

PREGRADO



UNIDAD 3 | USER INTERFACE IMPLEMENTATION

DATA VISUALIZATION

SI385 | IHC y Tecnologías móviles



Al finalizar la unidad el estudiante implementa aspectos frontend de una interfaz web, a la vez que examina interfaces aplicando métodos de evaluación de usabilidad.

AGENDA

DEFINICIÓN

POR QUÉ DATAVIZ

TIPOS DE GRÁFICOS

CONSIDERACIONES

DATAVIZ LIBRARIES



DATA VISUALIZATION



Es el estudio de la representación gráfica de **datos** con el objetivo principal de transmitir **información** de manera clara y efectiva a los usuarios.

Representación
gráfica

Datos

Información

Mensaje

¿Cuál es la diferencia entre “Datos” e “Información”?

(ojo: desde el punto de vista del usuario)

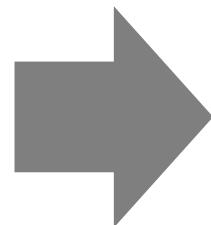


Datos vs. Información

¿Reconocen este medidor en el panel de un auto?



Es un indicador muy valioso



¿Porqué no entonces un sensor de alta precisión?

ebay Comprar por categoría ▾ Buscar... Todas las categorías ▾ E

Volver a los resultados de búsqueda | En la categoría: Motor: recambios y accesorios > Coches: recambios > Instrumentos y relojes > Otros



Pasa el puntero del ratón sobre la imagen para ampliarla

2" 52MM Temperatura del Agua Gauge Medidor + Sensor Para Coche LED Rojo Digital

★★★★★ Sé el primero en escribir una opinión.

Estado: Nuevo Cantidad: 1 Más de 10 disponibles 53 vendidos

12,99 EUR

¡Cómpralo ya!

Añadir a la cesta

● Añadir a lista de seguimiento
★ Añadir a colección 71 en seguimiento

Estado - nuevo	Vendedor con experiencia	Más de 63% vendidos
----------------	--------------------------	---------------------

Garantía al cliente

- Servicio de Atención al cliente en chat, email.
- Reembolso si no recibes o pagas con PayPal.
- Gestión simplificada de tu cuenta.

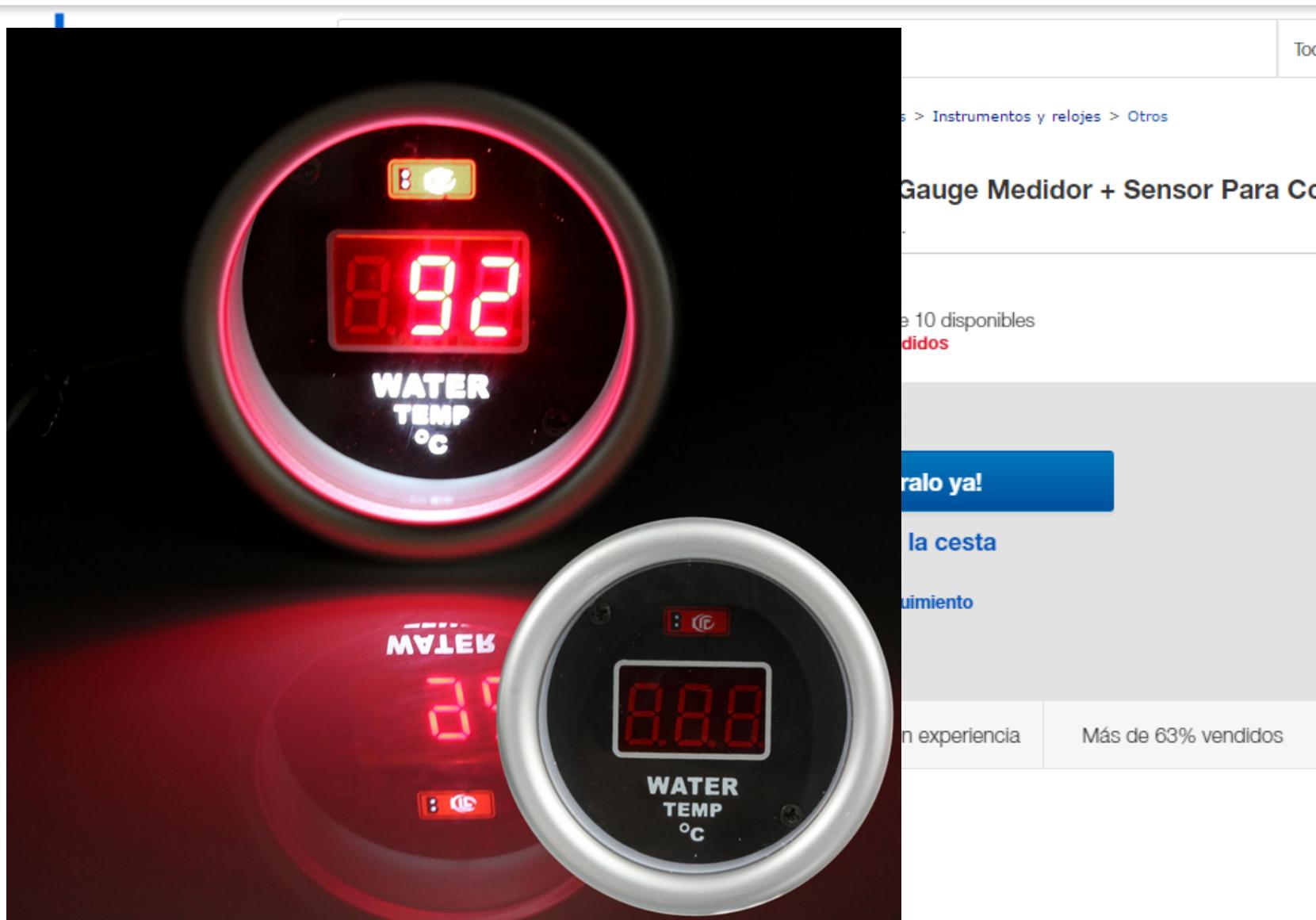
Ver términos y condiciones. Tus datos de consumo no se ven afectados.

Vendedor excelente
unoper (402783) 

98,7% Votos positivos

✓ Recibe constantemente valoraciones positivas de los compradores
✓ Envía los artículos con rapidez

¿Porqué no entonces un sensor de alta precisión?



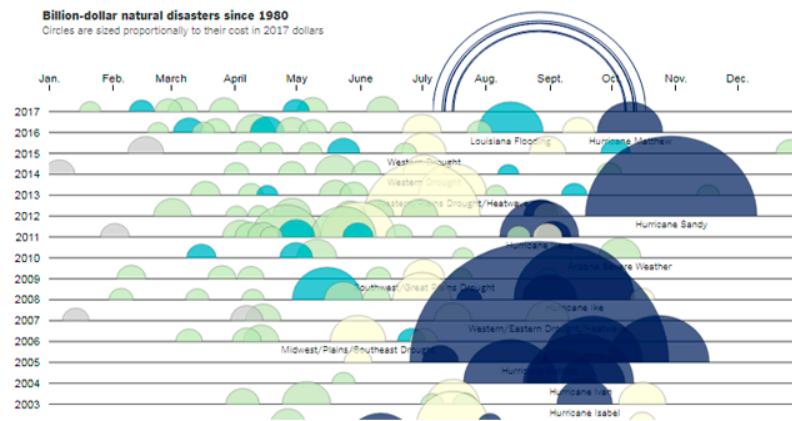
¿Porqué no entonces un sensor de alta precisión?



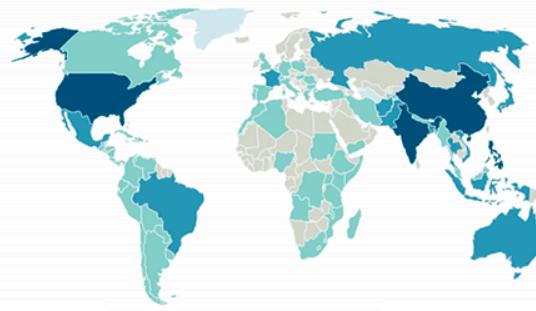
Pero en verdad, sabemos si
¿92° C es bueno o malo?

