

**Term Project Report for CSCI 55200  
On**

# **Visualization of Nobel Prize Data**



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## 1) Objective

The Nobel Prize is one of the prestigious awards which is awarded to eminent personalities who efforts in particular field, contribute to wellbeing of the mankind. Every year noted luminaries are given this award. Visualizing this data using different techniques will help to understand and analyze the data in better way.

## 2) Background & Motivation

Alfred Nobel signed a will and it was opened after his death which stated that majority of his wealth would be set aside for an award to be constituted to be given to personalities who work for world peace. This award was later named 'The Nobel Prize'. A new trust has be established and it will decide the list of recipients who have contributed a great deal of work in their respective fields in the previous year. All of his capital and assets were converted into fund, and interest of that corpus will be used to award the people of above mentioned criteria. (1) Initially, 5 categories decided for giving the award which are as follows:

1. Physics
2. Chemistry
3. Physiology/Medicine
4. Literature
5. Peace/Service

And later on from 1969, one more category was included for work done in the field of Economic Science. (2)

The official Nobel Prize website and other websites on the internet were studied and we couldn't find any interactive data visualization representations. They just contained only the list of noble laureates along with some other details. So, this spurred the interest in us to use this data and construct some interesting visualizations on the same.

## 3) Dataset

The dataset is a list of all the records who have received the Nobel Prize till now. The dataset is in .csv format. The prize is being awarded since 1901. And from this year onwards, it has been awarded every year in 5 different categories. New category of Economics is also introduced from the year 1969. Initially only individuals were awarded the Nobel Prize but, later on they started to recognize the contributions of institutions as

well for their work in the field. Till date 579 awards given to 911 people and organisations. The dataset contains more than 900 records with different attributes.

List of attributes:

1. Year
2. Category
3. Name
4. Individual / Organization
5. Gender
6. Place of Birth
7. Country of Birth
8. Continent
9. Year of Birth
10. Age at which Nobel is received
11. Country represented
12. Description

#### *4) Tools used for Visualization*

##### **1. D3.js**

D3.js is a java script library used to visualize the data in different format. It is used to display the data in more interactive and graphical form. D3.js library uses the SVG elements of web pages along with HTML and CSS. It is used widely in front end development interactive display of data. It can support multiple format of data sheets. Data can be provided either in JSON or CSV and using inbuilt libraries this data is visualized in different graphs. (3)

##### **2. HTML and CSS**

HTML is Hyper Text Markup Language is the markup language. This is used to design and develop the web pages or applications. HTML is structured set of predefined tags. (4) Along with HTML, CSS is used for styling purpose. CSS is Cascading Style Sheets which is used to enhance the display of the web page. It is used for better presentation. Using the CSS style sheet, different font, image styles imposed on the web page. (5)

### 3. Javascript

JavaScript is one of the core technologies used for web development. It is used along with HTML and CSS. This scripting language is embedded in the HTML code. All the major browsers support this scripting language. (6) D3 library is used in java script for visualizing the data.

### 4. TopoJSON

GeoJSON is format to represent the simple geographical attributes which are in form of JSON. But issues with this file is it is complex and file size is too large. A notable offspring of GeoJSON is TopoJSON, It is an extension of GeoJSON file format. The file size is much smaller than the GeoJSON. It also contains spatial co-ordinates of geographical features. For this project we have used world geospatial co-ordinates which is used for geo visualization.

## 5) *Visualization Techniques*

Our term project is visualizing the data of Nobel Prize winners using different visualization techniques. Our emphasis in this project is to make it a tool for the users who would like to analyze the Nobel Prize winners' data. We have concentrated on visualizing major parameters with which one can perform their analysis. The following visualizations have been performed.

