

# Gramática de los Gráficos

ROBERTO THERÓN

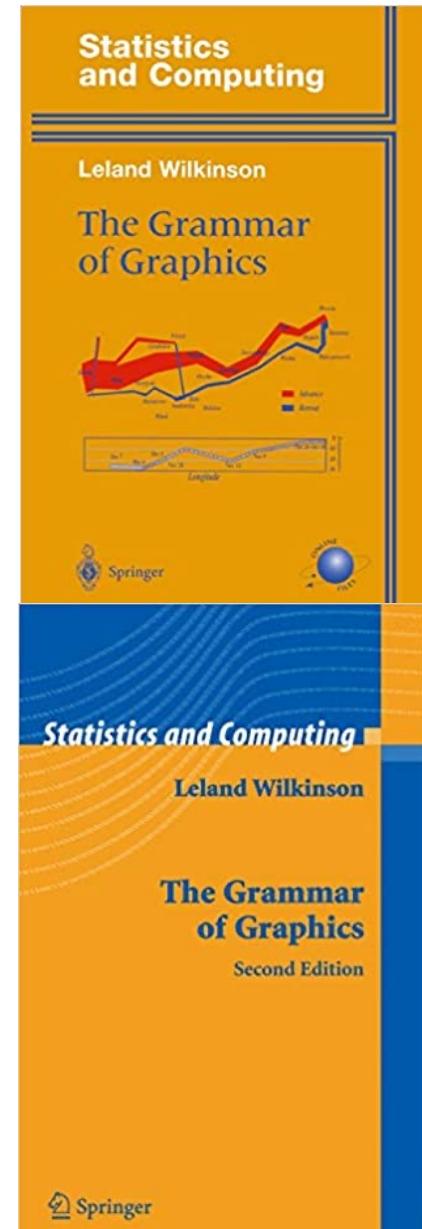
NOVIEMBRE 2022

# UN CAMBIO DE ENFOQUE

En 1999 Leland Wilkinson publica “*The Grammar of Graphics*” con dos objetivos:

- Mostrar a los programadores cómo diseñar e implementar gráficos estadísticos
- Revelar la base matemática de los gráficos estadísticos

En 2005 se publica la segunda edición



# ANTECEDENTES

En 1983, el cartógrafo Jaques Bertin publica “Semiology of Graphics”

- Bertin disecciona un gráfico hasta sus componentes básicos: las marcas
- Dependiendo de las características visuales de estas marcas, de su posición y de cómo se presenten, se obtienen los diferentes gráficos

