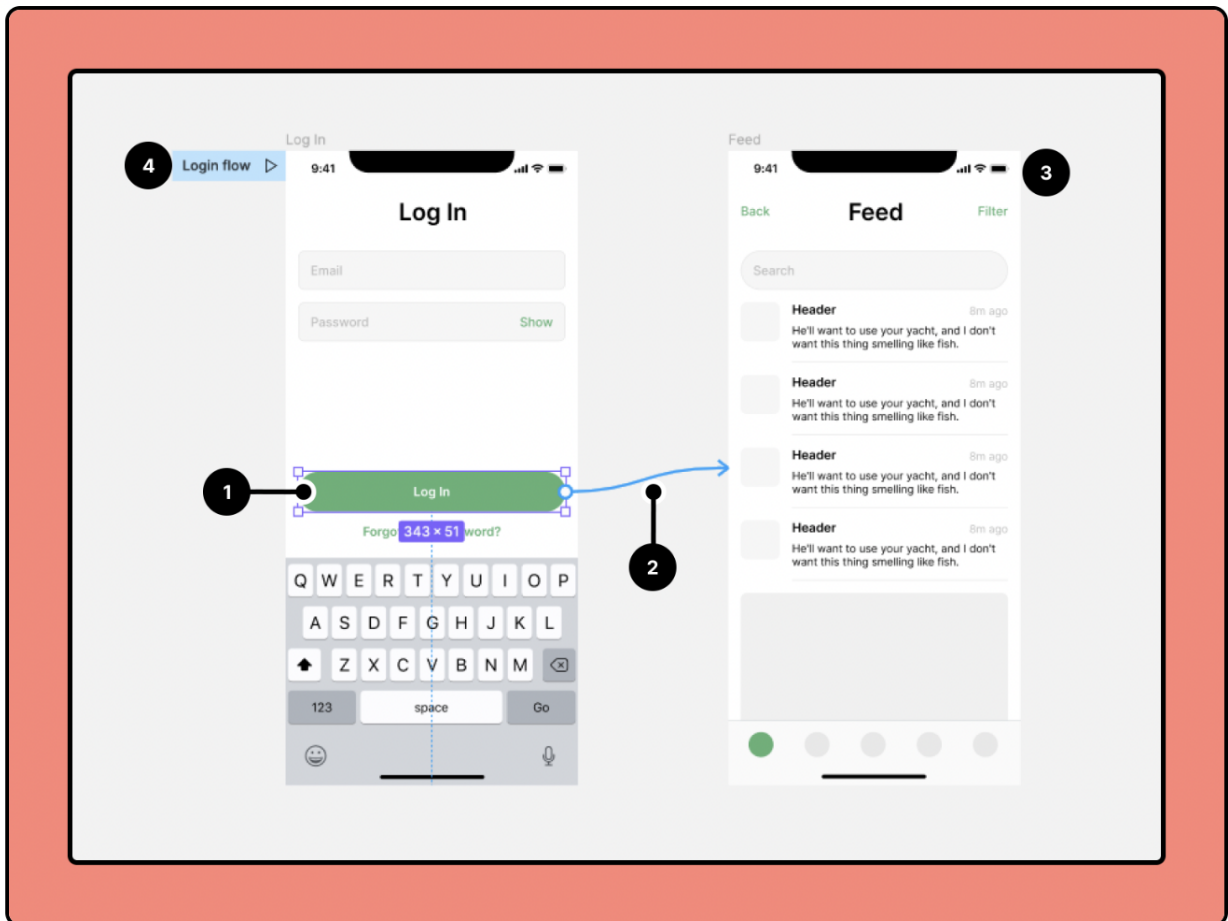
Well, that's enough preamble. Let's get into it.

This gave me a starting point to figure out how to convert the hiring data into an input for Sankey Chart.

## 2. The figma prototype:

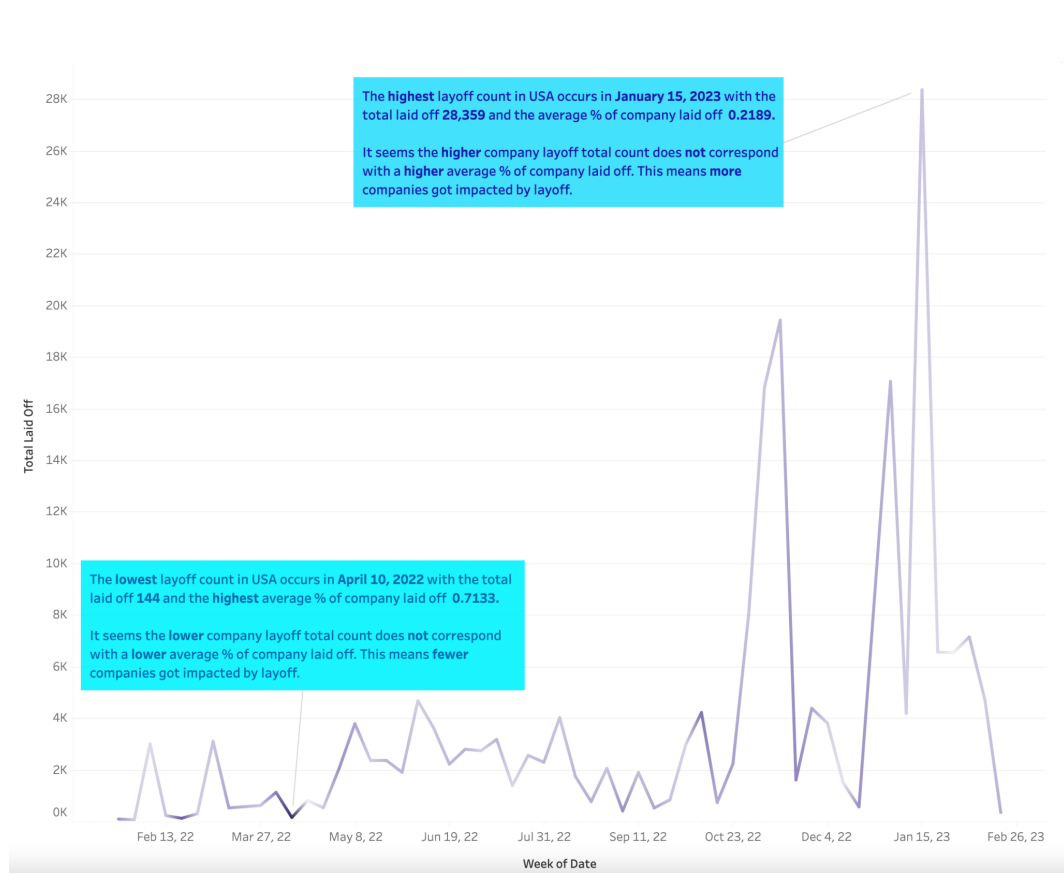
<https://help.figma.com/hc/en-us/articles/360040314193-Guide-to-prototyping-in-Figma>

I didn't know how to prototype in Figma. For the 2nd set of graphs, highlighting the information regarding the top hiring companies, I wanted to show additional information in the hover mode. Creating that interaction in d3 may have taken a lot more effort since I wasn't comfortable with d3 hover, and wasn't really sure how much time it would take in getting it right. Hence, I decided to use the figma prototype. The article helped a lot by breaking down the steps.