### ❖ Geo Visualization

The world map is used for Geo visualization. First it requires, geo-spatial co-ordinate file which can be used to plot/ draw the map. TopoJSON file format is used as its simpler version of GeoJSON and also it is small in size. The data is read using below function.

```
topojson.feature(data, data.objects.countries1).features;
```

And then the data is added to the SVG element using path and projection. D3 provide multiple projection (different style in which map is to be displayed on the SVG). In our project we have used geoMercator projection.

```
var projection = d3.geoMercator()  
    .translate([w/2, h/2])  
    .scale(120);  
  
var path = d3.geoPath()  
    .projection(projection);
```

The map displayed on those countries which have won the awards in selected categories. So, we have filter the data using D3.nest() function. No of awards are grouped based on the countries and then this data is used to represent on the map.

```
grpByCategory = d3.nest()
    .key(function(d) { return d.Country_of_Birth; })
    .rollup(function(v) { return v.length; })
    .entries(data1);
```

And the color coding scale is used to display those countries with different colors. Domain for the colors is calculated based on the no of awards won by the listed countries. Minimum, average and maximum values for these are used as range for the color scheme.

```
var color = d3.scaleLinear()
    .domain([min, avg, max])
    .interpolate(d3.interpolateHcl)
    .range(["#F9D565", "#C5A130", "#81640A"]);
```

### ❖ Gender Wise visualization (Using Pie Chart)

Further we were specifying the visualization on continent level from world. Based on the selection of selected continent gender wise pie chart will be displayed. Again this data is filtered using nest() function for continents. Pie function requires path which is passed through d3.arc() defining the path.

```
var arc = d3.arc()
    .innerRadius(0)
    .outerRadius(r-150)
```

### ❖ Country wise visualization (Using bubble chart)

Similar to gender wise, based on the selection of continent, country wise list of awards will be displayed in form of bubbles. The chart is displayed in place of same DIV. The previous SVG is removed and new is inserted using following code:

```
d3.select("#chart").select("svg").remove();
```

Position of circles are placed dynamically based on the defined force. This force act of the position (x and y co-ordinates) of the circles (bubble) and placed on the SVG component. And another force (collision force) act on it to separate the 2 bubbles from each other.

```
var force = d3.forceSimulation()
    .force("x", d3.forceX(0).strength(0.1))
    .force("y", d3.forceY(0).strength(0.1))
```

```
.force("colision",d3.forceCollide(function(d)
{return radiusscale(d.value)+3}
));
```

Hover functionality is provided when mouse pointer points to any of the bubble which displays the count of the awards won by the particular country.

```
.on('mouseover', function(d) {
    tooltip.transition()
        .duration(200)
        .style("opacity", .9);
    tooltip.html("Awards: " + "<br/>" + d.value)
        .style("left", (d3.event.pageX) + "px")
        .style("top", (d3.event.pageY) - 40 + "px");
})
```

### ❖ Category wise visualization (using bar chart)

Similar to country wise, based on the selection of continent, category wise list of awards will be displayed in form of bar chart. X and Y co-ordinates of the bars are defined by scales of D3. In this project, we have used scaleBand for x co-ordinate and linear scale for y co-ordinate.

```
var xScale = d3.scaleBand()
    .domain(grpByCategory.map(function(d) {return d.key;}))
    .rangeRound([0,w])
    .padding(0.1);

var yScale = d3.scaleLinear()
    .domain([max + 1,min - 1])
    .range([ (margin.top), (h) ]);
```

### ❖ Time line visualization (timeline graph)

This visualization will be more specific to the country level. The timeline graph will display the no of awards won by the countries across the years. And radius of the circle in the time line will represent the count. The details of the laureates for particular year will be displayed in separate DIV element by clicking on the circle.

```
.on('click',function (d) {
    d3.select("#detail").selectAll("label").remove();
    var year = d.key;
    var data2 = data.filter(function(data) {
        return data.Country_of_Birth == country});
    var detail = document.getElementById("detail");
    for(i=0;i<data2.length;i++) {
        if(data2[i].year == year) {
            var label = document.createElement("Label");
            label.innerHTML = "<b>Name: </b> "+data2[i].Winner+..
            detail.appendChild(label);
        }
    }
});
```



## 6) Results

Starting with the geo visualization which gives a view of the world map accentuating on the point of which countries have won the Nobel prizes from the beginning. This just gives a view of countries which have won the awards. Now we concentrated on making the visualizations very specific to certain parameters. For this we have done visualizations with parameters like according to country, according to gender, category, and timeline.