[CITATION] **Semiology of graphics; diagrams networks maps**

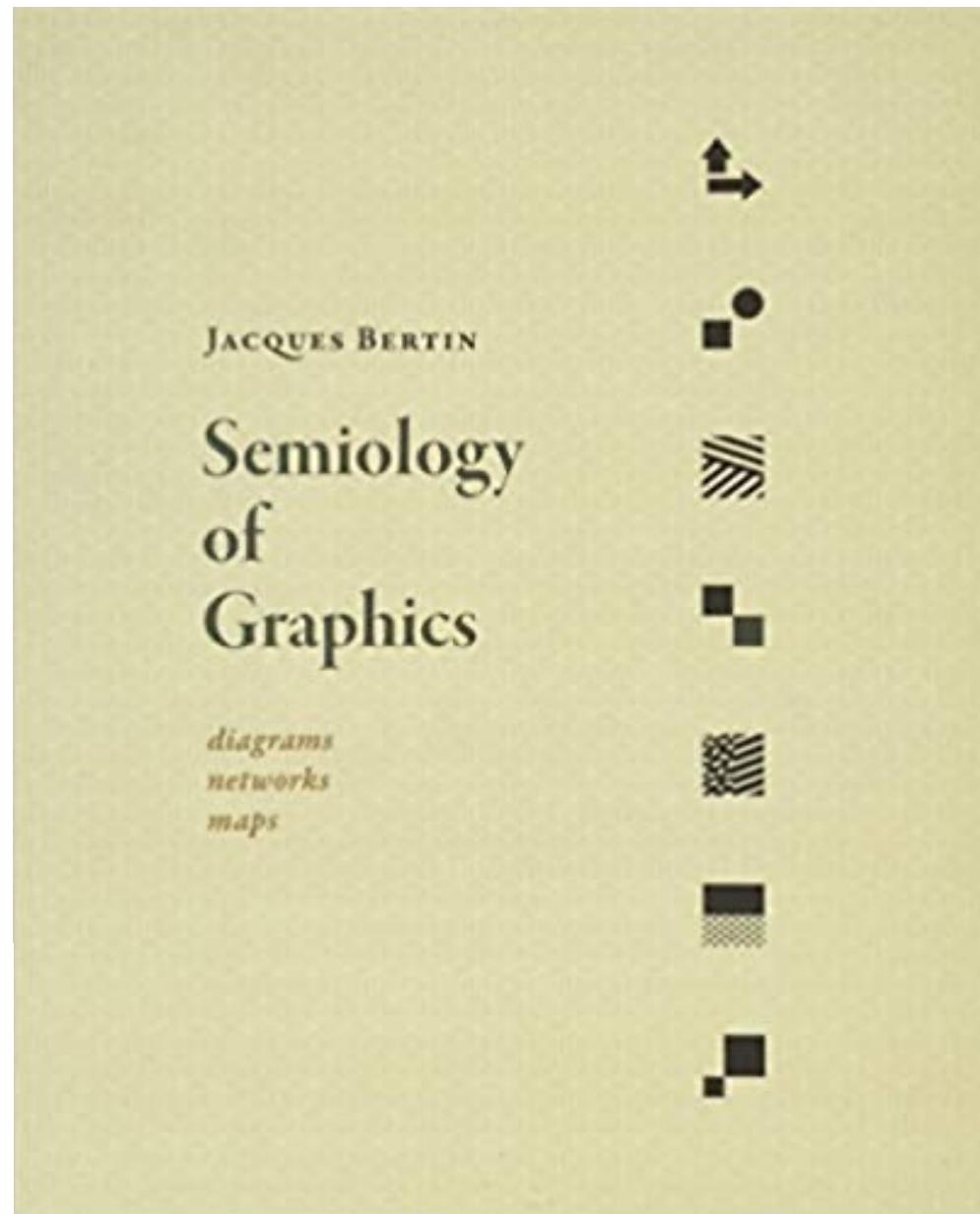
J Bertin - 1983 - sidalc.net

... 1 / 1 Seleccione referencia / Select reference Signatura: QA90 B7. Autor: Bertin, Jacques.

Título: **Semiology of graphics; diagrams networks maps** /. P. imprenta: Madison, Wis

University of Wisconsin198415 p. ilus. Notas: (Trad. del francés). Descriptores: GRAPHIC ...

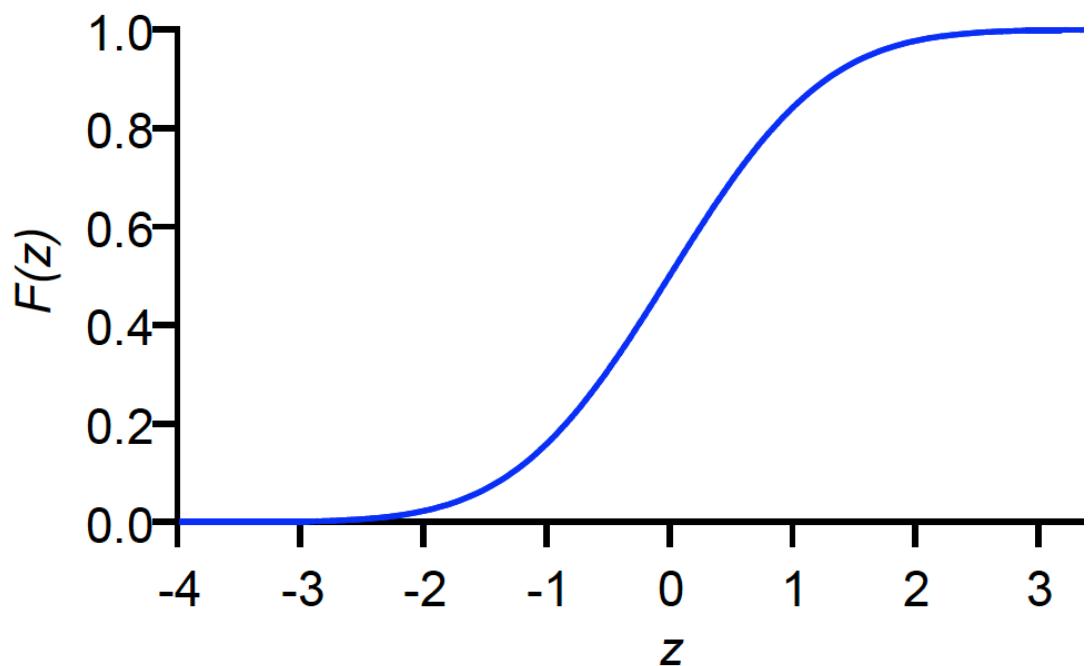
☆ 99 Cited by 4046 Related articles All 2 versions ☰



# MOTIVACIÓN

¿Qué es un gráfico estadístico?

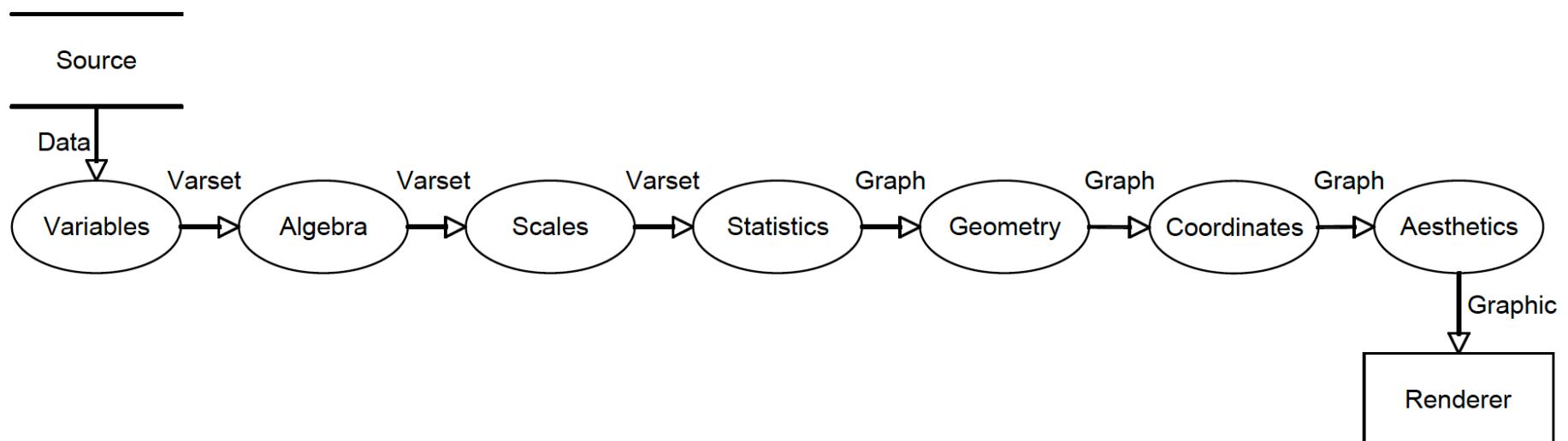
- Un gráfico estadístico es una representación de la gráfica de una función
- La gráfica de una función es un subconjunto del producto de su dominio y codominio
- El gráfico que representa  $F(z) = \Phi(z)$  aquí es azul
- El resto es [anotación](#)