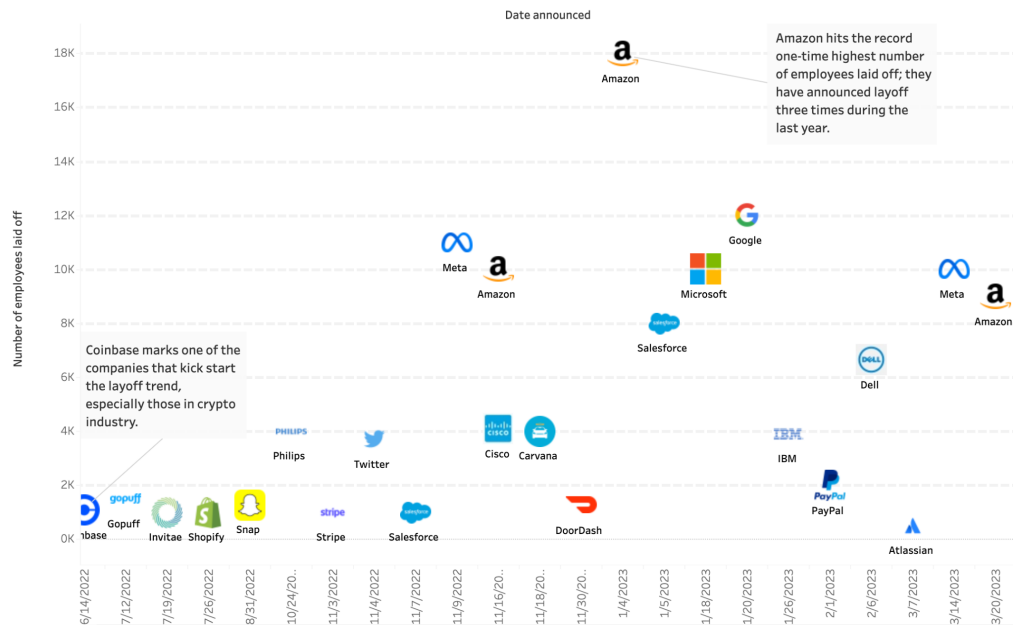
## 3. Description of Visualizations

### 3.1 Layoff Visualization Designs



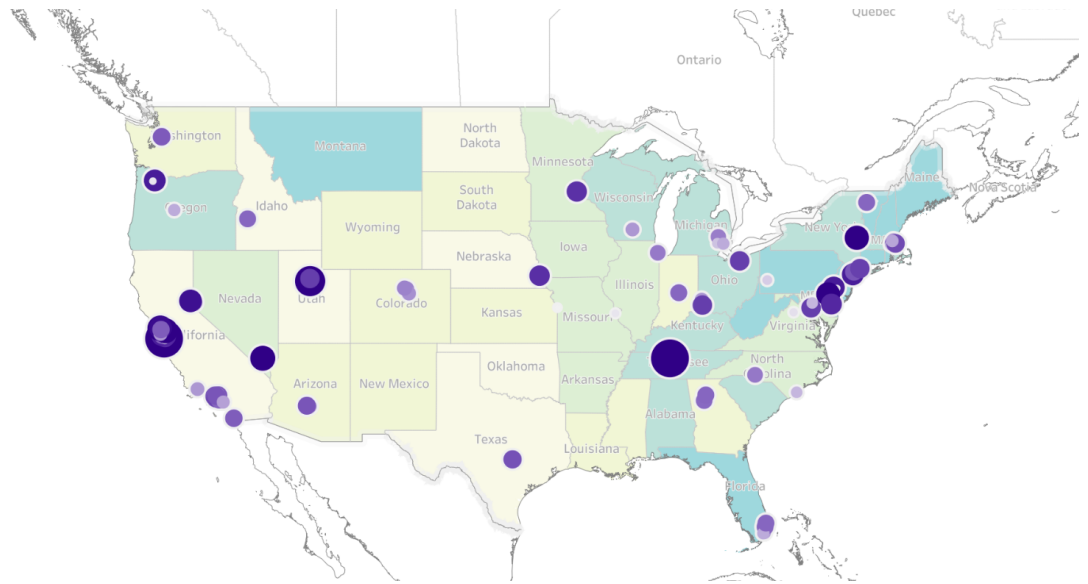
The first section of our website is to introduce several visualizations illustrating layoff and some factors that we believe contribute to layoff (e.g. locations, time, maturity of company). Within this section, we created the first graph that depicts the numbers of layoff overtime in order to give readers a clear representation of the lows and highs of layoff. Additionally, we use distinctive colors over the line to further show the “average percentages of companies laid off” where we could provide users simultaneously the information of whether more layoff means more companies were impacted. Two annotations were added to this line chart at the lowest and highest lay off points where the average percentage of companies laid off at these times are clearly noted, and how these data points could help us conclude many companies were impacted by layoff at its peak.

## Major Tech Firms Layoff Timeline



Following some description of some major layoff breaking news we have seen over the past year, we are introducing the second visualization - the layoff corporate timeline, which is illustrated as a scatter plot with symbols that differentially position the major companies whose layoff shows up on the news. We attempt to use the positions of these companies and the uses of their logos to clearly tell the series of stories when and how badly these big tech companies suffer from the layoff. Annotations were given to highlight some phenomenal events such as Amazon where the one-time layoff amount hits the peak, and Coinbase that represents the start of the layoff trend.

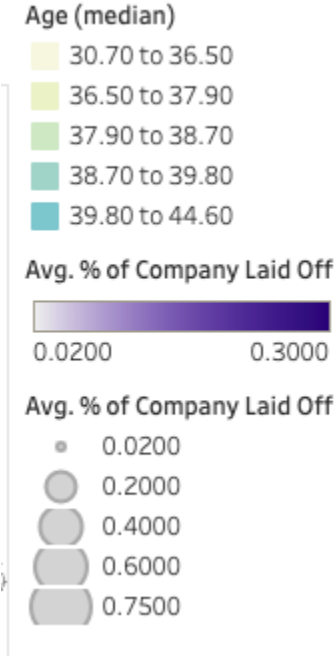
For the next part of the website, we introduce the textual descriptions of the several factors we aim to study that contribute to the layoff: locations, sizes, ages and maturity of companies (pre and post IPO). The purpose of the layoff geographic choropleth is to show the correlation between age of workers, company headquarters' locations and average percentage of company layoff. We aim to let users tell by city level which cities suffer the most.