### 1. Geo Visualization

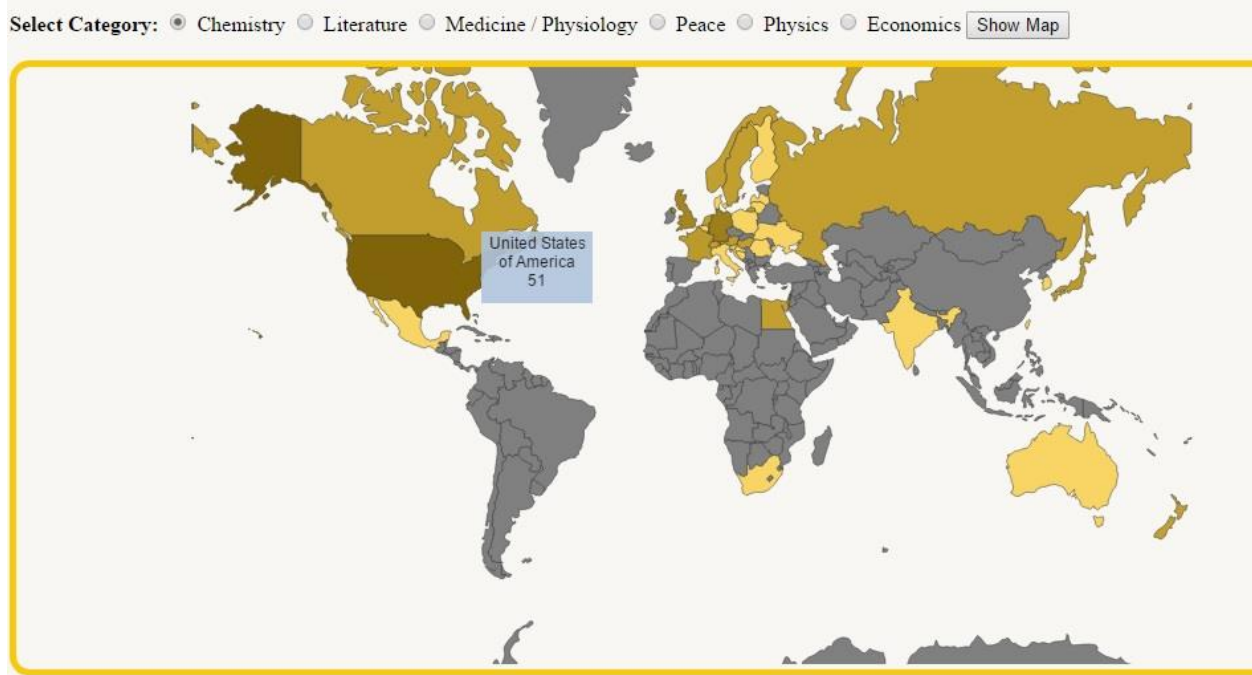


Figure 1: Geo Visualization (World Map)

In this visualization, the world map is displayed highlighting the countries, which the Noble prize winners represented. The color scheme used in this visualization is in such a way that as the number of noble prize winners increase the intensity of color with which the country is highlighted also increases.

For example, in the sample provided below we can observe, that USA has been represented more number of time than any other county hence the color intensity of this country is more. Whereas it can be observed that other countries have been represented with lighter intensity indicating less representations.

It can also be observed that several countries are shaded grey. This implies that these countries have not yet been represented.

This visualization can be used to see the countries represented specific to the field i.e physics, chemistry, literature etc.

When the cursor is hovered over a specific country, the tool tip displays the name of the country and also the number of awards.