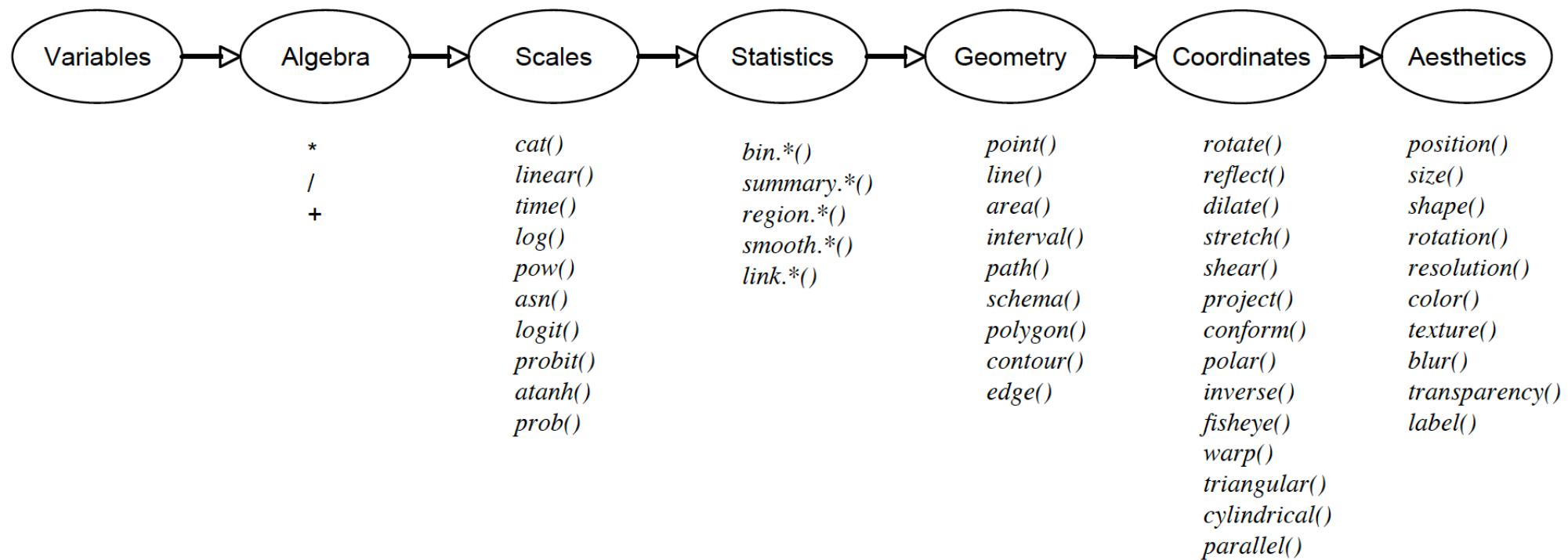
# CADENA DE FUNCIONES EN GoG

La cadena tiene una secuencia fija

- cambiar este orden produce un gráfico sin sentido



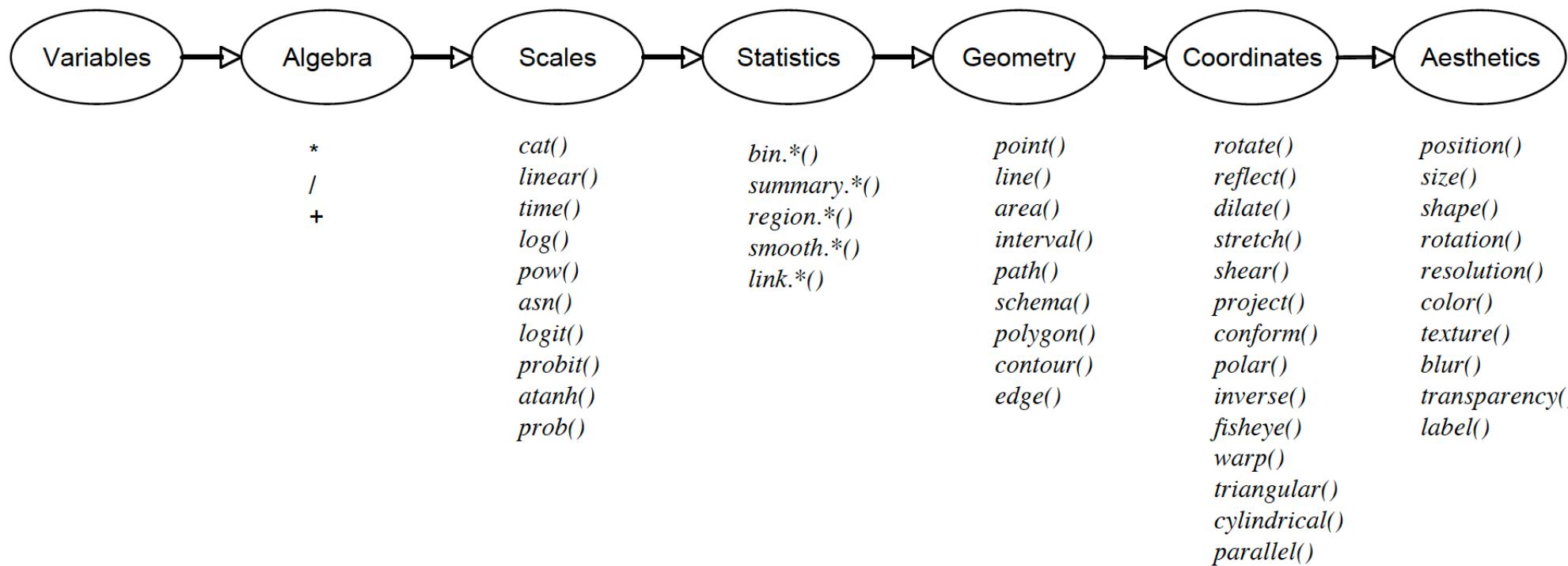
# CADENA DE FUNCIONES EN GoG



# CADENA DE FUNCIONES EN GoG

La cadena tiene una secuencia fija

- cambiar este orden produce un gráfico sin sentido



# ALTERNATIVAS

```
Name,Miles_per_Gallon,Cylinders,Displacement,Horsepower,Weight_in_lbs,Acceleration,Year,Origin
chevrolet chevelle malibu,18,8,307,130,3504,12,1970,USA
buick skylark 320,15,8,350,165,3693,11.5,1970,USA
plymouth satellite,18,8,318,150,3436,11,1970,USA
amc rebel sst,16,8,304,150,3433,12,1970,USA
ford torino,17,8,302,140,3449,10.5,1970,USA
ford galaxie 500,15,8,429,198,4341,10,1970,USA
chevrolet impala,14,8,454,220,4354,9,1970,USA
plymouth fury iii,14,8,440,215,4312,8.5,1970,USA
pontiac catalina,14,8,455,225,4425,10,1970,USA
amc ambassador dpl,15,8,390,190,3850,8.5,1970,USA
citroen ds-21 pallas,,4,133,115,3090,17.5,1970,Europe
chevrolet chevelle concours (sw),,8,350,165,4142,11.5,1970,USA
ford torino (sw),,8,351,153,4034,11,1970,USA
plymouth satellite (sw),,8,383,175,4166,10.5,1970,USA
amc rebel sst (sw),,8,360,175,3850,11,1970,USA
dodge challenger se,15,8,383,170,3563,10,1970,USA