¿El conductor debería
continuar manejando
tranquilamente e incluso
acelerar ó debería detener el
auto a revisar si algo está
pasado?

¿Qué es Data Visualization (DV)?



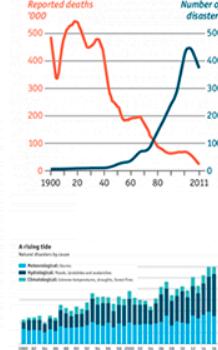
Total number of natural disasters* reported per country, 1995-2015



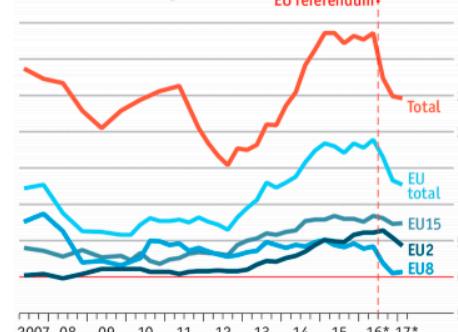
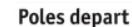
Source: UNISDR



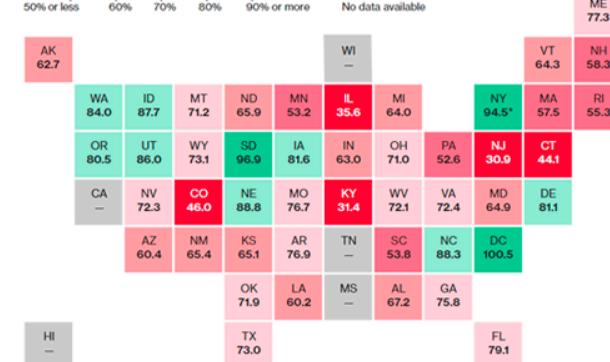
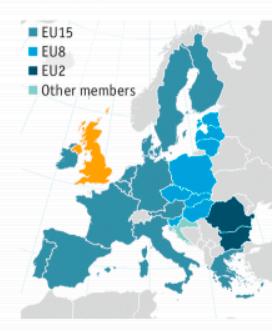
Global deaths from natural disasters



Las visualizaciones ayudan a las personas a ver cosas que no eran tan obvias para ellos antes.



Source: Office for National Statistics



Cuando los volúmenes de datos son muy grandes se pueden detectar patrones fácil y rápidamente.

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Veamos los primeros 6:14 minutos



Video completo:

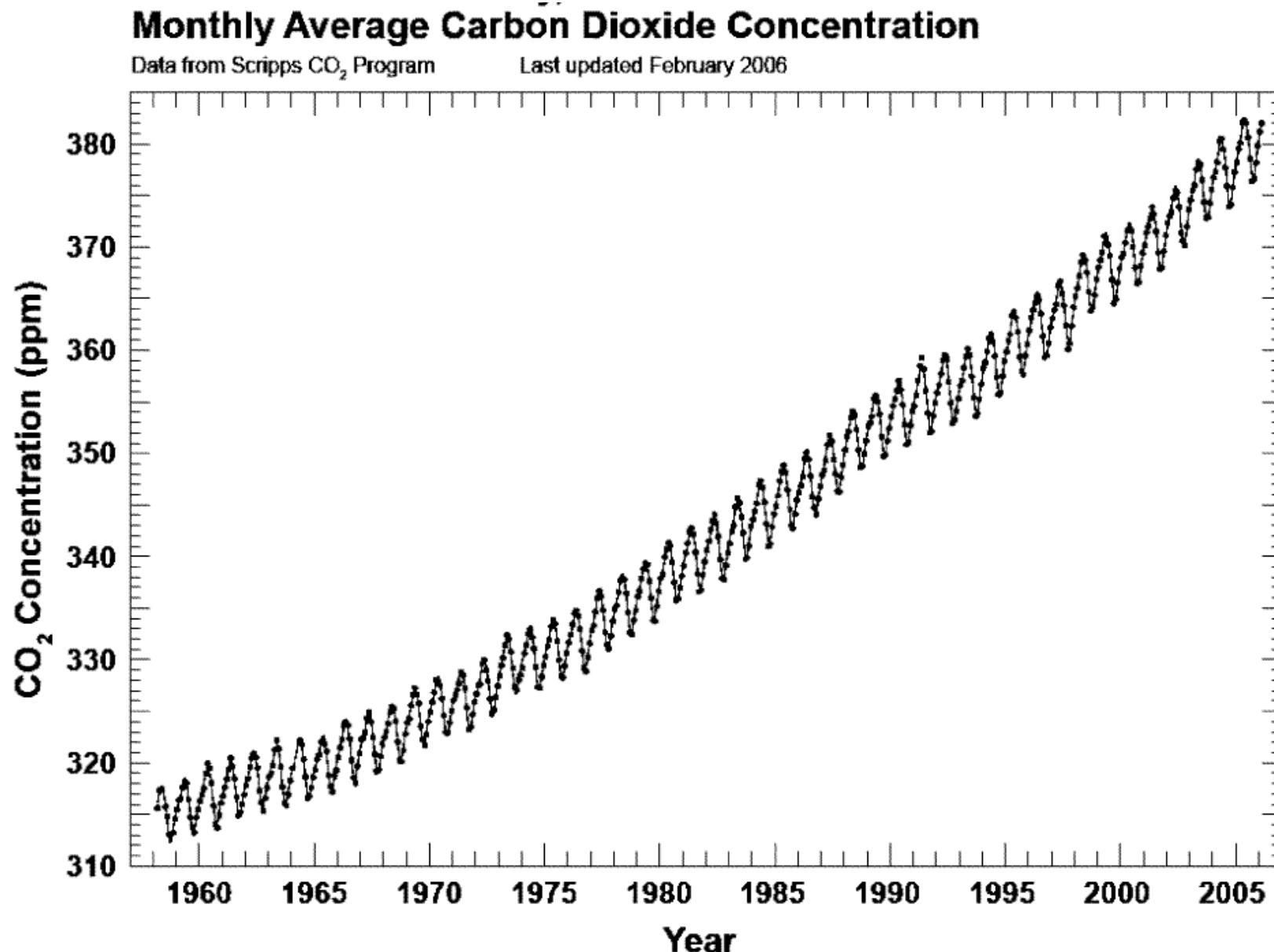
http://www.ted.com/talks/david_mccandless_the_beauty_of_data_visualization?language=es

¿Qué me puedes decir acerca de estos datos?

