Front-end data visualization tools to look out for in 2021

Data visualization leverages the incredible capabilities and bandwidth of the visual systems to move a huge amount of information into our brains quickly - it helps us comprehend information quickly. For instance, charts, maps, graphs, etc. are used to show trends, patterns, irregularities and relationships. Data visualization techniques are continuously evolving and significantly impact today's business due to the crazy amount of data we are rapidly producing. This is where data visualization tools come into play to create different charts from simple to advanced to bring data to life. In this article, we will discuss the top 5 data visualization tools for front-end developers to look out for in 2021. Although data visualization tools help us to visualize the data, we need to ensure that the visualizations that appear on front-end application must be simple, powerful and give meaning despite the screen size. In addition, nowadays, industries are inspired to follow design patterns such as atomic design that involve breaking down web applications into simple and small components to be easily reused somewhere in the application. This improves the development time, maintainability and readability (especially if you return to the code later in the future for reference or to make changes). With this atomic design pattern in mind, the data visualization tool we choose needs to be aligned with the concept of this pattern.

Furthermore, we will try to understand which tools are widely used among the developers by looking at their weekly Node Package Manager (NPM) downloads, Stack overflow data, GitHub activities and topic searches on Google. We will go through the below points to see the capability of each tool – this helps us to know the likelihood of the tool appearing or dominating in 2021:

- How large is the dataset?
- What kind of charts do you want to use?
- Where is this tool used? e.g., Web, tablet, mobile?
- Browser support
- Do you need to use any framework/library or plain JavaScript will be sufficient?

1. D3.js

D3 is one of the most popular JavaScript libraries available for creating dynamic and interactive data visualization. D3.js uses Scalable Vector Graphics (SVG) to create objects on browser. D3 functions enable us to bind large datasets with SVG objects in order to generate graphic charts and diagrams.

There are three important concepts every developer needs to understand before using D3. The first concept is to know how to use and manipulate SVG in order to create an object on the browser, such as shapes. The second concept is data binding - D3 has its own way of joining or binding data into SVGs. This may be confusing for the developer who has just started learning D3. The last concept is to pick up the scale functions D3 provides. This function is used to transform data values into visual variables such as position, length, colour, etc.

D3 might be useful for vanilla (plain) JS developer as integration with plain JS is easy. However, as D3.js has access to the Document Object Model (DOM), there may be a conflict in handling the DOM if JS library/framework such as React is used. For instance, React creates its own virtual DOM or node tree rather than using the real DOM to update state. React only updates the elements where changes are detected. Whereas, D3 accesses the real DOM directly for updates or manipulation. As we have noticed React and D3 use two different approaches to handle updates or manipulation. Therefore, there will be a conflict if we decide to integrate D3 with React. To avoid this conflict, the developer needs to ensure that React and D3 work in their own spaces. This is an indicator that shows that D3 has a steep learning curve that is time consuming. D3 is also useful to create charts from scratch.

Community:

NPM Data suggests that many users depend on the library as it has 1,286,805 weekly downloads. D3 is maintained regularly since its last published date was 21 days ago. Its 93.8K star on Github shows that a substantial number of people are interested in this project.