plymouth 'cuda 340,14,8,340,160,3609,8,1970,USA
```

DATOS

TRADUCCIÓN

GRÁFICO

¿Cómo hacer esta traducción?

# ALTERNATIVAS

```
Name,Miles_per_Gallon,Cylinders,Displacement,Horsepower,Weight_in_lbs,Acceleration,Year,Origin  
chevrolet chevelle malibu,18,8,307,130,3504,12,1970,USA  
buick skylark 320,15,8,350,165,3693,11.5,1970,USA  
plymouth satellite,18,8,318,150,3436,11,1970,USA  
amc rebel sst,16,8,304,150,3433,12,1970,USA  
ford torino,17,8,302,140,3449,10.5,1970,USA  
ford galaxie 500,15,8,429,198,4341,10,1970,USA  
chevrolet impala,14,8,454,220,4354,9,1970,USA  
plymouth fury iii,14,8,440,215,4312,8.5,1970,USA  
pontiac catalina,14,8,455,225,4425,10,1970,USA  
amc ambassador dpl,15,8,390,190,3850,8.5,1970,USA  
citroen ds-21 pallas,,4,133,115,3090,17.5,1970,Europe  
chevrolet chevelle concours (sw),,8,350,165,4142,11.5,1970,USA  
ford torino (sw),,8,351,153,4034,11,1970,USA  
plymouth satellite (sw),,8,383,175,4166,10.5,1970,USA  
amc rebel sst (sw),,8,360,175,3850,11,1970,USA  
dodge challenger se,15,8,383,170,3563,10,1970,USA  
plymouth 'cuda 340,14,8,340,160,3609,8,1970,USA
```

DATOS

¿Cómo hacer esta traducción?

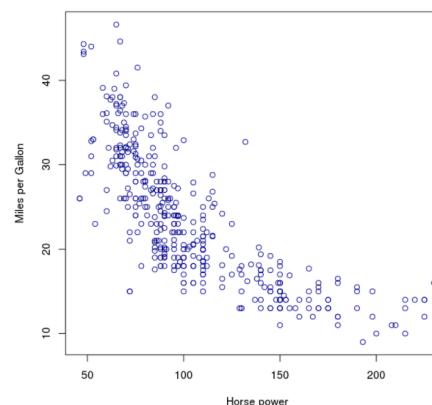
TRADUCCIÓN

Usando funciones predefinidas: ej. plot() en R

¡Demasiado alto nivel!