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Average
1958	-99.99	-99.99	315.7	317.45	317.5	317.26	315.86	314.93	313.2	312.44	313.33	314.67	-99.99
1959	315.62	316.38	316.71	317.72	318.29	318.16	316.54	314.8	313.84	313.26	314.8	315.58	315.98
1960	316.43	316.97	317.58	319.02	320.03	319.59	318.18	315.91	314.16	313.84	315	316.19	316.91
1961	316.93	317.7	318.54	319.48	320.58	319.77	318.57	316.79	314.8	315.38	316.1	317.01	317.64
1962	317.94	318.56	319.68	320.63	321.01	320.55	319.58	317.4	316.25	315.42	316.69	317.7	318.45
1963	318.74	319.08	319.86	321.39	322.24	321.47	319.74	317.77	316.21	315.99	317.12	318.31	318.99
1964	319.57	-99.99	-99.99	-99.99	322.24	321.89	320.44	318.7	316.7	316.79	317.79	318.71	-99.99
1965	319.44	320.44	320.89	322.13	322.16	321.87	321.39	318.8	317.81	317.3	318.87	319.42	320.04
1966	320.62	321.59	322.39	323.87	324.01	323.75	322.39	320.37	318.64	318.1	319.79	321.08	321.38
1967	322.06	322.5	323.04	324.42	325	324.09	322.55	320.92	319.31	319.31	320.72	321.96	322.16
1968	322.57	323.15	323.89	325.02	325.57	325.36	324.14	322.03	320.41	320.25	321.31	322.84	323.05
1969	324	324.42	325.64	326.66	327.34	326.76	325.88	323.67	322.38	321.78	322.85	324.12	324.63
1970	325.03	325.99	326.87	328.14	328.07	327.66	326.35	324.69	323.1	323.16	323.98	325.13	325.68
1971	326.17	326.68	327.18	327.78	328.92	328.57	327.34	325.46	323.36	323.57	324.8	326.01	326.32
1972	326.77	327.63	327.75	329.72	330.07	329.09	328.05	326.32	324.93	325.06	326.5	327.55	327.45
1973	328.55	329.56	330.3	331.5	332.48	332.07	330.87	329.31	327.51	327.18	328.16	328.64	329.68
1974	329.35	330.71	331.48	332.65	333.09	332.25	331.18	329.4	327.43	327.37	328.46	329.57	330.25
1975	330.4	331.41	332.04	333.31	333.96	333.6	331.91	330.06	328.56	328.34	329.49	330.76	331.15
1976	331.75	332.56	333.5	334.58	334.87	334.34	333.05	330.94	329.3	328.94	330.31	331.68	332.15
1977	332.93	333.42	334.7	336.07	336.74	336.27	334.93	332.75	331.59	331.16	332.4	333.85	333.9
1978	334.97	335.39	336.64	337.76	338.01	337.89	336.54	334.68	332.76	332.55	333.92	334.95	335.51
1979	336.23	336.76	337.96	338.89	339.47	339.29	337.73	336.09	333.91	333.86	335.29	336.73	336.85
1980	338.01	338.36	340.08	340.77	341.46	341.17	339.56	337.6	335.88	336.02	337.1	338.21	338.69
1981	339.23	340.47	341.38	342.51	342.91	342.25	340.49	338.43	336.69	336.86	338.36	339.61	339.93
1982	340.75	341.61	342.7	343.57	344.13	343.35	342.06	339.81	337.98	337.86	339.26	340.49	341.13
1983	341.37	342.52	343.1	344.94	345.75	345.32	343.99	342.39	339.86	339.99	341.15	342.99	342.78
1984	343.7	344.5	345.28	347.08	347.43	346.79	345.4	343.28	341.07	341.35	342.98	344.22	344.42
1985	344.97	346	347.43	348.35	348.93	348.25	346.56	344.68	343.09	342.8	344.24	345.55	345.9
1986	346.3	346.96	347.86	349.55	350.21	349.54	347.94	345.9	344.85	344.17	345.66	346.9	347.15
1987	348.02	348.47	349.42	350.99	351.84	351.25	349.52	348.1	346.45	346.36	347.81	348.96	348.93
1988	350.43	351.73	352.22	353.59	354.22	353.79	352.38	350.43	348.72	348.88	350.07	351.34	351.48
1989	352.76	353.07	353.68	355.42	355.67	355.13	353.9	351.67	349.8	349.99	351.29	352.52	352.91
1990	353.66	354.7	355.39	356.2	357.16	356.23	354.82	352.91	350.96	351.18	352.83	354.21	354.19
1991	354.72	355.75	357.16	358.6	359.33	358.24	356.17	354.02	352.15	352.21	353.75	354.99	355.59
1992	355.98	356.72	357.81	359.15	359.66	359.25	357.02	355	353.01	353.31	354.16	355.4	356.37
1993	356.7	357.16	358.38	359.46	360.28	359.6	357.57	355.52	353.69	353.99	355.34	356.8	357.04
1994	358.37	358.91	359.97	361.26	361.68	360.95	359.55	357.48	355.84	355.99	357.58	359.04	358.89
1995	359.97	361	361.64	363.45	363.79	363.26	361.9	359.46	358.05	357.76	359.56	360.7	360.88
1996	362.05	363.25	364.02	364.72	365.41	364.97	363.65	361.48	359.45	359.6	360.76	362.33	362.64
1997	363.18	364	364.56	366.35	366.79	365.62	364.47	362.51	360.19	360.77	362.43	364.28	363.76
1998	365.33	366.15	367.31	368.61	369.3	368.87	367.64	365.77	363.9	364.23	365.46	366.97	366.63
1999	368.15	368.87	369.59	371.14	371	370.35	369.27	366.93	364.63	365.13	366.67	368.01	368.31
2000	369.14	369.46	370.52	371.66	371.82	371.7	370.12	368.12	366.62	366.73	368.29	369.53	369.48
2001	370.28	371.5	372.12	372.87	374.02	373.3	371.62	369.55	367.96	368.09	369.68	371.24	371.02
2002	372.43	373.09	373.52	374.86	375.55	375.41	374.02	371.49	370.7	370.25	372.08	373.78	373.1
2003	374.68	375.63	376.11	377.65	378.35	378.13	376.62	374.5	372.99	373.01	374.35	375.7	375.64
2004	376.79	377.37	378.41	380.52	380.63	379.57	377.79	375.86	374.07	374.24	375.86	377.47	377.38
2005	378.37	379.69	380.41	382.1	382.28	382.13	380.66	378.71	376.42	376.88	378.32	380.04	379.67
2006	381.38	382.03	382.64	384.62	384.95	384.06	382.29	380.47	378.67	379.06	380.14	381.74	381.84
2007	382.45	383.68	384.23	386.26	386.39	385.87	384.39	381.78	380.73	380.81	382.33	383.69	383.55
2008	385.07	385.72	385.85	386.71	388.45	387.64	386.1	383.95	382.91	382.73	383.96	385.02	385.34

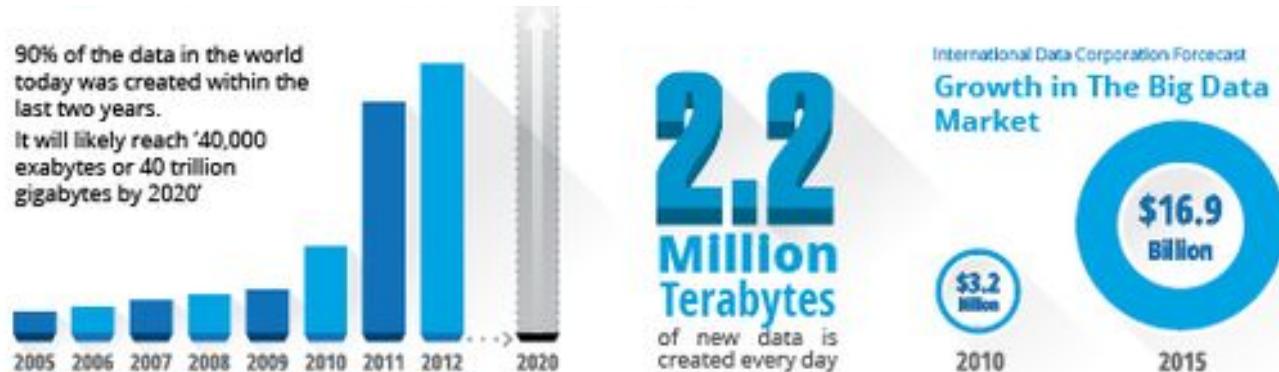
Values above represent monthly concentrations adjusted to represent 2400 hours on the 15th day of each month. Units are parts per million by volume (ppmv) expressed in the 2003A SIO manometric mole fraction scale. The "annual average" is the arithmetic mean of the twelve monthly values where no monthly values are missing.

¿Y ahora que los graficamos?



¿Porqué la necesidad de Data Visualization?

Repuesta: Big Data



Companies are Spending Big on Big Data



Why?

The companies that use analytics best are...