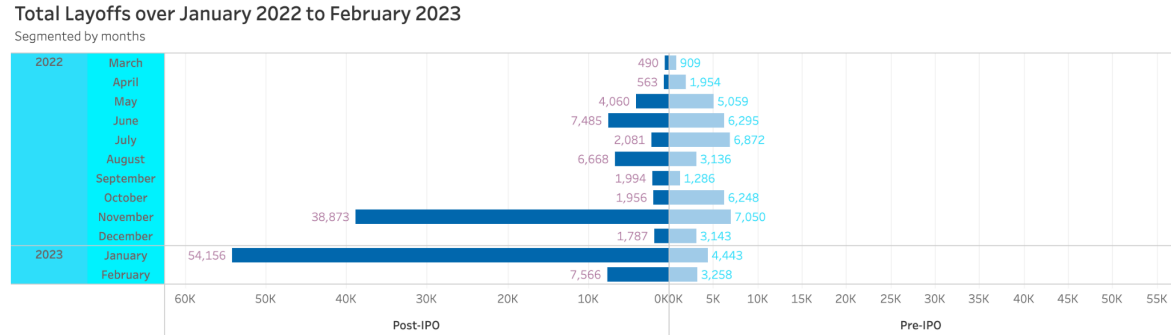
The first differentiator on the map is to represent the different average percentages of company layoff by cities with colors and sizes of circles as we identify the average percentage of company layoff is a reasonable indicator of the severity of layoff. The map shows cities of larger and darker dots suffer more layoff, and vice versa. Users are able to zoom in and out the map with Tableau settings for a clearer view of dots within a specific region of any state.



The second differentiator on the map is to discover if the ages of employees who were laid off in different states could be a factor. We used the Tableau default US population age data as a filter to color code the median ages of each state and see whether age distribution is correlated with the severity of layoff.



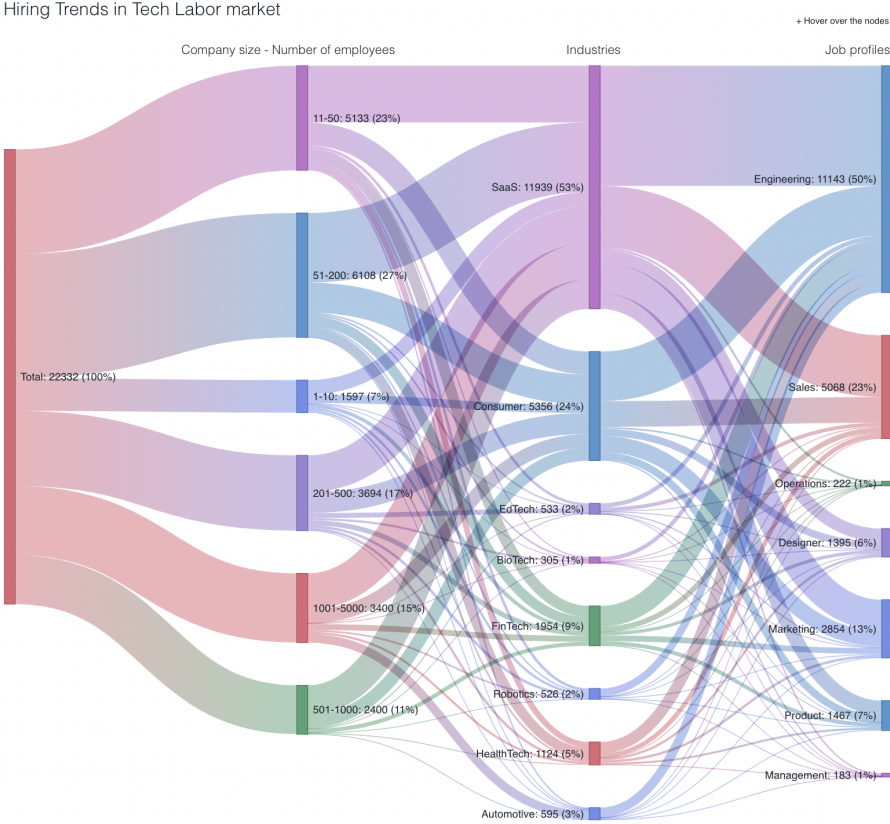
On the right side of the dot map, we included legends that show the several intervals of median ages of states, the range of average % of companies laid off (by color and sizes) for users to intuitively navigate the dot map with symbols and their corresponding values.