GRÁFICO

```
cars <- read.csv(file = 'https://gist.githubusercontent.com/mbostock/5870a43c73b8899213019ded657840bd/raw/469d70043a0e0e1adba24f5390d147c9970046e/cars.csv')  
  
plot(cars$Horsepower, cars$Miles_per_Gallon, col='darkblue', xlab='Horse power', ylab='Miles per Gallon')
```



```

chart = {
  const ctx = DOM.context2d(width + margin.left + margin.right, height + margin.bottom + margin.top);
  ctx.canvas.style.display = "block";
  ctx.canvas.style.maxWidth = "100%";
  ctx.canvas.style.margin = "auto";

  // Points
  ctx.strokeStyle = "#4682B4";
  const drawDot = (d) => {
    ctx.beginPath();
    ctx.arc(x(d.x) + margin.left, y(d.y) + margin.top, 3, 0, 2 * Math.PI);
    ctx.stroke();
  };
  data.map(drawDot);

  // Axes
  const xAxis = () => {
    var tickCount = 10,
      tickSize = 6,
      ticks = x.ticks(tickCount),
      tickFormat = x.tickFormat();

    ctx.beginPath();
    ticks.forEach(function(d) {
      ctx.moveTo(x(d) + margin.left, height + margin.top - margin.bottom);
      ctx.lineTo(x(d) + margin.left, height + margin.top - margin.bottom + tickSize);
    });
    ctx.strokeStyle = "black";
    ctx.stroke();

    ctx.textAlign = "center";
    ctx.textBaseline = "top";
    ticks.forEach(function(d) {
      ctx.fillText(tickFormat(d), x(d) + margin.left, height + margin.top - margin.bottom + tickSize);
    });
  };

  const yAxis = () => {
    var tickCount = 10,
      tickSize = 6,
      tickPadding = 3,
      ticks = y.ticks(tickCount),
      tickFormat = y.tickFormat(tickCount);

    // ticks
    ctx.beginPath();
    ticks.forEach(function(d) {
      ctx.moveTo(margin.left + 40, y(d) + margin.top);
      ctx.lineTo(margin.left + 40 - 6, y(d) + margin.top);
    });

    ctx.strokeStyle = "black";
    ctx.stroke();

    // text
    ctx.textAlign = "right";
    ctx.textBaseline = "middle";
    ticks.forEach(function(d) {
      ctx.fillText(tickFormat(d), margin.left - tickSize - tickPadding + 40, y(d) + margin.top);
    });
  };

  xAxis();
  yAxis();

  yield ctx.canvas
}

```

Name	Miles_per_Gallon	Cylinders	Displacement	Horsepower	Weight_in_lbs	Acceleration	Year	Origin
chevrolet chevelle malibu	18	8	307,130	3504,12	1970,USA			
buick skylark 320	15	8	350,165	3693,11.5	1970,USA			
plymouth satellite	18	8	318,150	3436,11	1970,USA			
amc rebel sst	16	8	304,150	3433,12	1970,USA			
ford torino	17	8	302,140	3449,10.5	1970,USA			
ford galaxie	500	15	8,429,198	4341,10	1970,USA			
chevrolet impala	14	8	454,220	4354,9	1970,USA			
plymouth fury iii	14	8	440,215	4312,8.5	1970,USA			
pontiac catalina	14	8	455,225	4425,10	1970,USA			
amc ambassador dpl	15	8	390,190	3850,8.5	1970,USA			
citroen ds-21 pallas	,4	133,115	3090,17.5		1970,Europe			
chevrolet chevelle concours (sw)	,8	350,165	4142,11.5		1970,USA			
ford torino (sw)	,8	351,153	4034,11		1970,USA			
plymouth satellite (sw)	,8	383,175	4166,10.5		1970,USA			
amc rebel sst (sw)	,8	360,175	3850,11		1970,USA			
dodge challenger se	15	8	383,170	3563,10	1970,USA			
plymouth 'cuda	340	14	8,340,160	3609,8	1970,USA			

DATOS

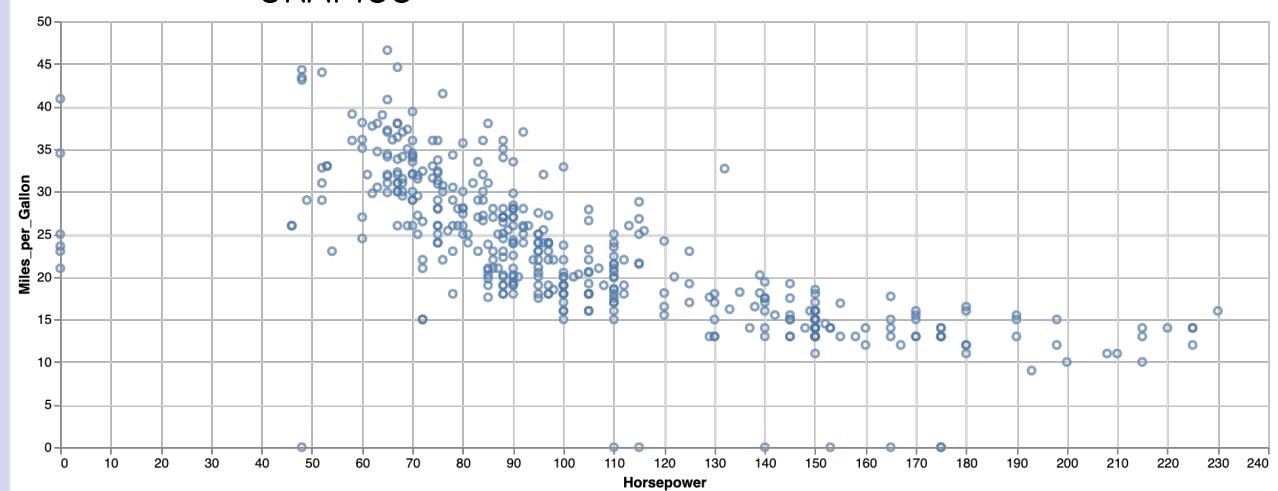
¿Cómo hacer esta traducción?

TRADUCCIÓN

Trabajar a bajo nivel: ej. D3.js

GRÁFICO

iDemasiado bajo nivel!