## 2. Gender wise Visualization

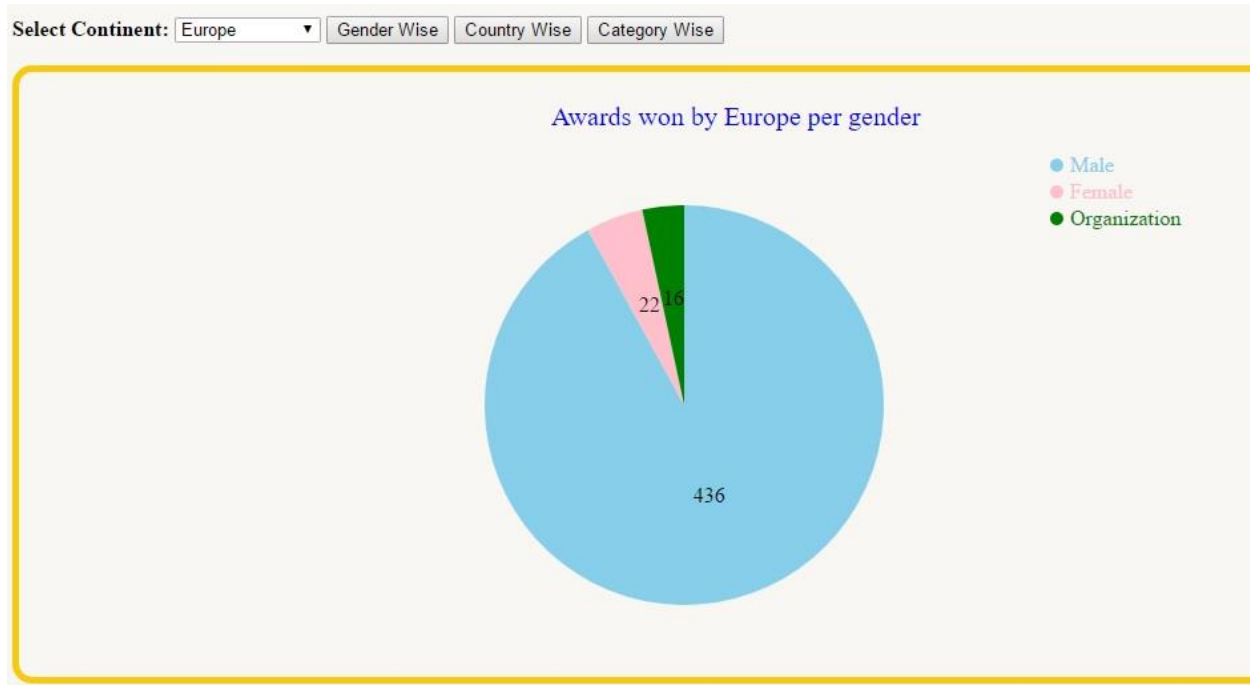


Figure 2: Gender wise Visualization (Pie Chart)

The next visualization the emphasis is on the gender of the noble laureates (with the exception of organizations). For this visualization, we have used a pie chart. The pie chart represents entities, male female, and organizations. This visualization can be viewed according to a continent. The continent can be selected from the drop-down list.

### 3. Country Wise Visualization(Bubble chart)

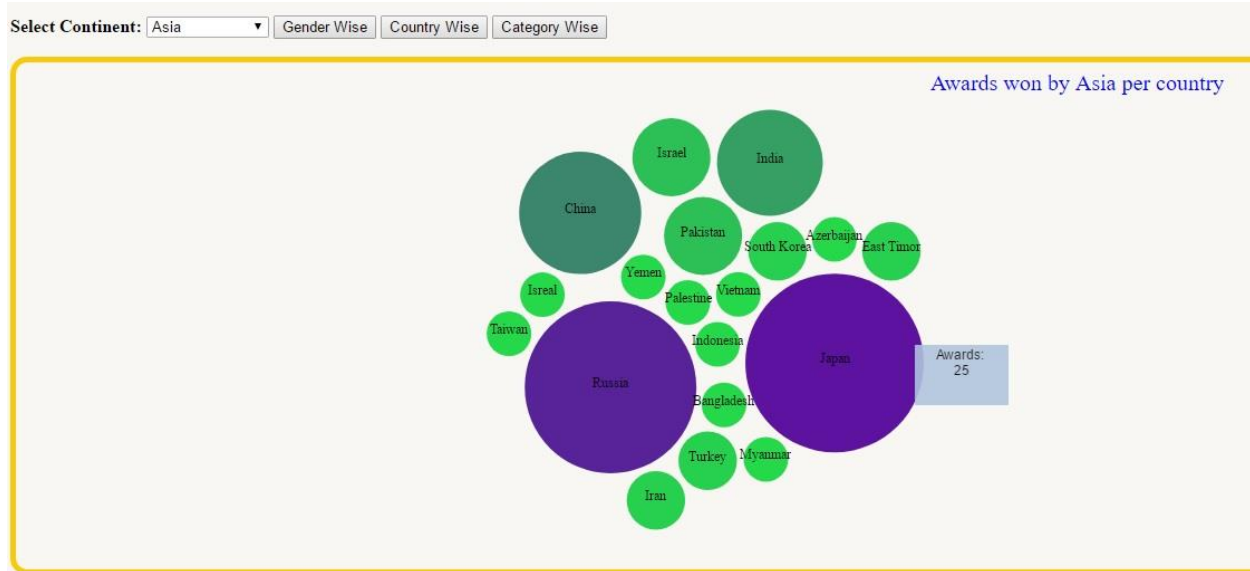


Figure 3: Country wise Visualization (Bubble chart)