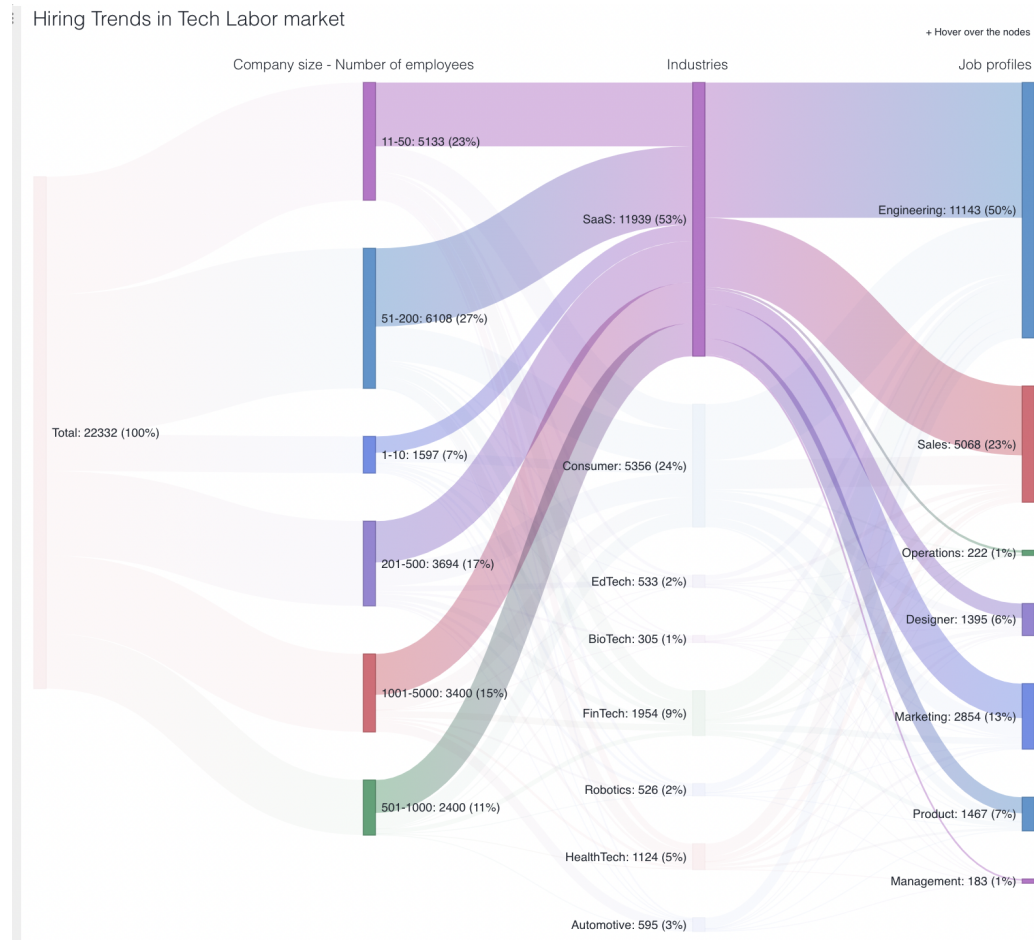


In order to illustrate the contrast between the layoff numbers of Post-IPOs and Pre-IPOs, we figured a butterfly chart with each month per row could be effective in clarifying the magnitude of differences between the two

groups. We implicitly drew a positive correlation between the sizes of companies and the maturity of companies for this exercise and attempted to test our hypothesis that Post-IPOs (larger companies) are the major contributors to the layoff peaks. We were able to identify the analysis that matches our hypothesis by looking at the butterfly chart - November 2022 and January 2023, the two peaks of layoff that we have already noticed as layoff peaks, have significantly higher numbers of post-IPOs' layoffs. Additionally, we normalized the x-axis into the same range of 0 to 60K employees layoff for the accuracy of comparison.

For hiring, we wanted to understand the open roles across 3 major attributes: company size, industry, designations. This is a result of anecdotal conversations, personal experiences and usability study, wherein it has been reflected that these are the 3 major attributes, among others, that people think when planning their job application strategy. Initially, we were planning to have multiple bar graphs to explain these different aspects. From the usability study we gathered that the users would prefer to have a single graph for the entire information instead of multiple bar graphs. Hence, we decided to switch to Sankey.





We have added hover interaction in the Sankey chart, to ensure that while the graph may seem overwhelming at first, there is an easy way to get around it and quickly make sense of the information at hand. The color gradients along the paths and node labels have been added, to further aid the information and context.

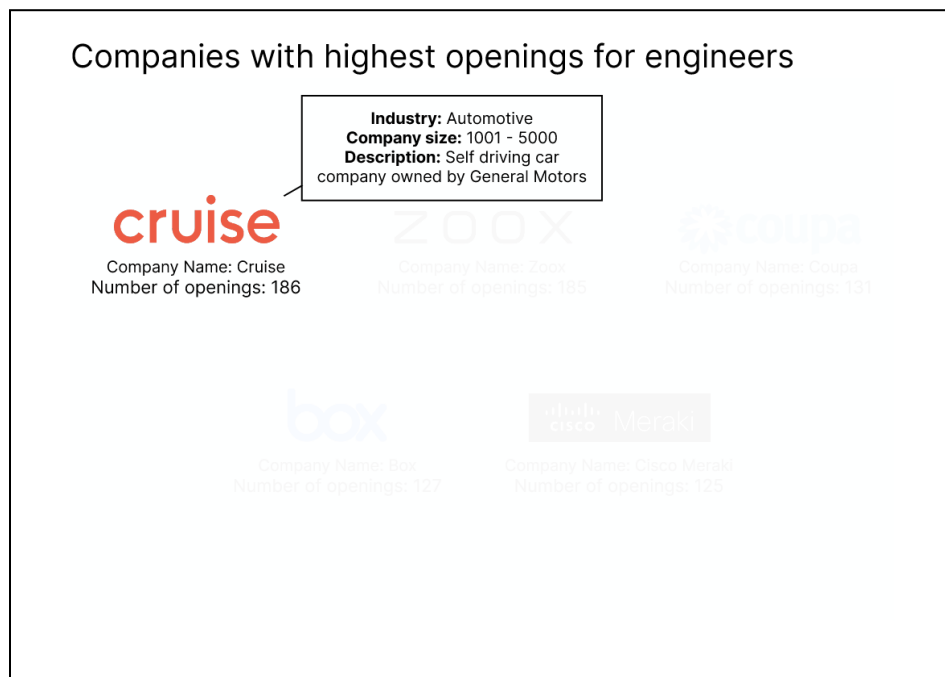
Once the users have explored the Sankey chart, and understand the larger picture, we wanted to understand the other question: where should I apply? For that we decided to list the companies with open positions across some of the disciplines that we care about as information professionals: Engineering, Product, Designers. In the view we have the logo(for visual aid), the company name and the number of open positions.

## Companies with highest openings for engineers



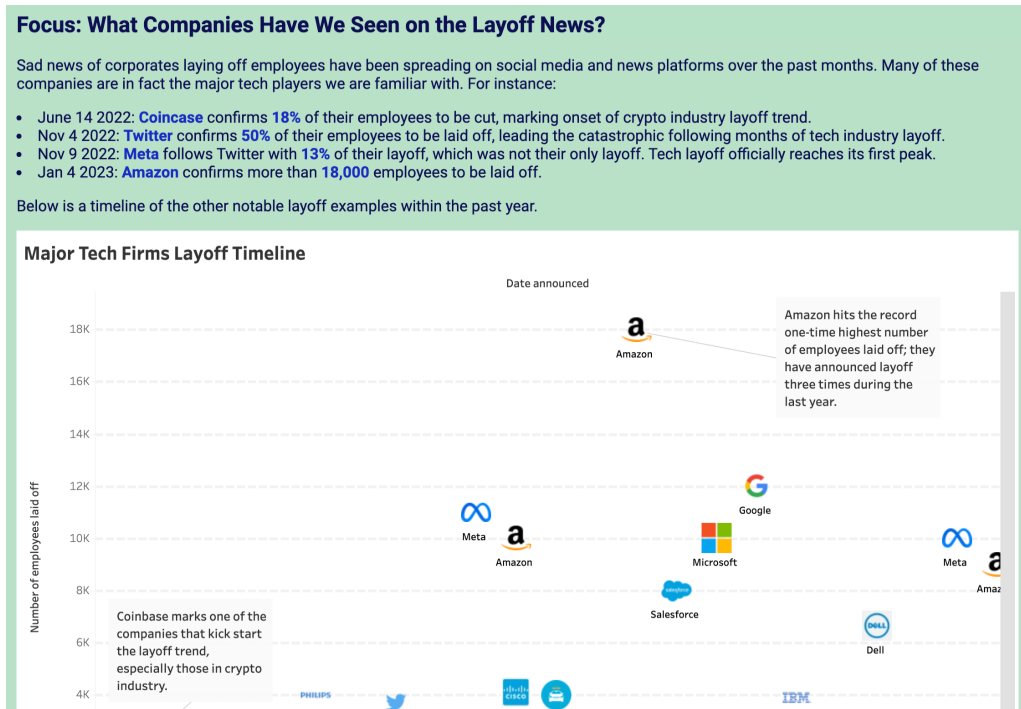
However, we also wanted to include additional information regarding the company to give more context and tie it back to the Sankey Chart. Hence, we added additional information on hover.