2X

More likely to have top-quartile financial performance

5X

More likely to make decisions "much faster than competition"

3X

More likely to execute decisions as intended

2X

More likely to use data very frequently when making decisions

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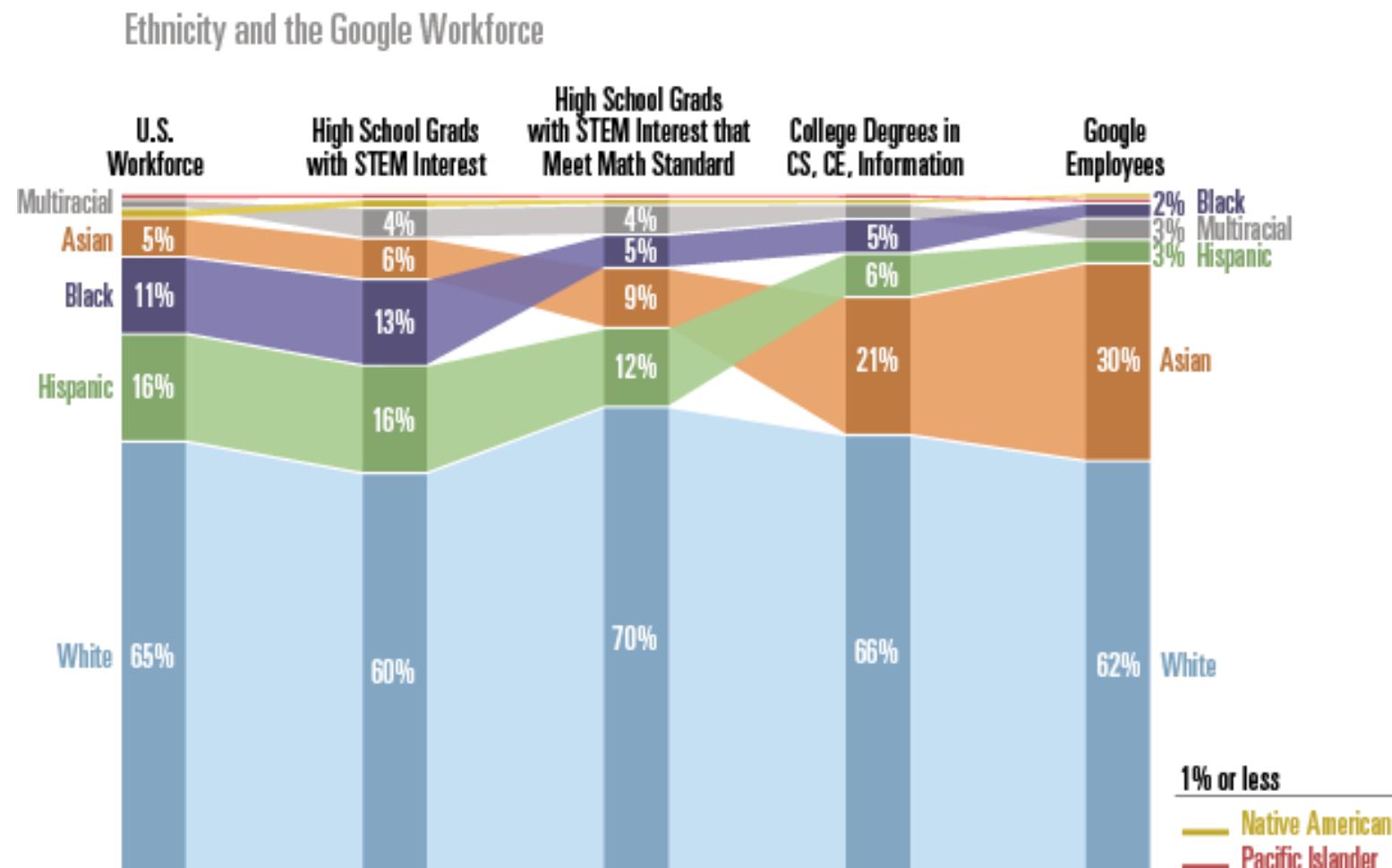
CONSIDERACIONES

DATAVIZ LIBRARIES



Tipos de gráficos modernos - Alluvial

Se usa cuando se busca transmitir el flujo causa->consecuencia



Sources:

Current Population Survey 2013, U.S. Bureau of Labor Statistics; ACT, Inc. - *The Condition of STEM 2014*
CRA Taulbee Survey 2013; Google 2013 EEO-1 Report

Tipos de gráficos modernos – Tree map

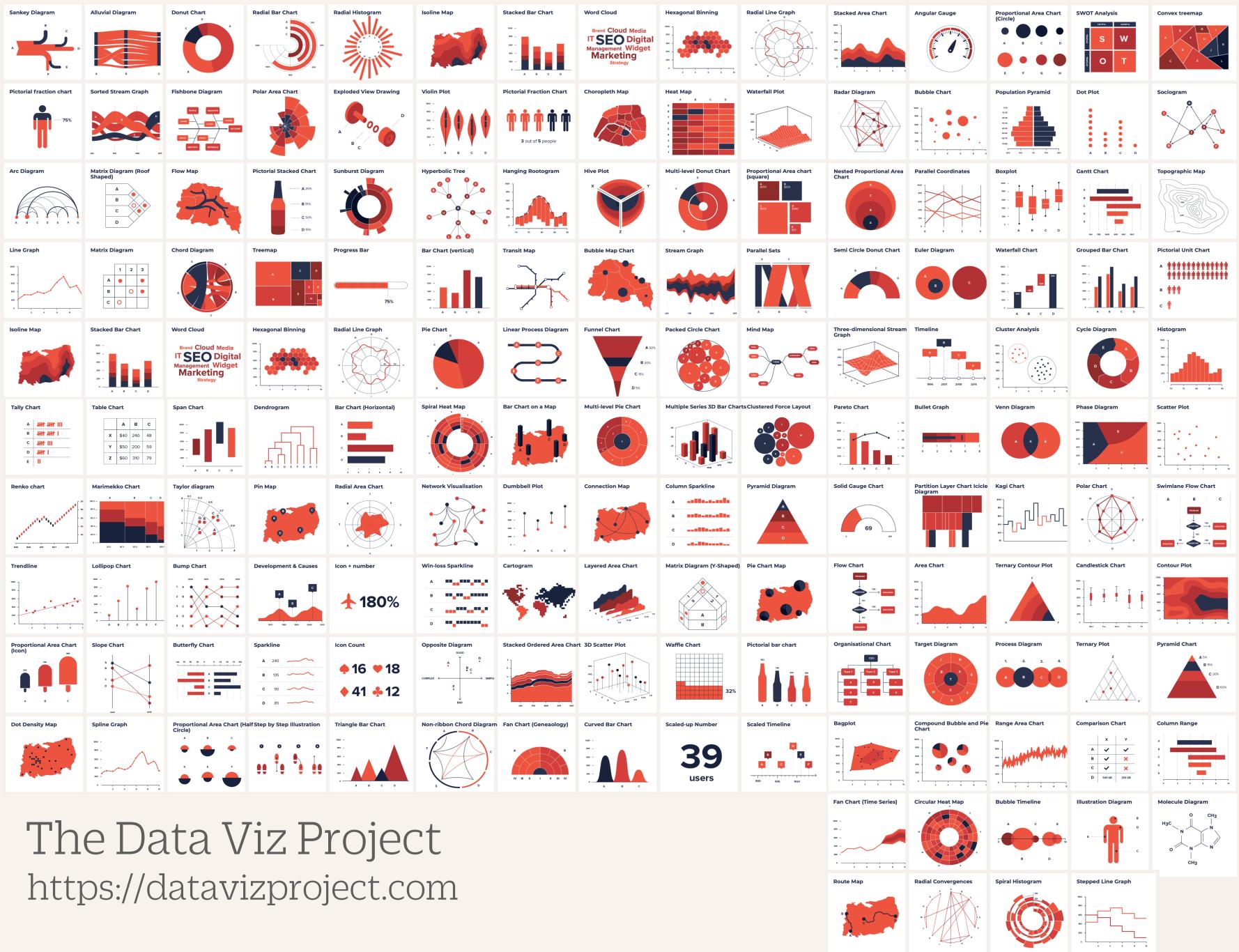
Se usa cuando se busca transmitir una relación parte a todo.