In this visualization, emphasizes is on the countries. With the help of bubble chart, it can be observed visually how many times a country is represented in comparison with other countries in the selected continent. When a continent is selected from the dropdown list, a bubble chart of the respective continent comprising the countries is displayed.

Unlike the geo visualization, in country wise visualization only the countries which have been represented only will be displayed. The color intensity display is similar on the lines of geo visualization. When the tool tip hovered on a particular bubble displays the number of awards.

### 4. Category wise visualization(bar chart)

In this visualization we use the bar chart where when a continent is selected, the visualization displayed shows the number of awards the country has been represented for like literature, physics, chemistry... etc.

The x axis represents the categories while the y axis represents the number count of awards. When hovered over any bar, the tool tip displays the category name and number of awards.

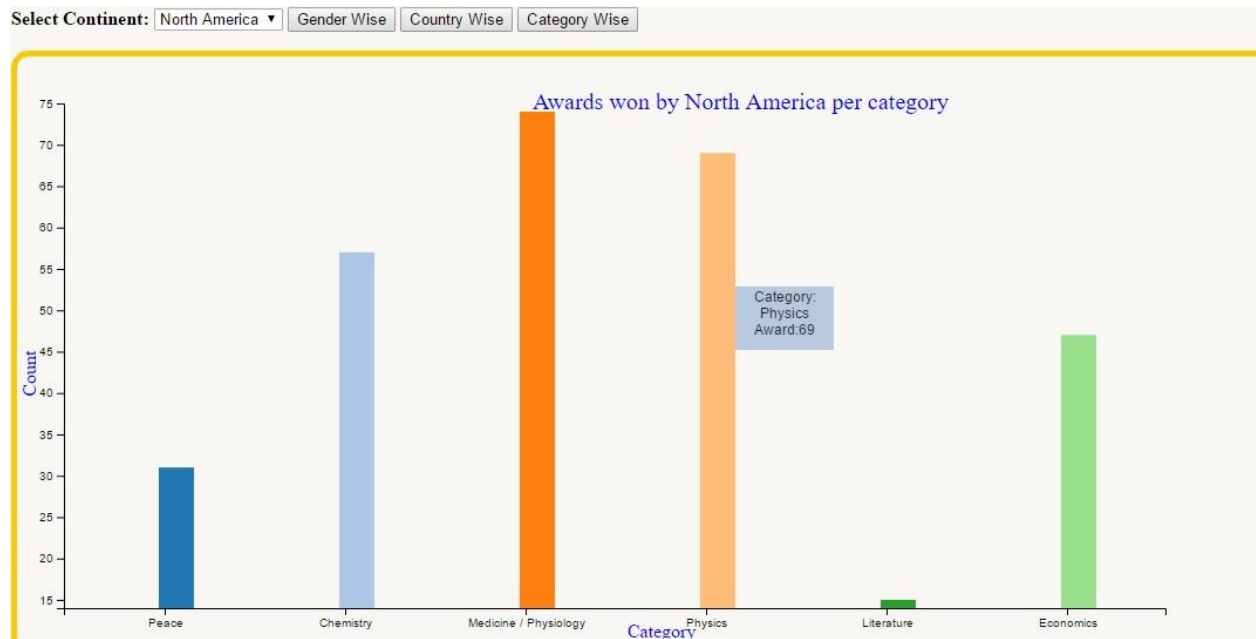


Figure 4: Category wise Visualization (Bar Chart)