## Companies with highest openings for engineers



### 3.3 Website Designs and Other Visual Deliverables

For the layout of the website, I chose to stay minimalist and using the visualizations to tell a story. Because we have convincing data visualizations that can tell a story. By using a minimalistic approach, we can allow the data to take center stage and present it in a clear and concise manner. This will help the reader to understand the information quickly and easily, without any unnecessary distractions. I also added text before and after each graph to offer supportive context and help users to understand the visualization better.



*(Context before a visualization and Section Header to Support the graph)*

Moreover, we are dealing with subject matter that is severe and serious. We want to convey the gravity and importance of the information we are presenting, and avoid any design elements that could be perceived as insensitive or trivializing. By using a minimalistic design and sans serif font, we can create a sense of respect and professionalism that will help readers take the information seriously.

However, we also want to make sure that the experience is engaging and memorable for readers. So in addition to interaction within the embedded visualization, we also added navigation bar and clickable titles for users to

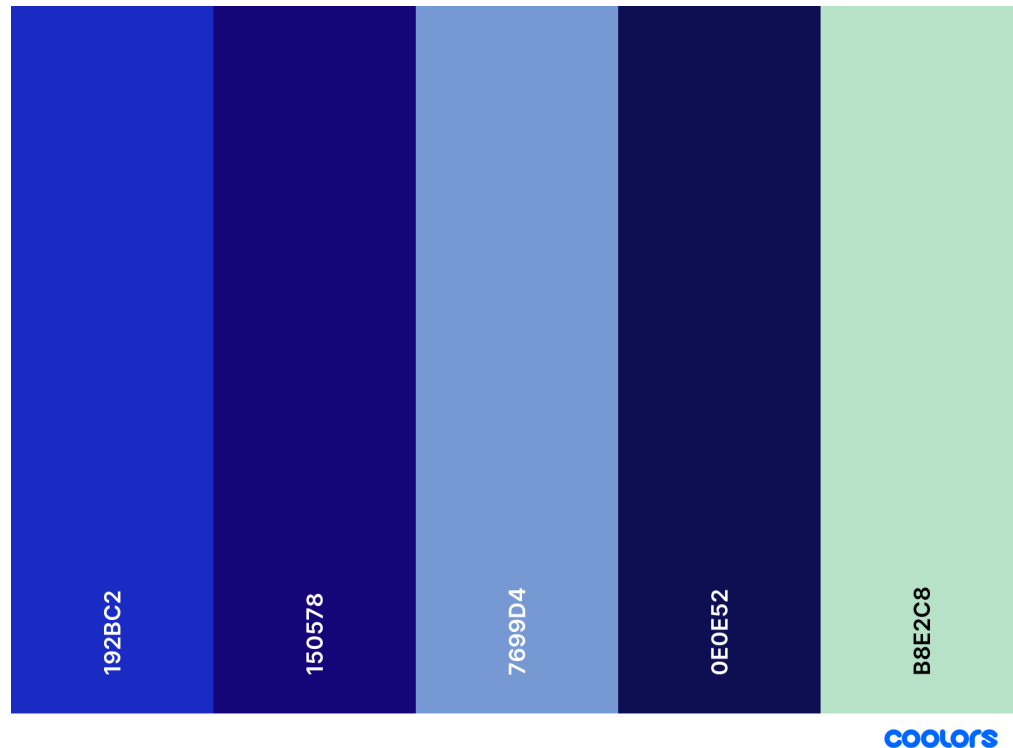
jump around from different sections of the website. By using this approach, we can create an experience that is both dynamic and informative.



*(Clickable Section Titles, Navigation Bars with Dropdown Menu)*

To create this experience, we drew inspiration from magazines like The Economist, which are known for their clean and minimalist designs. We wanted to create a similar sense of familiarity and trust with readers, while still adding our own unique interactive elements to create a truly memorable experience. Hence we chose a similar name: The Job Seeker, to outline our target audience but at the same time emphasize with them.

For other illustrations on the websites, we used free-licensed illustrations from other platforms, which we credited in our Attribution Section. We chose the color palette which mainly consists of different shades of blue to echo the severity of the problem we are investigating, but also remain hopeful and positive to encourage our viewers.



(The color palette we used, generated from [Coolors](#))

## 4. Data Sources

Our data was provided by [layoff.fyi](#) which was exported into [Kaggle.com](#) and downloadable as an [xlsx](#) file. The file contains the layoff information across different countries and industries from March 2020 to February 2023 including 12 columns (fields) that has convincing attributes that illustrate layoff status quo such as company (headquarters), funds that are raised by the companies, and dates when the layoff happened and was recorded, and 2252 rows (entries) including ~1600 entries that happen between 2022 and 2023, which serves as a decent sample size for me to explore any trends and significant factors that cause the layoff. We extracted the companies' headquarters information and manually paired them with corresponding states in the US when creating the hierarchy fields for the choropleth on Tableau.

In order to provide highlights of major companies' layoff and layoff trend, we quoted some data points on a few online news articles such as [ComputerWorld](#) and [S&P Global](#). These articles provided us with reliable resources to create the layoff timeline with companies of significant scales. We extracted the dates (year, month,

and day), company names, % of company laid off and number of employees laid off from these articles in order to create the timeline scatterplot.

Our hiring dataset is from kaggle.com as well. It covers open positions in February 2023. The data has 10 columns and 2941 rows (hiring companies) with attributes such as company names, descriptions, industry, company size, number of openings etc. The data needed processing for the number of openings and industry. The entries in the number of openings were in this format: "(Engineering: 7), (Marketing: 1), (Product: 1)." So we needed to manipulate the data in excel to extract the number of openings across each discipline in a workable format. Industry also needed processing because we had 236 unique industries in the data. We manually mapped them to the industries in the Sankey chart based on our judgment and understanding.