The Data Visualization Catalogue



<https://datavizcatalogue.com>



The Data Viz Project
<https://datavizproject.com>

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DEFINICIÓN

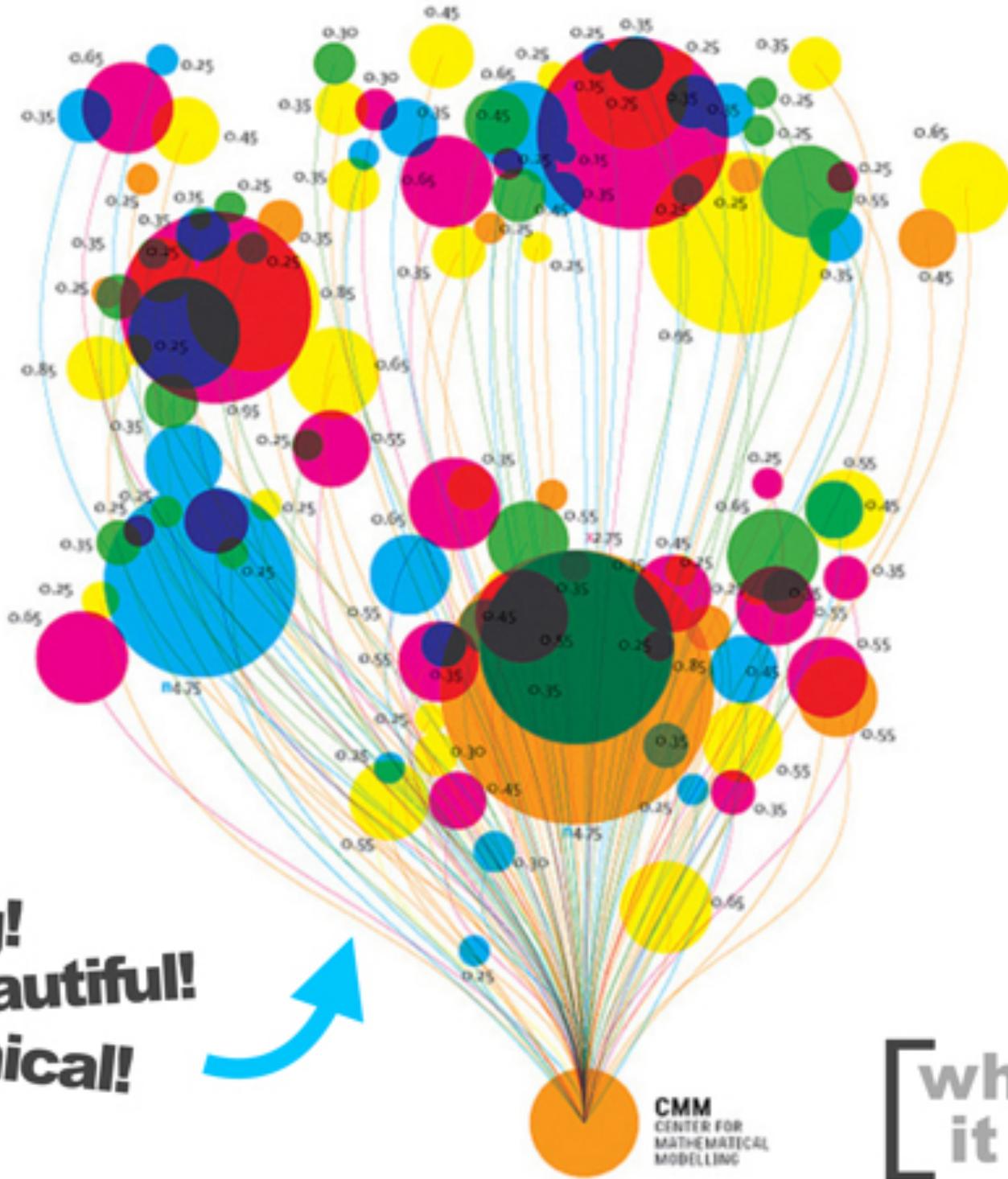
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exciting!
beautiful!
technical!

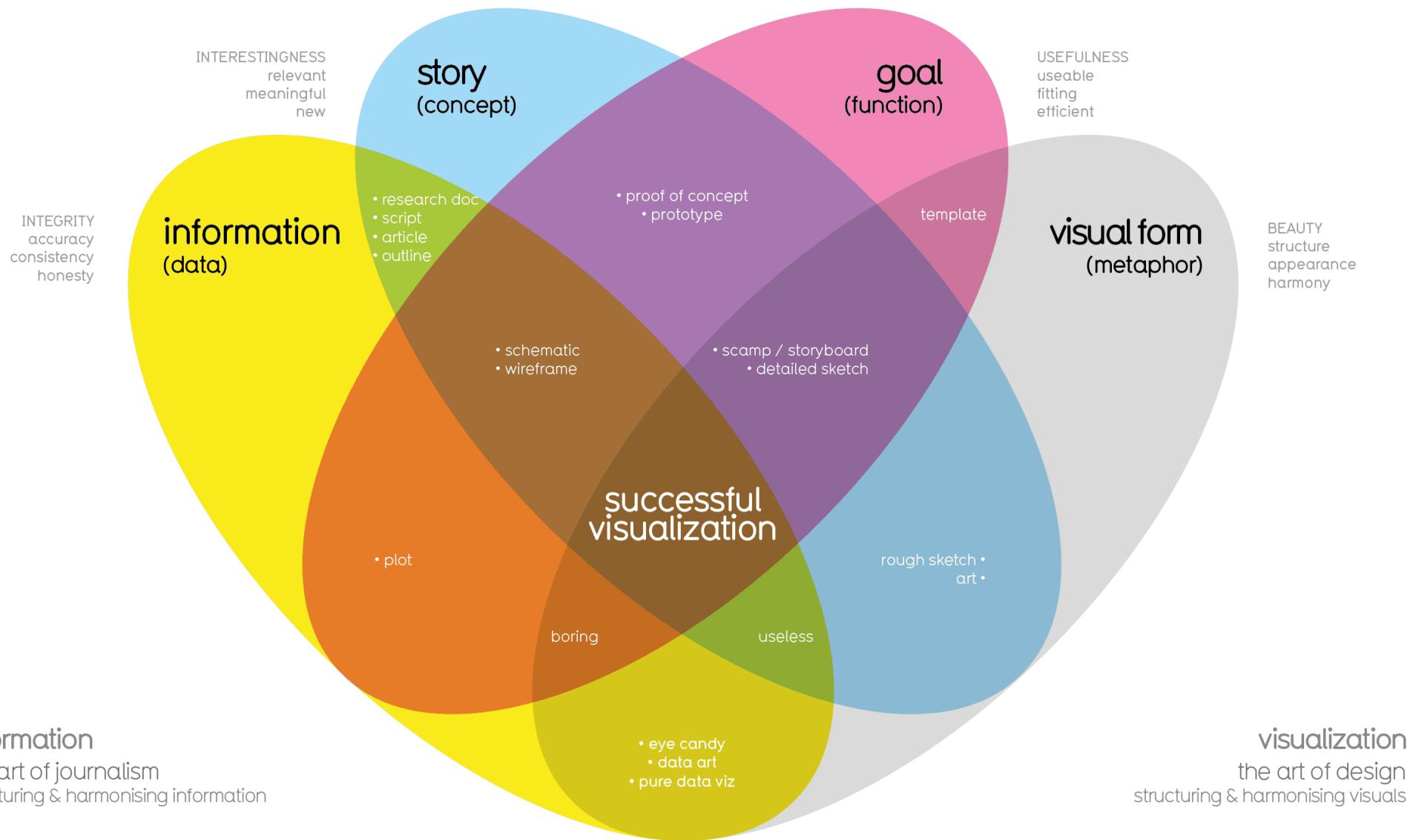


CMM
CENTER FOR
MATHEMATICAL
MODELLING

BUT
[what does
it mean?]