# ALTERNATIVAS

```
vegalite({
  data: {url:
    "https://gist.githubusercontent.com/mbostock/5870a43c73b8899213019ded657840bd/raw/469d70043a0e0e11adba24f5390d1
    47c9970046e/cars.csv",
  mark: "point",
  width,
  height: 360,
  autosize: "fit",
  encoding: {
    x: {field: "Horsepower", type: "quantitative"},
    y: {field: "Miles_per_Gallon", type: "quantitative"}
  }
})
```

```
Name,Miles_per_Gallon,Cylinders,Displacement,Horsepower,Weight_in_lbs,Acceleration,Year,Origin
chevrolet chevelle malibu,18,8,307,130,3504,12,1970,USA
buick skylark 320,15,8,350,165,3693,11.5,1970,USA
plymouth satellite,18,8,318,150,3436,11,1970,USA
amc rebel sst,16,8,304,150,3433,12,1970,USA
ford torino,17,8,302,140,3449,10.5,1970,USA
ford galaxie 500,15,8,429,198,4341,10,1970,USA
chevrolet impala,14,8,454,220,4354,9,1970,USA
plymouth fury iii,14,8,440,215,4312,8.5,1970,USA
pontiac catalina,14,8,455,225,4425,10,1970,USA
amc ambassador dpl,15,8,390,190,3850,8.5,1970,USA
citroen ds-21 pallas,,4,133,115,3090,17.5,1970,Europe
chevrolet chevelle concours (sw),,8,350,165,4142,11.5,1970,USA
ford torino (sw),,8,351,153,4034,11,1970,USA
plymouth satellite (sw),,8,383,175,4166,10.5,1970,USA
amc rebel sst (sw),,8,360,175,3850,11,1970,USA
dodge challenger se,15,8,383,170,3563,10,1970,USA
plymouth 'cuda 340,14,8,340,160,3609,8,1970,USA
```

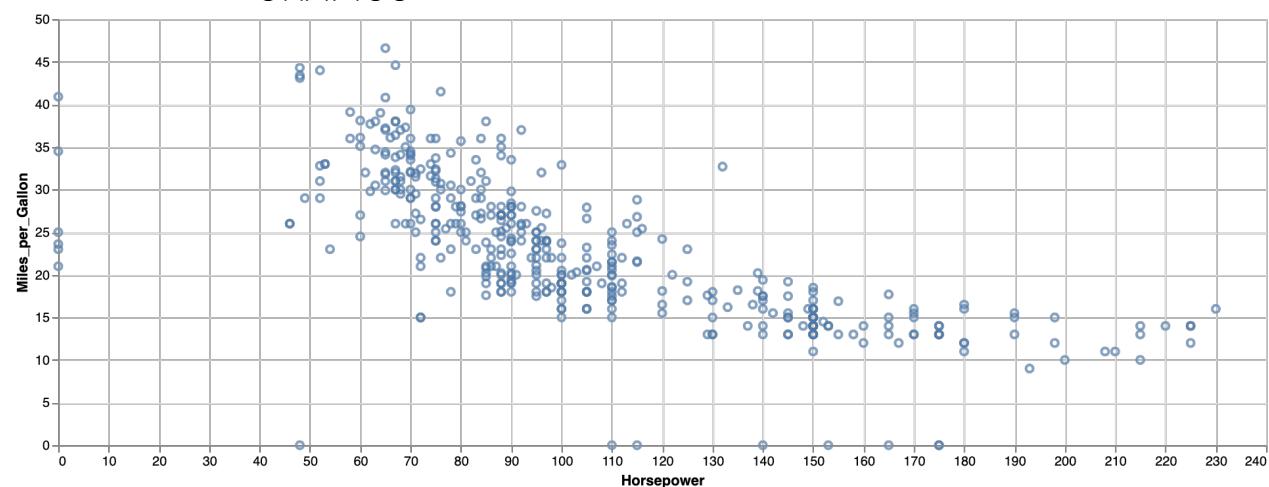
DATOS

¿Cómo hacer esta traducción?

TRADUCCIÓN

Trabajar usando una gramática de los  
gráficos: ej. Tableau, Vega, ggplot, Altair...

GRÁFICO



Codificar datos con canales visuales

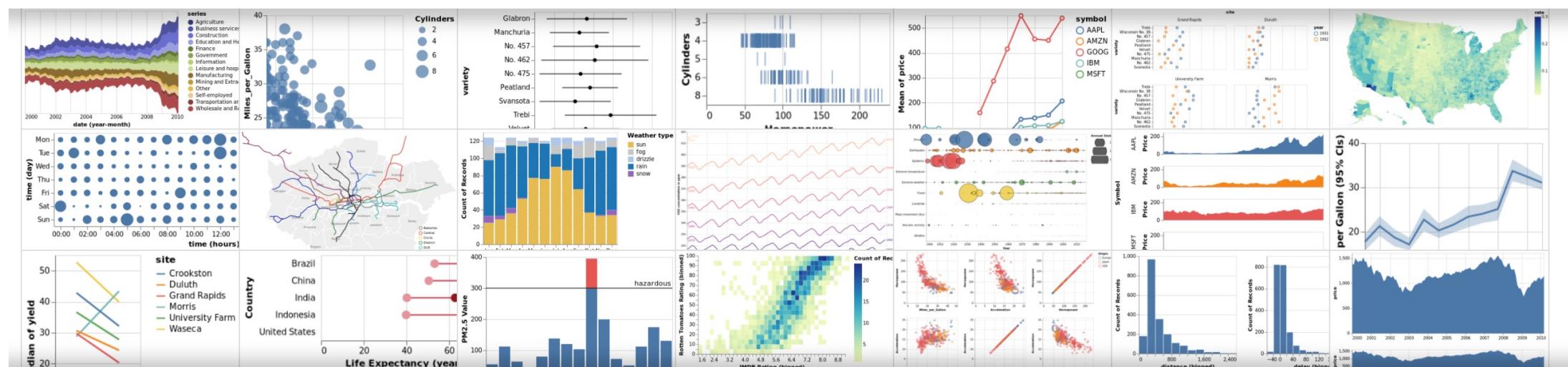
Mostrar codificaciones con marcas

DATOS

TRADUCCIÓN

GRÁFICO

## Vega-Lite – A Grammar of Interactive Graphics



**Vega-Lite** is a high-level grammar of interactive graphics. It provides a concise, declarative JSON syntax to create an expressive range of visualizations for data analysis and presentation.