## 5. Tools and Techniques

### 5.1 Tableau

The multiple visualizations depicting the status quo and different contributors to layoff are created in Tableau. We connected the xlsx file to Tableau Public (for embedding on our final website) and customized the "headquarter" field manually to ensure it includes both states and cities as a complete set of geographic fields for choropleth. We then dragged the numerical data field (% of company laid off) and converted it into average % per city, visualizing the various magnitudes onto the "Color" and "Size" shelf under the "Marks" card. Tableau automatically created a color legend for us representing the range of values in the dataset. The final step was to add interactivity to the choropleth map by using filters, highlighting, and tooltips that link to a separate sheet with bar charts that rank the top 3 most layoffs filtered by city. This allows users to explore the dots of cities in more detail and gain additional insights of layoff.

As mentioned above, we also used Tableau to create a butterfly plot where we created calculated fields that split the "layoff count" field by post-IPO and pre-IPO. We then plotted the new fields by creating a horizontal bar chart for post-IPO and pre-IPO with the bars originating from a common central axis (year and month). The length of the bars represents the values of the variables, allowing for easy comparison between the two.

We also used customized icons to the Tableau scatterplot when making the company layoff timelines. The first step was to search for companies' logos on Google images and import the images (in PNG format) into Tableau Repository on



our local device. We then navigated to the “Shape” shelf, where we chose from a library of custom icons in our newly created folder and assigned the icons to each individual company on the scatterplot.

## 5.2 HTML & CSS

The website is created using HTML and CSS, without JavaScript because all the visualizations are embedded using iFrame. We tried to natively incorporate the d3 graph into our website but it wasn't consistent with the other elements on our page so we gave up. HTML is outlined by sections, including Navigation Bar, Title, Body1-5 and Conclusion.

```
<!-- NavBar -->
<!-- Navigation Bar -->
<nav id = "navBar">
  
  <a class="active" href="#navBar">Cover</a>
  <div class="dropdown">
    <button class="dropbtn">Sections
      <i class="fa fa-caret-down"></i>
    </button>
    <div class="dropdown-content">
      <a href="#bodyblock1">Context: Total Layoff Timeline</a>
      <a href="#bodyblock2">Focus: What Companies Have We Seen on the Layoff News?</a>
      <a href="#bodyblock3">Factors: Layoff Geographic Distribution in USA</a>
      <a href="#bodyblock4">Study: Do Bigger Companies Suffer More Layoff?</a>
      <a href="#bodyblock5">Hope: Hiring Trend (industries, opening roles, etc)</a>
    </div>
  </div>
  <a href="#conclusion">Conclusion</a>
</nav>

<!-- Title -->
</img>
<hr id = "line1">
<a href="#bodyblock1">
<div id = "section1box">
  <h3 class="section-text">Context: </h3>
  <h3 class="section-text2" id = "section1_2">Total Layoff Timeline</h3>
</div>
</a>
<hr id = "line2">
<a href="#bodyblock2">
<div id = "section2box">
  <h3 class="section-text">Focus: </h3>
  <h3 class="section-text2" id = "section2_2">What Companies Have We Seen on the Layoff News?</h3>
</div>
</a>
```

*(The overall structure of our HTML file)*

In each section, there normally are heading, body text, the embedded graham, the context and the sources link. By using different tags of HTML, we can define the various elements of a page, such as headings, paragraphs, images, and links, and organize them in a logical hierarchy.

```

<!-- Body1 -->
<div id="bodyblock1">
  <hr class="blockline">
<div class = "bodytext">
  <h2 class="heading-text" style='margin-top:5vh'>Context: Total Layoff Timeline</h2>
  <p class="body-text">First, we want to introduce the layoff trend from the past year and discover when t
<br><br>However, the <b>average percentages of layoff</b> per company at these times are not quite high. T
  <div class='tableauPlaceholder' id='viz1682982964901' style='position: relative'><noscript><a href='#'><
  > <param name='site_root' value='' /><param name='name' value='EDAcopy&#47;TotalLayoffsovertimeLine' /><
  value='yes' /><param name='display_count' value='yes' /><param name='language' value='en-US' /></object>
  document.createElement('script'); scriptElement.src = 'https://public.tableau.com/jav
  <p class = "body-text"><b>Sources</b><br><a href="https://layoffs.fyi/">Layoffs.fyi</a>
</div>

```

### (Body 1 Code Sample)

CSS is also used heavily to arrange the different elements on the website. It allows us to define the colors, fonts, layouts, and other visual elements of our page, giving you complete control over its look and feel. By using CSS, we created this consistent and professional-looking website that is easy to read and visually appealing. Important elements are labeled with a unique ID so that we can retrieve and assign style to it. Some repeating elements share the same styles, so we used class to arrange them together. Some of the CSS code is generated directly from Figma. We used Figma to create the layout of the website and export the CSS code for certain elements such as the title png.

```

.section-text2{
  font-family: 'Roboto';
  font-style: italic;
  font-weight: 700;
  font-size: 20px;
  line-height: 23px;
  color: #0E0E52;
  text-shadow: 0px 4px 4px rgba(0, 0, 0, 0.25);
}
.blockline{
  position: relative;
  width: 80%;
  top: 0vh;
  border: 1px solid #192BC2;
}
#title {
  position: absolute;
  width: 926px;
  height: 59px;
  left: 257px;
  top: 410px;
}