What Makes a Good Visualization?

explicit (implicit)



information
the art of journalism
structuring & harmonising information

David McCandless
InformationisBeautiful.net

taken from new book
Knowledge is Beautiful

visualization
the art of design
structuring & harmonising visuals

find out more
bit.ly/KIB_Books

¿Qué tomar en cuenta?

Paso 1: Determine lo que intenta visualizar y qué clase de información desea comunicar.



Paso 2: Conozca su audiencia y entienda cómo procesa ésta la información visual.

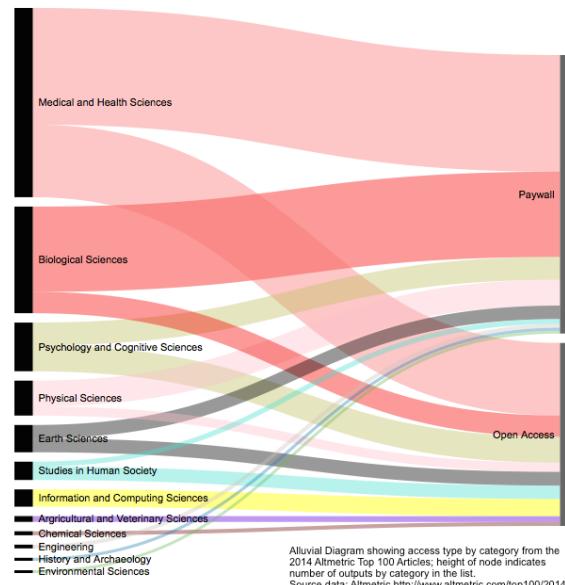


¿Qué tomar en cuenta?

Paso 3: Entienda los datos que intenta visualizar, incluyendo su tamaño y cardinalidad, la unidad de valores de datos en una columna.

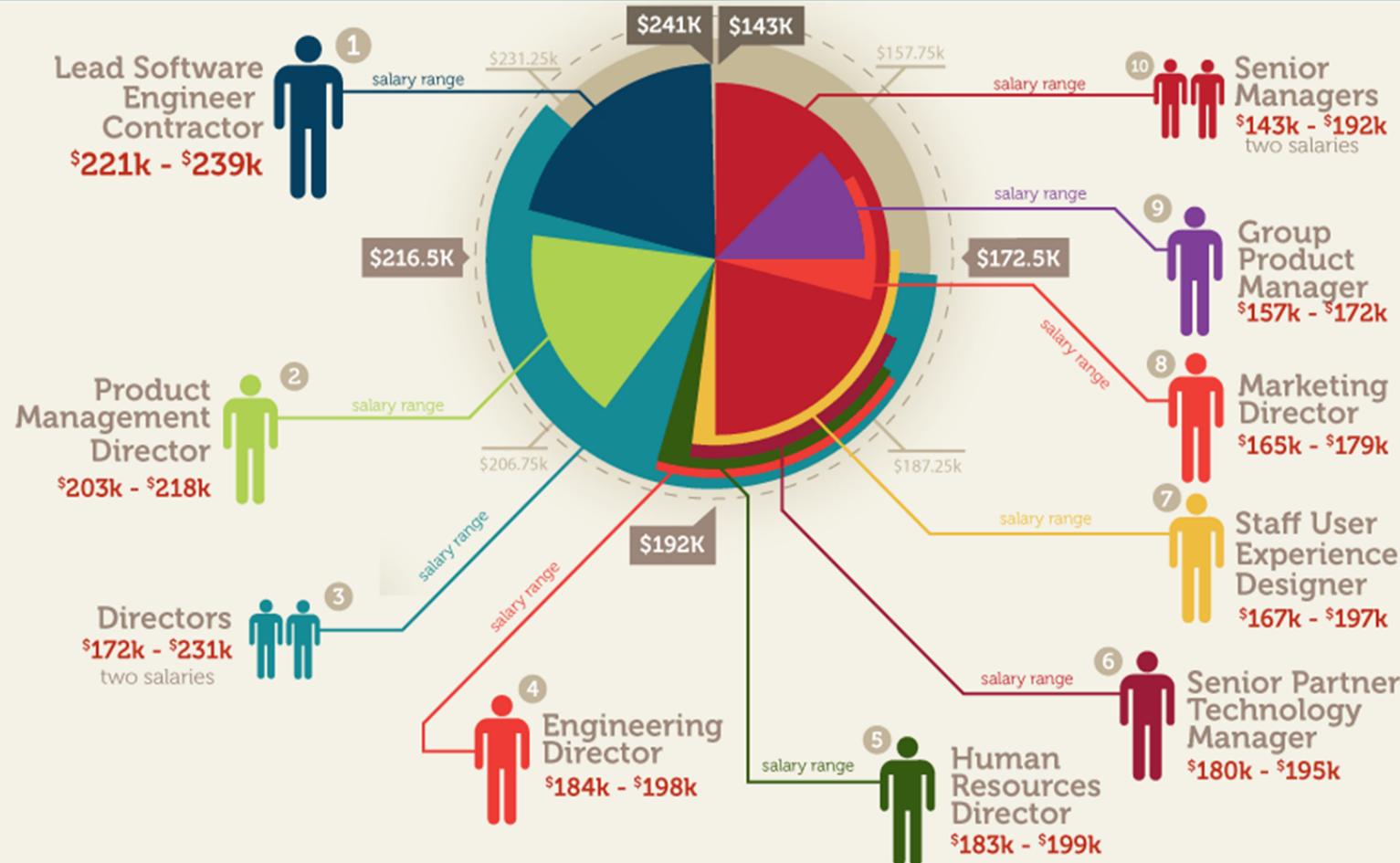
Restaurant	Location	Town	Stars
Domino's Pizza	615 Caliente Dr	Sunnyvale	4
Domino's Pizza	992 W El Camino Real	Sunnyvale	4
Giovannis Pizzeria	1127 N Lawrence Expy	Sunnyvale	4.5
Little Caesars Pizza	1039 Sunnyvale Saratoga Rd	Sunnyvale	3
Pizza Depot	919 E Duane Ave	Sunnyvale	3.5
Pizza Hut	464 N Mathilda Ave	Sunnyvale	2.5
Round Table Pizza	415 N Mary Ave	Sunnyvale	5
Round Table Pizza	101 Town And Countr	Sunnyvale	3
Round Table Pizza	860 Old San Francisco Rd	Sunnyvale	3
Vitos Famous Pizza	1155 Reed Ave	Sunnyvale	4.5

Paso 4: Use un elemento visual que conlleve la información en la forma mejor y más simple para su audiencia.



top 10 salaries at Google™

RANGE FROM \$143,000 TO \$241,000 PER YEAR.



¿Crees que para este gráfico tipo pie, necesitabas el grafico del medio, para que puedas entender los datos

6

BEST PRACTICES OF DATA VISUALIZATION



EMBRACE CLARITY

Avoid adding more formatting than is needed to achieve data clarity. Avoid clutter or elements that draw too much (or too little) focus. Label data points and put clear titles on charts and graphs.



BE CONSISTENT

Keep design elements such as color and line weight uniform. Make certain the name and color representing a particular data point across a dashboard or related charts stays the same.



SUPPORT READABILITY

Use light and dark values to create contrast instead of relying on different colors. Use font types, font sizes, and text orientation that are easy to read. Choose shape fills and backgrounds that support numbers and text.



ACHIEVE BALANCE

Simplify and make sure that what's important is easy to see. Leave the right amount of "white space" between chart elements. Show the right number of data relationships per chart.