# JSON Editor Online

NEW BETA AVAILABLE

About

New document 2



powered by ace

```
1 {  
2   "compras": [  
3     {"carniceria": [{"filetes": 3}, {"hamburguesas": 6}],  
4     {"frutería": [{"manzanas": 2}, {"peras": 5}]}  
5   ],  
6   "tareas": {"limpiar": ["salón", "dormitorio", "recoger_platos"]}  
7 }
```

Copy >

< Copy

Diff

New document 1



```
object ► compras ► 0 ► carniceria ► 1 ►  
  └─ object {2}  
    └─ compras [2]  
      └─ 0 {1}  
        └─ carniceria [2]  
          └─ 0 {1}  
            filetes : 3  
          └─ 1 {1}  
            hamburguesas : 6  
          └─ 1 {1}  
            frutería [2]  
              └─ 0 {1}  
                manzanas : 2  
              └─ 1 {1}  
                peras : 5  
            └─ tareas {1}  
              └─ limpiar [3]  
                0 : salón  
                1 : dormitorio  
                2 : recoger_platos
```

<https://jsoneditoronline.org/>

# DATOS

a	b
C	2
C	7
C	4
D	1
D	2
D	6
E	8
E	4
E	7

JSON Editor Online NEW BETA AVAILABLE About

New document 2

code tree

powered by ace

```
1 ↵ []
2 ↵   "data": [
3 ↵     "values": [
4 ↵       {"a": "C", "b": 2},
5 ↵       {"a": "C", "b": 7},
6 ↵       {"a": "C", "b": 4},
7 ↵       {"a": "D", "b": 1},
8 ↵       {"a": "D", "b": 2},
9 ↵       {"a": "D", "b": 6},
10 ↵      {"a": "E", "b": 8},
11 ↵      {"a": "E", "b": 4},
12 ↵      {"a": "E", "b": 7}
13 ↵    ]
14 ↵  }
15 ↵ ]
```

Copy >

Copy

Diff

New document 1

object ► data ► values ► 1 ►

object {1}

data {1}

values [9]

0 {2}

a : C

b : 2

1 {2}

a : C

b : 7

2 {2}

3 {2}

4 {2}

5 {2}

6 {2}

7 {2}

8 {2}

## TRADUCCIÓN: CODIFICACIÓN DE LOS DATOS CON MARCAS VISUALES

The screenshot displays two JSON Editor Online windows side-by-side. The left window, titled 'New document 2', contains the following JSON code:

```
1 {  
2   "data": {  
3     "values": [  
4       {"a": "C", "b": 2}, {"a": "C", "b": 7}, {"a": "C", "b": 4},  
5       {"a": "D", "b": 1}, {"a": "D", "b": 2}, {"a": "D", "b": 6},  
6       {"a": "E", "b": 8}, {"a": "E", "b": 4}, {"a": "E", "b": 7}  
7     ]  
8   },  
9   "mark": "point",  
10  "encoding": {}  
11 }
```

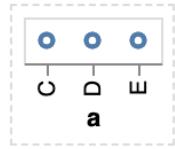
The right window, titled 'New document 1', shows the same data in a hierarchical tree structure. The 'object' node has an 'encoding' child, which further has a 'data' child containing a 'values' array of 9 items. Each item in the array has an 'a' field (containing 'C', 'D', or 'E') and a 'b' field with a numerical value (2, 1, 6, 8, 4, 7, 2, 7, 4). A 'mark : point' entry is also present under 'encoding'. A 'Copy' button is highlighted in blue on the left side.

Parece que solo hay un punto.  
En realidad, Vega-Lite representa un punto para cada objeto en la matriz, pero todos se superponen ya que no hemos especificado la posición de cada punto.

Los elementos gráficos básicos en Vega-Lite son las [marcas](#). Las marcas proporcionan formas básicas cuyas propiedades (como la posición, el tamaño y el color) se pueden utilizar para codificar visualmente datos.

Para mostrar los datos como un punto, podemos establecer la propiedad **mark** como **point**.

## TRADUCCIÓN: CODIFICACIÓN DE LOS DATOS CON MARCAS VISUALES



Otros tipos de datos son:

quantitative  
temporal  
ordinal  
nominal

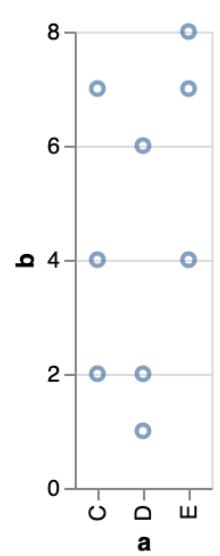
```
[{"data": {"values": [{"a": "C", "b": 2}, {"a": "C", "b": 7}, {"a": "C", "b": 4}, {"a": "D", "b": 1}, {"a": "D", "b": 2}, {"a": "D", "b": 6}, {"a": "E", "b": 8}, {"a": "E", "b": 4}, {"a": "E", "b": 7}], "mark": "point", "encoding": {"x": {"field": "a", "type": "nominal"}}}]
```