```

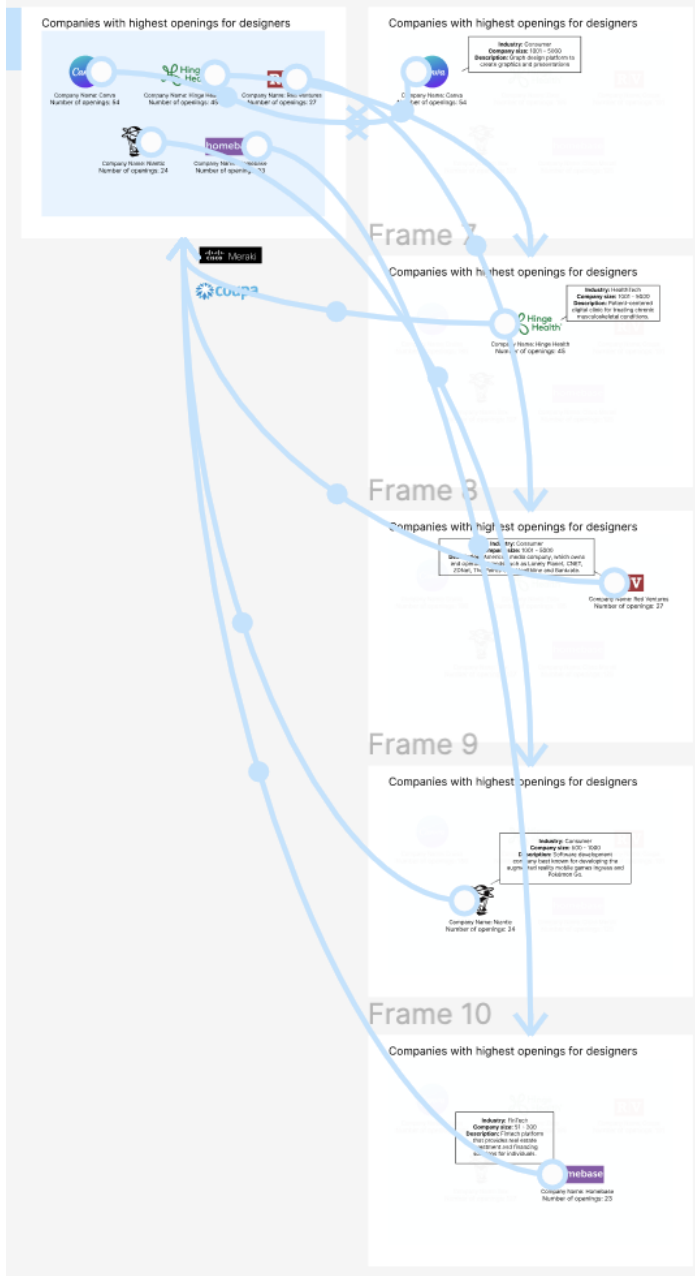
*(CSS Code Sample)*

### **5.3 D3 (Observable):**

We used the D3 (observable) to create the Sankey chart. We experimented with different ways to present in the Sankey chart. Whether the Sankey should be static with no interactivity, one with draggable nodes interactivity, or a hover node one. Testing these out required codes from different sources, and merging and demerging segments of code to make them work. Finally, the processed hiring was converted into a format that could be understood by the code to create the Sankey chart.

### **5.4 Figma:**

We learnt how to use the Figma prototype to achieve the hover effect. The design entailed putting the logos and information together, and designing different frames for flows. The design for one designation (Engineering, Product or Designer) has 6 frames: 1 main frame, one for each company's hover details. The company logos were obtained from the internet. Other options such as d3, canva, microsoft ppt were thought about. But realized that the hover interactivity can be best achieved by Figma, so decided to go ahead with it.



## 6. Results

We conducted our usability testing on one of our initial prototypes that were generated in Notion (see Appendix) that consists of a choropleth for showing layoff distributions by locations, a scatterplot showing layoff distributions by company fundings and a bar chart set for showing. The usability testing consists of qualitative and quantitative analysis with 3 participants who were UC Berkeley

master students and either curious about or actively looking for technology related jobs.

From our usability testing, we overall received positive feedback on the design regarding the scopes of information presented to the audience in terms of where the layoff happens and what roles provide more hirings, we collected a few qualitative insights from our users to our visualizations: 1) Big companies hiring few designers; 2) smaller companies have larger openings as compared to larger companies and 3) users were surprised that product openings distribution aren't the same as engineering ones.

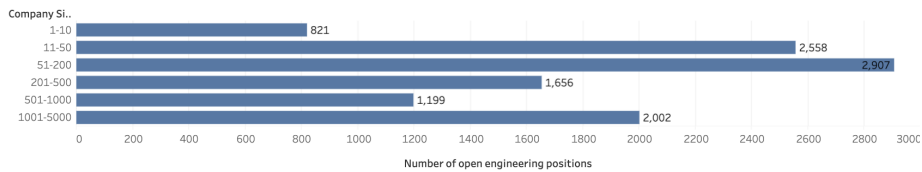
We also focused on testing different visualization iterations, the time spent and accuracy of our participants when they were looking for some specific sample information we wanted to highlight on our initial visualizations. For instance, for the choropleth, we asked our users to 1) explore both graphs for 1 minute each and allow the participant to decide some pros and cons for both versions, 2) find which three regions have the most layoff companies and 3) find what companies have the most layoff within each state. The results turned out to be almost 90% of accuracy achieved across each task and users were able to find the designated information within 30 seconds to 1 minute. However, we received feedback from the users and our professor that the original choropleth may bias towards some layoff areas that have particularly higher amounts of population, and some locations and numeric labels are too congested. We incorporated the feedback in our final deliverable and made a more granular map view that represents layoff situations per city and average % of company layoff, instead of using absolute numbers of layoff by state.

For the Scatterplot, Participants 1 and 2 took longer to find the piece of information they were looking for, while participant 3 found it quickly due to their prior assumptions about the scale of the company at stake. This suggests that users may have different goals when interacting with the graph and may require different ways of searching for information. Adding a search box and keeping the interaction could satisfy both needs. Other qualitative results suggest that users thought the legend had filtering function, wished there was a text box for indexing information faster, and generally accepted their assumptions about the correlation between the maturity of a company and the percentage of employees laid off. Users also understood what the x-axis and y-axis represent, but were confused by the overlapping data points and annotation boxes. Adding self-elimination function to the annotation boxes and jittering the data points while making the graph bigger could help address these issues.

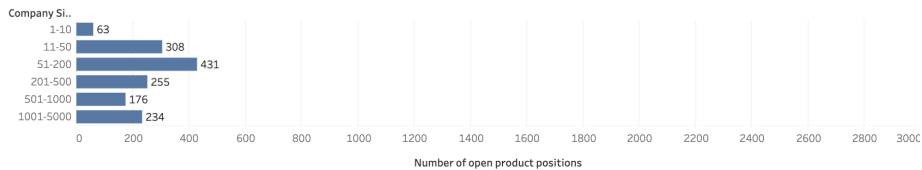
From the bar graphs that we had shown to the users during usability study there were a few issues that emerged that we have addressed in our new designs.

## Older bar graphs:

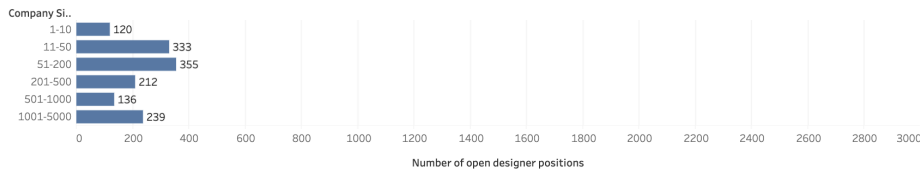
Engineering Openings - by Company Size (Number of employees)



Product Openings - by Company Size (Number of employees)



Designer Openings - by Company Size (Number of employees)



Users wanted a clearer differentiation between different company sizes. They were also looking for industry wise distribution, and easier comparison between engineering, product and designer roles instead of needing to compare across bar charts. Users were also getting confused with what a couple of bar graphs actually represented.

The proposed change of our study was that the choropleth was edited into a new version of more granularity, the scatterplot was discarded per feedback and the hiring bar charts were converted into a new version of more animations.