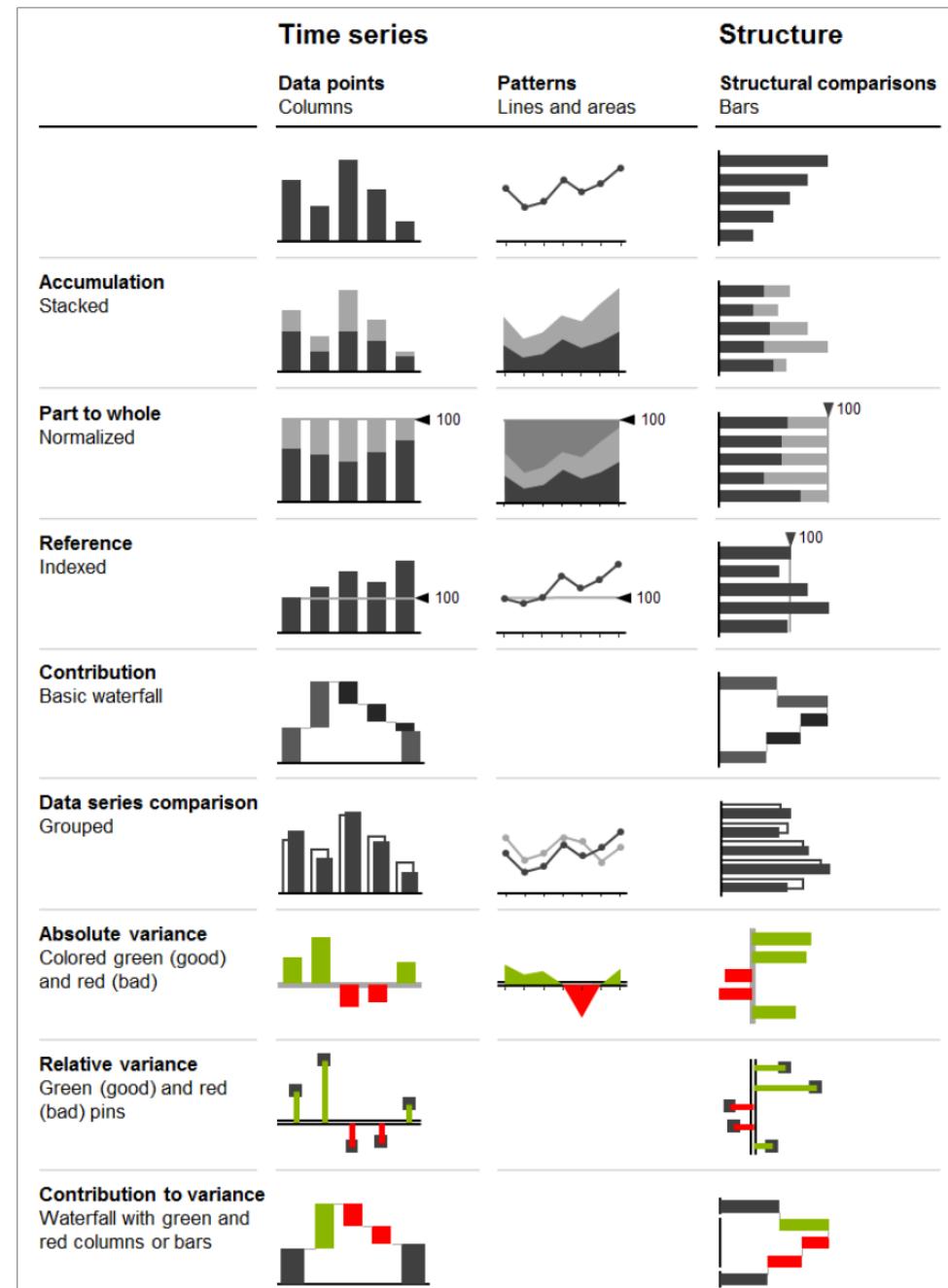
GET INPUT

Get feedback on your visualization, to see if your message is getting across. If your message didn't come through, adjust your visualization or try a different approach.



PURSUE TRUTH

Pick the type of chart that best represents the data. Start from zero on the y axis for graphs to avoid misinterpretation—unless you have a clear reason not to.



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Google Charts

Data Visualization Library Set.

Charts exposed as JavaScript classes.

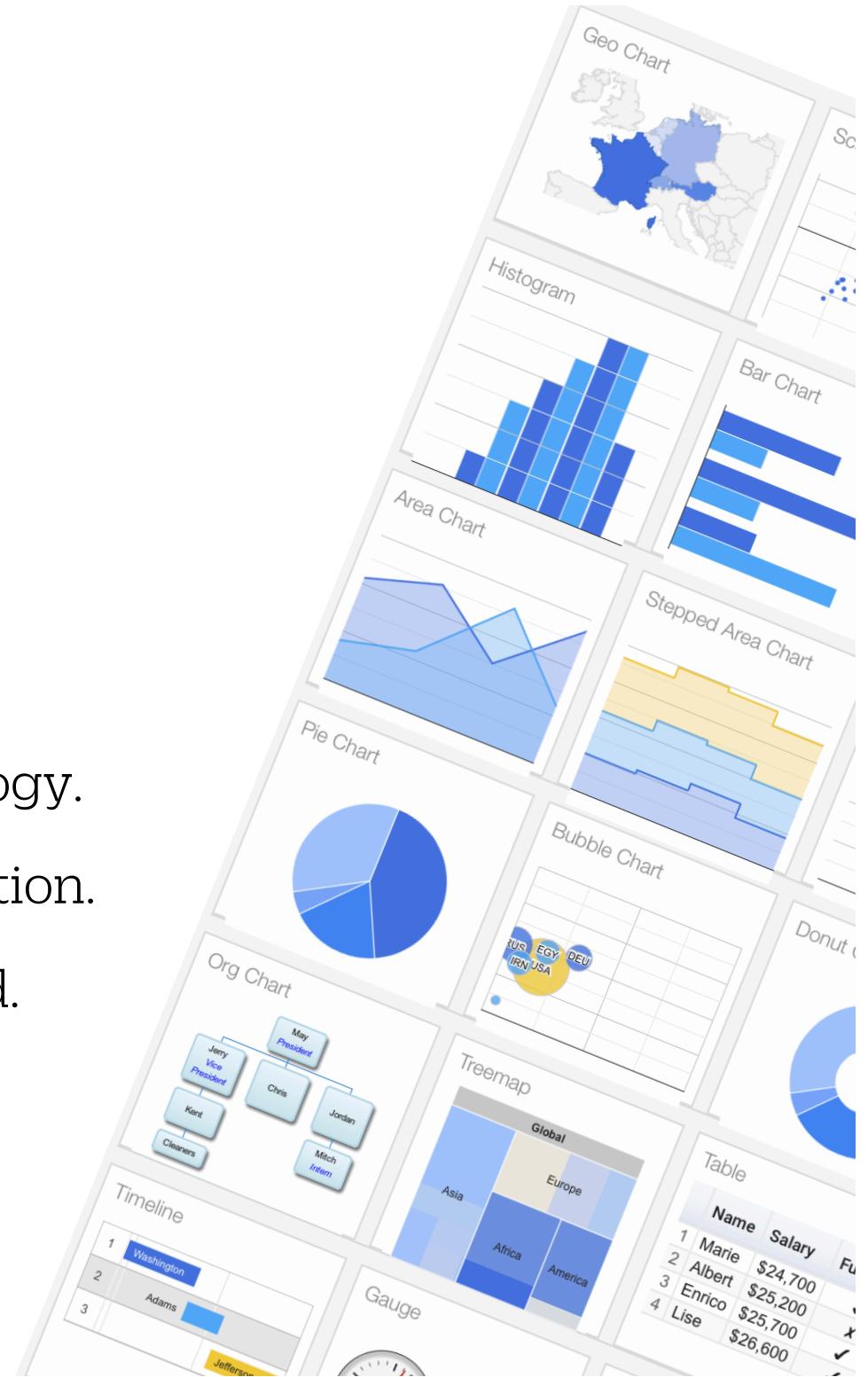
Customizable Look and feel.