## 5. The time line visualization:

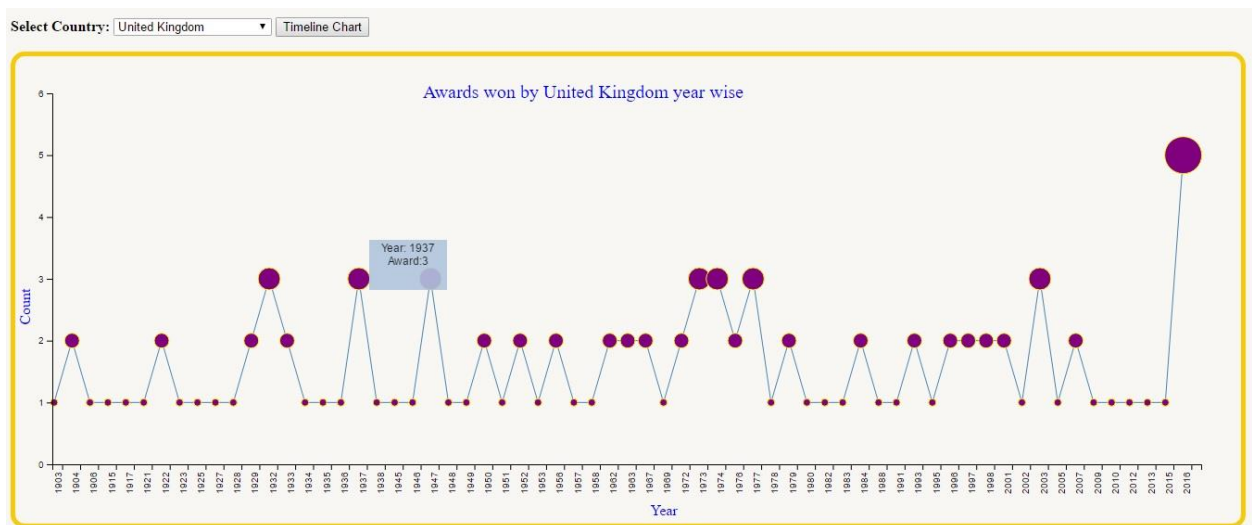


Figure 5: Timeline chart

This visualization has been done with the intention of further narrowing down the scope of analysis. Here the timeline shows one of the number of times the country has been represented from the inception of awards i.e. 1901 to the latest i.e. 2016.

The tipping points have a circle. The radius of this circle is directly proportional to the number of awards. The circles are joined by dots to give a continuous flow for the

visualization. The x axis represents the time line from 1901 to 2016 while the y axis represents the number of awards.

#### Details of Laureate:

Name: John Galsworthy  
Age at Nobel win: 65 Gender: Male  
Year: 1932 Category: Literature

Description: John Galsworthy OM (/?????lzw?r?i/; 14 August 1867 – 31 January 1933) was an English novelist and playwright. Notable works include *The Forsyte Saga* (1906–1921) and its sequels, *A Modern Comedy* and *End of the Chapter*. He won the Nobel Prize in Literature in 1932.

Name: Edgar Adrian  
Age at Nobel win: 43 Gender: Male  
Year: 1932 Category: Medicine / Physiology

Description: Edgar Douglas Adrian, 1st Baron Adrian, OM PRS (30 November 1889 – 4 August 1977) was an English electrophysiologist and recipient of the 1932 Nobel Prize for Physiology, won jointly with Sir Charles Sherrington for work on the function of neurons. He provided experimental evidence for the all-or-none law of nerves.

Figure 6: Details of Laureates

When clicked on any circle, the list of the noble laureates will be displayed along with a brief description about them.

## 7) Contribution

### ❖ Keyur Kirti Mehta

- Collected the dataset.
- Created Geo visualization with world map.
- Implemented pie chart for gender wise visualization
- Created timeline graph for country specific visualization
- Contribution in presentation and report preparation.

### ❖ Sundaram Narasimhan. C

- Data is refined as to use in visualization
- Created bubble chart for country wise visualization.
- Implemented bar chart for category wise visualization
- Contribution in presentation and report preparation.

## 8) Conclusion

Through this project we tried to visualize the Nobel Prize data using some of the possible ways through different visualization techniques at hand. The visualization used will help to understand the trend and analysis of the dataset. However more visualizations will help in giving even deeper view of things in the data.

## References

1. [Online] [http://www.nobelprize.org/alfred\\_nobel/will/](http://www.nobelprize.org/alfred_nobel/will/).
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3. [Online] <https://en.wikipedia.org/wiki/D3.js>.
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