D3 remains dominant over the years on Stack overflow and the result is the same on Google search as shown in the below graphs:
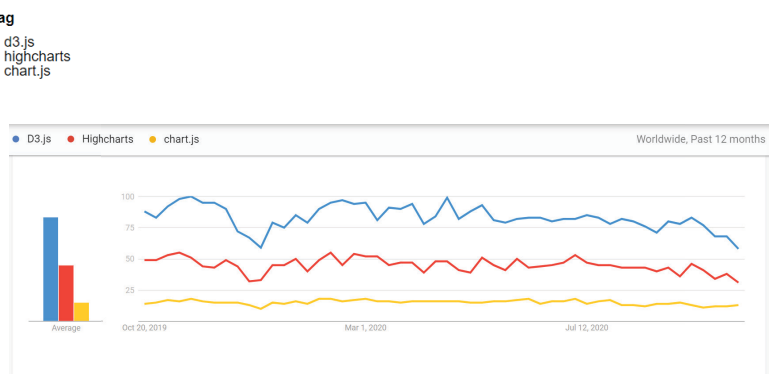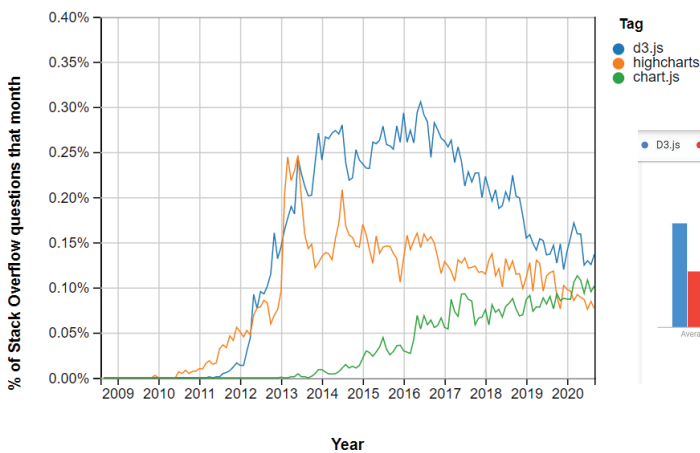
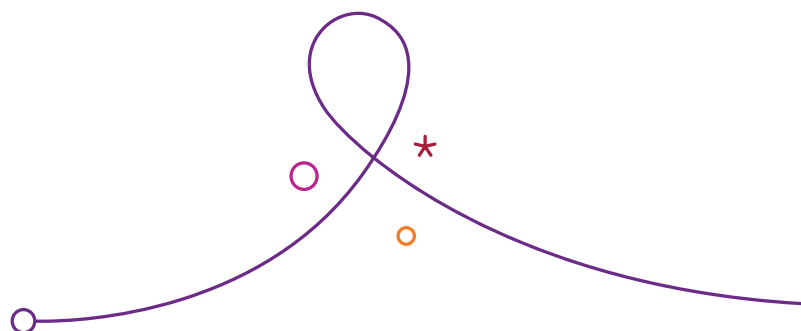| Pros	Cons
D3 is open source, which gives you the flexibility to work directly with the source code and also add your own feature/s	Although D3 provides you the absolute control you need to create your own visualization, the learning curve is steep and time consuming
You don't need additional plug-ins or technology to make D3 work – only a browser is required	D3, does not allow you to build things right out-of-the-box
It can be integrated with JavaScript, React, Angular-JS, React Native and Bootstrap	
You have complete control: you can customise or even create your own visualization as suitable for your needs	
D3 is lightweight, fast, works directly with large datasets and web standards	
Large community	
Offers high levels of interactivity	

2. Highcharts

Highcharts is another modern SVG based, cross-platform charting library. Highcharts is written in pure JavaScript and contains predefined and standard charts that enable you to add an interactive visualization. It provides full API functionality that allows you to tailor the system based on the business requirement. It is compatible with modern browsers including mobile, tablets and old IEs back to IE6, and it has been in active development since 2009.

WINTER OLYMPIC MEDAL WINS
Source: sports-reference.com
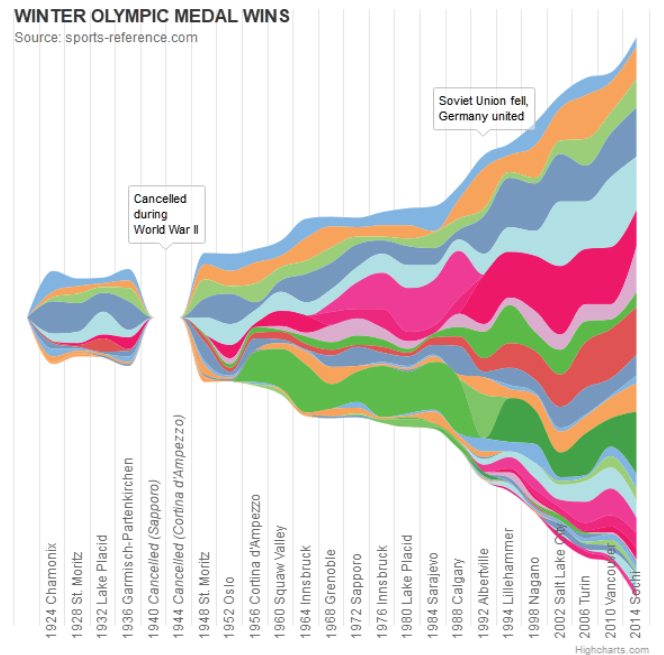
Community:

It is widely used by the community. As of now, 9.7K Github users star the project and NPM Data indicates that its weekly downloads are around 480,160. It is regularly maintained as it was last published about a month ago and has zero issues on Github.

Pros	Cons
The learning curve is easy and smooth.	It is not free for commercial use unless you use it for personal projects, school websites and non-profit organizations
JavaScript libraries (React, Vue and Angular) developers can easily integrate Highchart's wrapper to use the charts	
It has detailed documentation and has good support	
Wide range of browser support	
Provides good examples	

3. ChartJs

ChartJS is a library of open source HTML5 charts for responsive web applications that use canvas element. Its 8 chart types enable you to visualize your data in different ways that are animated and customisable. However, some charts such as bullet, funnel, Gantt, Network are not covered by ChartJs. There are available wrappers for React and Vue applications if you prefer not to integrate ChartJs directly.
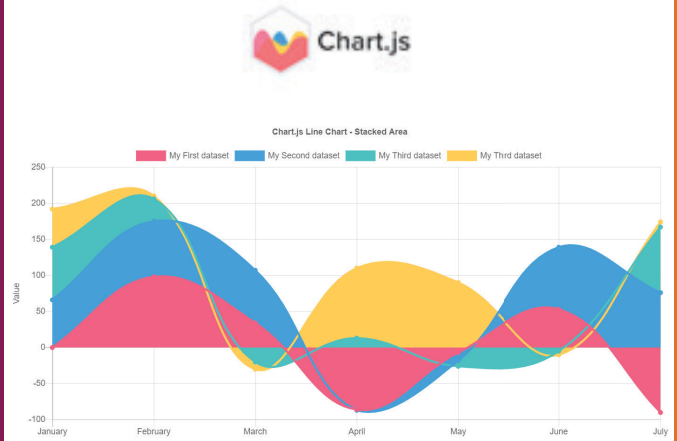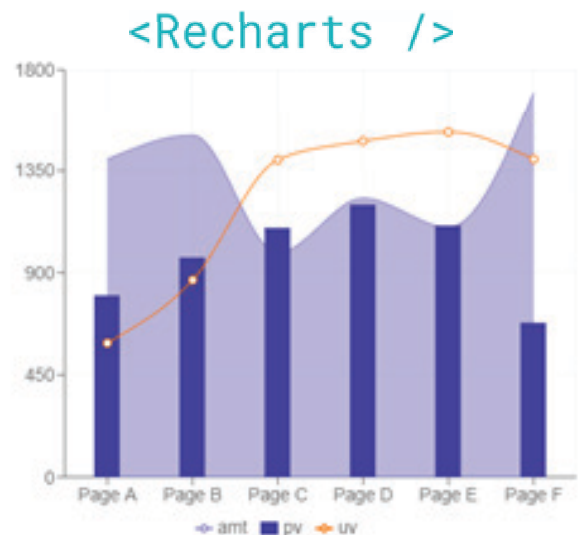

Community:

It is popular with 50.3K Star in Github and NPM Data of 1,144,858 NPM weekly downloads:

Pros	Cons
Lightweight and fast	Limited charts – it offers only 8 types of charts
Continues contribution from its large community as it is open source	Lack of features such as SVG – its canvas approach may be not suitable for small data
Responsive charts – redraws based on the window	
Its canvas-based approach is suitable for large dataset with interactivity particularly where SVG is not suitable	
Has wrapper for React & Vue	

4. Recharts

This library was created specifically for React users. D3 is used under the hood in order to create charts for React users. It is light and renders on SVG elements to create simple, customisable and interactive charts. Its performance is great for static charts. In addition, SVG based libraries perform better when we have small to medium size of datasets. Recharts may be slower when dealing with large datasets or multiple animated charts on the same page.