Support interaction and events.

Rendered using HTML5/SVG technology.

DataTable class for chart data population.

Chart Data Source Protocol supported.



Load the Charts Library

Basic Library Loading

```
<script src="https://www.gstatic.com/charts/loader.js"></script>
<script>
  google.charts.load('current', {packages: ['corechart']});
  google.charts.setOnLoadCallback(drawChart);
  ...
</script>
```

Create a DataTable

google.visualization.DataTable (JavaScript class)

	type: string label: Topping	type: number label: Slices
Mushrooms		3
Onions		1
Olives		1
Zucchini		1
Pepperoni		2

```
// Create the data table.  
var data = new google.visualization.DataTable();  
data.addColumn('string', 'Topping');  
data.addColumn('number', 'Slices');  
data.addRows([  
    ['Mushrooms', 3],  
    ['Onions', 1],  
    ['Olives', 1],  
    ['Zucchini', 1],  
    ['Pepperoni', 2]  
]);
```

Customize the Chart

Especificar opciones de personalización para el chart, definiendo un objeto de JavaScript con las propiedades en formato nombre opción / valor de la opción.

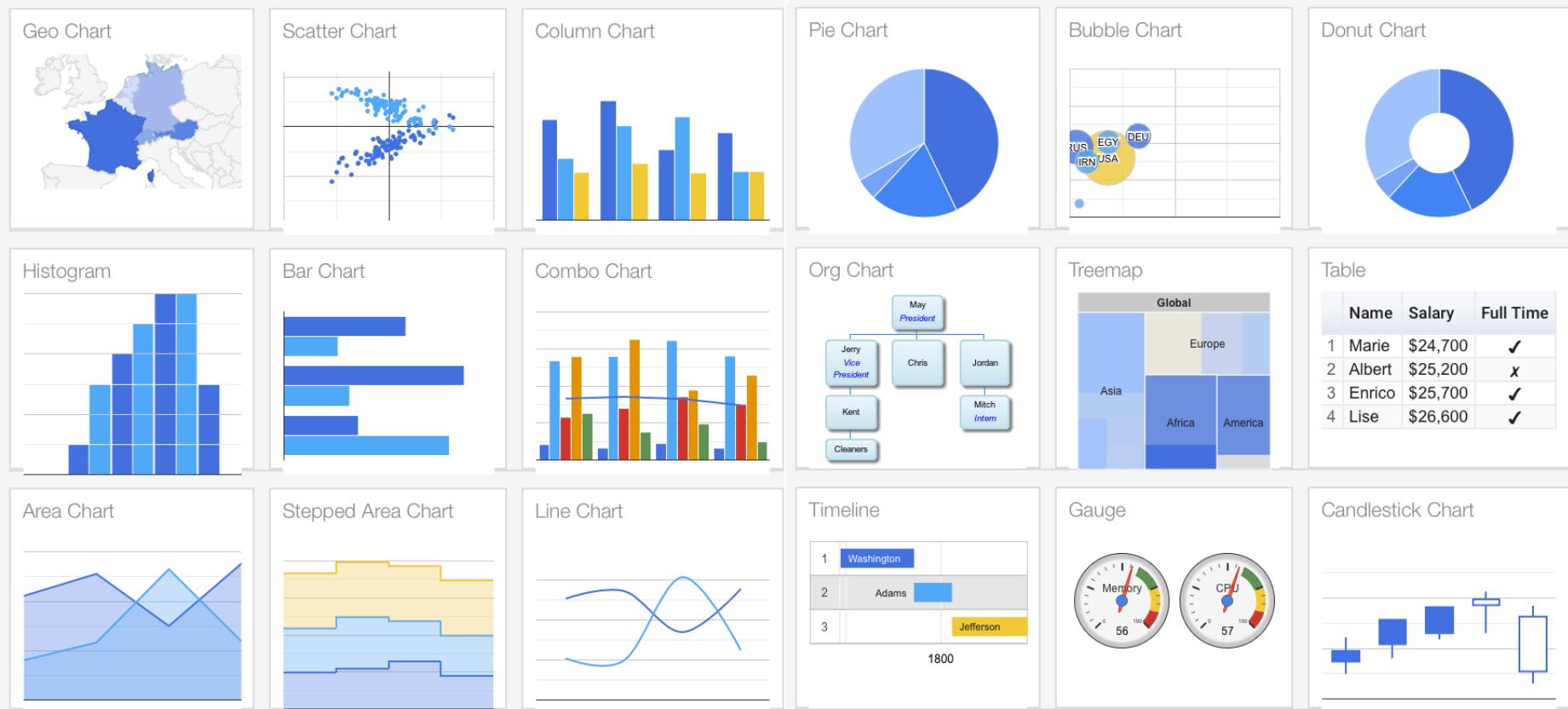
```
// Set chart options
var options = {'title':'How Much Pizza I Ate Last Night',
               'width':400,
               'height':300};
```

Draw the Chart

Primero se instancia la clase chart que se desea usar, para luego invocar a su método draw().

```
// Instantiate and draw our chart, passing in some options.  
var chart = new google.visualization.PieChart(document.getElementById('chart_div'));  
chart.draw(data, options);  
  
//Div that will hold the pie chart  
<div id="chart_div" style="width:400; height:300"></div>
```

Chart Gallery



<https://developers.google.com/chart/interactive/docs/gallery>

D3js

D3.js is a JavaScript library for manipulating documents based on data.

It uses HTML, SVG, and CSS.

```
<script src="https://d3js.org/d3.v5.min.js"></script>
```

<https://d3js.org/>

D3js

```
<script>
  var data = [80, 120, 60, 150, 200];
  var barHeight = 20;
  var bar = d3.select('svg').selectAll('rect').data(data).enter()
    .append('rect').attr('width', function (d) {
      return d;
    }).attr('height', barHeight - 1).attr('transform', function (d, i) {
      return "translate(0," + i * barHeight + ")";
    });
</script>

<svg width='200' height='500'></svg>
```

Charts.js

Simple HTML5 charts using the canvas element.

<https://cdnjs.cloudflare.com/ajax/libs/Chart.js/2.9.3/Chart.bundle.js>

<https://cdnjs.cloudflare.com/ajax/libs/Chart.js/2.9.3/Chart.css>

```
<canvas id="myChart" width="400" height="400"></canvas>
```

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

Charts.js

```
<canvas id="myChart" width="400" height="400"></canvas>

<script>
var ctx = document.getElementById('myChart');
var myChart = new Chart(ctx, {
    type: 'bar',
    data: {
        labels: ['Red', 'Blue', 'Yellow', 'Green', 'Purple', 'Orange'],
        datasets: [{
            label: '# of Votes',
            data: [12, 19, 3, 5, 2, 3],
            backgroundColor: [
                'rgba(255, 99, 132, 0.2)', 'rgba(54, 162, 235, 0.2)',
                'rgba(255, 206, 86, 0.2)', 'rgba(75, 192, 192, 0.2)',
                'rgba(153, 102, 255, 0.2)', 'rgba(255, 159, 64, 0.2)'
            ],
            borderColor: [
                'rgba(255, 99, 132, 1)', 'rgba(54, 162, 235, 1)',
                'rgba(255, 206, 86, 1)', 'rgba(75, 192, 192, 1)',
                'rgba(153, 102, 255, 1)', 'rgba(255, 159, 64, 1)'
            ],
            borderWidth: 1
        }]
    },
    options: { scales: { yAxes: [{ ticks: { beginAtZero: true } }] } }
});
</script>
```

RESUMEN

Recordemos

Qué es Data Visualization

Porqué es importante

Principales gráficos

Consideraciones

Data Visualization Libraries



REFERENCIAS

Para profundizar

<https://www.interaction-design.org/literature/topics/information-visualization>

<https://www.interaction-design.org/literature/book/the-encyclopedia-of-human-computer-interaction-2nd-ed/data-visualization-for-human-perception/>



PREGRADO

Ingeniería de Software

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