## 7. Group Members Contributions

Members	Contributions
Harris Wang	Initial Research <ul style="list-style-type: none"> <li>- Conducted research on available layoff and hiring datasets and discovered news articles that support the major events in layoff</li> </ul>

	<ul style="list-style-type: none"> <li>- Data cleansed layoff.fyi and compiled initial findings in Exploratory Data Analysis using Tableau</li> </ul> <p>Usability Testing</p> <ul style="list-style-type: none"> <li>- Designed tasks and questions for the Tableau choropleth, compiled and recorded meeting notes of 1 out of 3 participants for the entire website flow, and drafted a report for this participant's input</li> <li>- Contributed to the qualitative and quantitative analysis for the choropleth</li> </ul> <p>Development</p> <ul style="list-style-type: none"> <li>- Designed and iterated 5 Tableau visualizations including the choropleth, bar chart of top 3 layoff companies per city, tech company layoff timeline, tech layoff trend and pre/post-IPO distribution.</li> <li>- Created contents for the opening text, transitional text in between layoff visualizations on the final website</li> </ul>
Jannie Zhou	<p>Initial Research</p> <ul style="list-style-type: none"> <li>- Conducted desk research on available layoff and hiring datasets and discovered reports by major players in this field that offered inspiration for our project.</li> <li>- Used R to complete data-mining and cleaning of our primary dataset layoff.fyi and compiled initial findings in Exploratory Data Analysis using Tableau</li> </ul> <p>Usability Testing</p> <ul style="list-style-type: none"> <li>- Designed tasks and questions for the Scatterplot, arranged the meetings, recorded all the sessions, led one usability study, observed and took notes for 2 other sessions, and led the synthesizing results meeting within the team.</li> <li>- Contributed to the qualitative and quantitative analysis for the report</li> </ul> <p>Development</p> <ul style="list-style-type: none"> <li>- Designed and iterated 3 Tableau visualizations including the scatterplot (funds raised vs. layoff percentage), layoff timeline, layoff percentage separated by company stage. Only the timeline graph is refined and integrated into the final project</li> <li>- Created the website from scratch, without using code templates</li> </ul>

	<ul style="list-style-type: none"> <li>- Design the important visual elements on the website, such as title image, logo image and color palette</li> <li>- Manage and maintain the GitHub repository of the project</li> </ul> <p>Management</p> <ul style="list-style-type: none"> <li>- Arranged meetings within group to discuss priorities, project goals, and keep up with the deadlines</li> <li>- Lead the conversations and decide the direction for our project</li> <li>- Keep track of meeting notes, project documents, and logistic planning</li> </ul>
Shubham	<p>Initial Research</p> <ul style="list-style-type: none"> <li>- Conducted research on available layoff and hiring datasets.</li> <li>- Searched for more exhaustive alternate data sets when the team wasn't sure about going ahead with layoff as the project topic.</li> </ul> <p>Usability Testing</p> <ul style="list-style-type: none"> <li>- Designed tasks and questions for the hiring data, compiled and recorded meeting notes of 1 out of 3 participants for the entire website flow, observed the other 2 meetings, and managed the hiring data part of the write up and research.</li> <li>- Contributed to the qualitative and quantitative analysis to synthesize results from the study.</li> </ul> <p>Development</p> <ul style="list-style-type: none"> <li>- Managed the hiring side of the project including finding data, cleaning it, experimenting different visualizations with it, and finally creating the plots presented in the usability study and then the final project.</li> <li>- Writing the hiring text on the report, usability study, and the website.</li> </ul>

## 8. Appendix

### 1. Datasets and News Articles

Layoff:

<https://www.kaggle.com/datasets/chickooo/top-tech-startups-hiring-2023?resource=download>



<https://news.crunchbase.com/startups/tech-layoffs/>

<https://www.computerworld.com/article/3685936/tech-layoffs-in-2023-a-timeline.html>

<https://www.spglobal.com/marketintelligence/en/news-insights/latest-news-headlines/corporate-layoffs-in-2023-8212-a-timeline-74012248>

Hiring:

<https://stillhiring.today/>

<https://www.kaggle.com/datasets/chickooo/top-tech-startups-hiring-2023>

## 2. EDA Reports

<https://docs.google.com/document/d/15iOOC1i7bBSXuJcTu0x7mQ9SK5dyi77mH--Q4QdUHjk/edit>

[https://docs.google.com/document/d/1\\_0KsJ\\_e\\_wgEmNQjLd29fvvNghS1AzxkcrY35ootC4jo/edit](https://docs.google.com/document/d/1_0KsJ_e_wgEmNQjLd29fvvNghS1AzxkcrY35ootC4jo/edit)

## 3. Usability Testing

Prototype Tested:

<https://cuboid-umbrella-b96.notion.site/What-happened-to-Tech-Labour-Market-b0d0067303d54aeebb04c7fac294fab7>

Observable Notebook:

<https://observablehq.com/d/f32395629ae5e38f>

Usability Script:

[https://docs.google.com/document/d/1eUM\\_31NreXbmzYbRAuZoqV07rsKKi9oMiWfxwdVy84U/edit?usp=sharing](https://docs.google.com/document/d/1eUM_31NreXbmzYbRAuZoqV07rsKKi9oMiWfxwdVy84U/edit?usp=sharing)

Preliminary feedback:

[https://docs.google.com/document/d/1eUNX7i1HszzPL1GuFYEqvSO-zvHds0Gv32i9T2KcaQ/edit?usp=share\\_link](https://docs.google.com/document/d/1eUNX7i1HszzPL1GuFYEqvSO-zvHds0Gv32i9T2KcaQ/edit?usp=share_link)

## 4. Visualizations

Repository:

[https://drive.google.com/file/d/13B0I5JRTgTKYb6Klia9GdNkgCPTVOTSw/view?usp=share\\_link](https://drive.google.com/file/d/13B0I5JRTgTKYb6Klia9GdNkgCPTVOTSw/view?usp=share_link)

Tableau Public Links:

<https://public.tableau.com/app/profile/harris.wang/viz/BigTechLayoffOverview/Sheet2?publish=yes> (includes total layoff trend timeline and IPO butterfly chart)

[https://public.tableau.com/app/profile/harris.wang/viz/FinalProject\\_16821473391160/LayoffCompanyv\\_States3?publish=yes](https://public.tableau.com/app/profile/harris.wang/viz/FinalProject_16821473391160/LayoffCompanyv_States3?publish=yes)

<https://public.tableau.com/app/profile/harris.wang/viz/EDACopy/TotalLayoffsovertimeBar>

5. Icon/Image Reference

Cover Image:

<https://www.pngwing.com/en/free-png-tkvnj>

Conclusion Image:

[https://www.kindpng.com/imgv/TxoTJxx\\_jobseeker-hero-illustration-job-seeker-png-transparent-png/](https://www.kindpng.com/imgv/TxoTJxx_jobseeker-hero-illustration-job-seeker-png-transparent-png/)