Community:

NPM Data shows that 446,260 users download this library on a weekly basis. The same data also suggest that the last publish date was 14 days ago. Although 14.8K people have given stars to the library, it has 181 unsolved issues on Github. This indicates that there may be slow response for any issues that may occur in the future.

Pros	Cons
Suitable for React applications as it's built on React components	Lack of multi-platform as it relies on React
Renders quickly and smoothly for small data and static charts	

5. ApexCharts

ApexChart is a new open source library that contains several chart types and is fully responsive (works on desktops, tablets and mobiles). ApexCharts helps developers create beautiful and interactive visualizations for web pages that are easy to configure and create charts as it provides great documentation. The library can be simply integrated with the JavaScript libraries/frameworks such as React, Vue and Angular. ApexChart provides source code for the examples it shows on its website – you can search for examples with the preferred JavaScript library/framework such as React or Vue. This enables you to pick up the tool quickly and adjust it based on your needs.

Community:

127,875 users download the library on a weekly basis according to NPM Data. It is maintained regularly as the last published date was just two days ago. Although the library is new, it is starred by 9.3K users in Github. Also, there are 505 unsolved issues which need to be considered before proceeding with this tool.

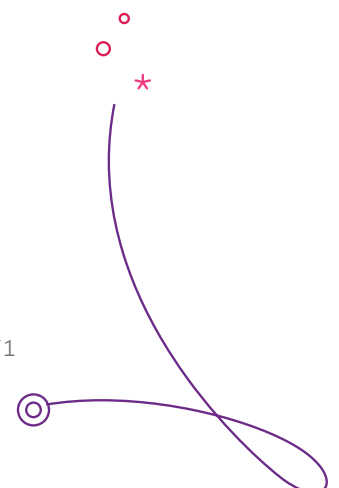| Pros	Cons
Open source	Smaller community
Highly customisable and easy to set up. It integrates and supports multiple platforms	
Beautiful design	

Conclusion:

We have discussed different types of data visualization tools that can be used for front-end application and seen their offerings and community. We have also tried to steer clear of diving into pros and cons for each tool. Lastly, the below table shows the kinds of chart types, features, interactivity and rendering technologies supported by each mentioned tool:

	Supported Chart Types												
Library Name	Free	Line	TimeLine	Scatter	Area	Pie	Donut	Bullet	Radar	Funnel	Gantt	Network	Grouped
D3.js	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Highchart	Free only for personal and non-commercial	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Chartjs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	No	No	No	Yes
ApexCharts	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	No	No	No	Yes

	Supported Chart Types					Other Features	Interactivity		Rendering technologies			Databinding
Library Name	Stacked	Negative	Discrete	Horizontal	3D	Legends	Mouse Over	onClick	Html 5 Canvas	SVG	VML	AxisXY
D3.js	Yes	Yes	Yes	Yes	N/A	Yes	Yes	Yes	No	Yes	No	Yes
Highchart	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes
Chartjs	Yes	Yes	Yes	Yes	N/A	Yes	Yes	Yes	Yes	No	No	No
ApexCharts	Yes	Yes	Yes	Yes	N/A	Yes	Yes	Yes	No	Yes	No	N/A

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Daniel has over 3 years of experience as software engineer and has worked on different domains such as retail and airline. He is a passionate engineer who works activity to optimise the application for maximum performance by identifying opportunities for improvement, designing and implementation. He is eager to learn new technologies and dedicated to solving complex business problems.

About Mindtree

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