New document 1

```
object > data > values >
  object {3}
    data {1}
      values [9]
        mark : point
    encoding {1}
      x {2}
        field : a
        type : nominal
```

El objeto **encoding** es una traducción clave-valor entre los canales de codificación (como x, y) y las definiciones de los campos de datos traducidos. La definición del canal describe el nombre del campo (**field**) y su tipo de datos (**type**). En este ejemplo, asignamos los valores del campo **a** al canal de codificación **x** (la posición x de los puntos) y establecemos el tipo de datos de **a** como **nominal**, ya que representa categorías

## TRADUCCIÓN: CODIFICACIÓN DE LOS DATOS CON MARCAS VISUALES



Otros tipos de datos son:

quantitative  
temporal  
ordinal  
nominal

New document 2

code tree powered by ace

```
1 [{"data": {  
2   "values": [  
3     {"a": "C", "b": 2}, {"a": "C", "b": 7}, {"a": "C", "b": 4},  
4     {"a": "D", "b": 1}, {"a": "D", "b": 2}, {"a": "D", "b": 6},  
5     {"a": "E", "b": 8}, {"a": "E", "b": 4}, {"a": "E", "b": 7}  
6   ]  
7 },  
8   "mark": "point",  
9   "encoding": {  
10    "x": {"field": "a", "type": "nominal"},  
11    "y": {"field": "b", "type": "quantitative"}  
12  }  
13 }]  
14 }
```

New document 1

code tree

object ► encoding ► y ►

- object {3}
- data {1}
- values [9]
- mark : point
- encoding {2}
- x {2}
  - field : a
  - type : nominal
- y {2}
  - field : b
  - type : quantitative

Copy >

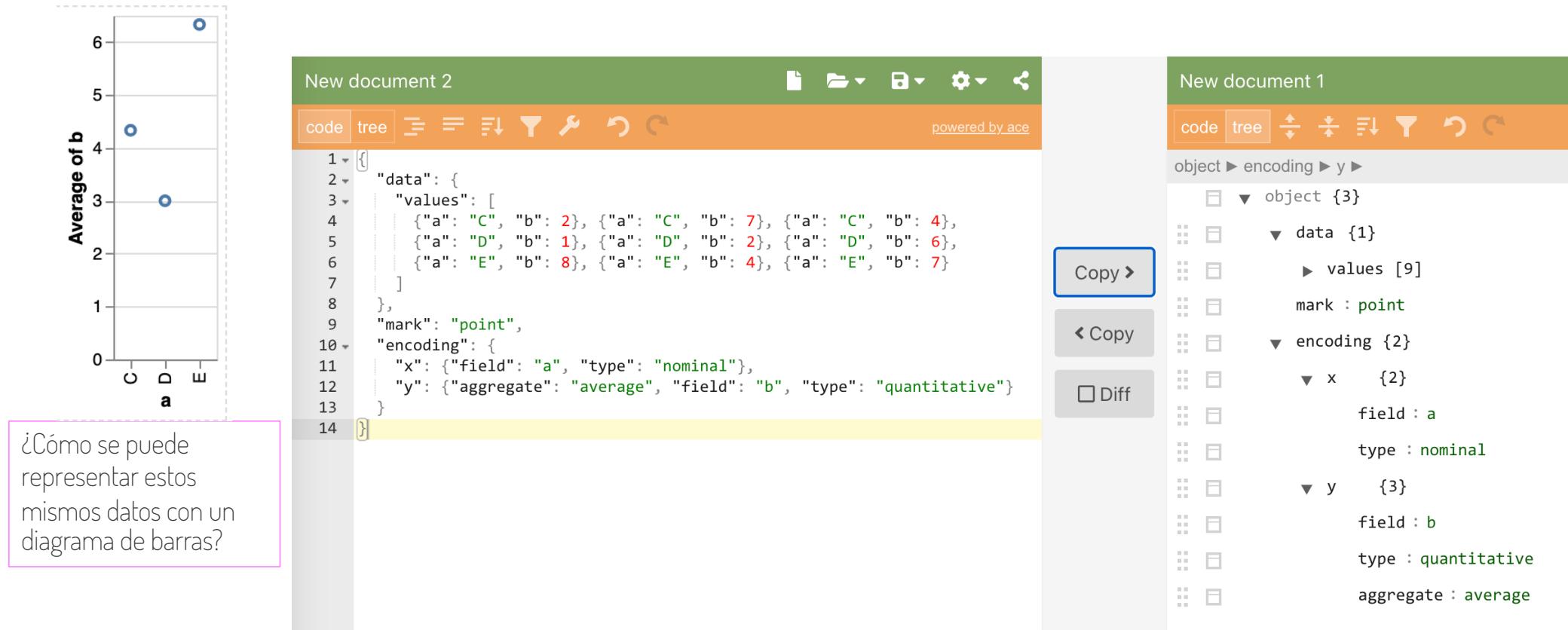
< Copy

Diff

También podemos hacer la traducción para el campo **b** al canal **y**.

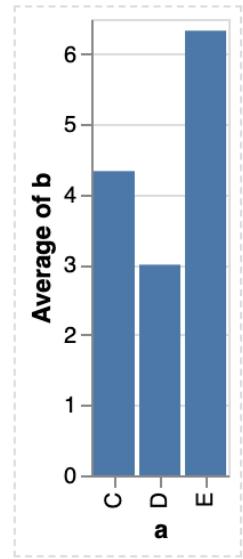
Esta vez configuramos el tipo de campo para que sea **quantitative** porque los valores en el campo **b** son numéricos.

## TRADUCCIÓN: CODIFICACIÓN DE LOS DATOS CON MARCAS VISUALES



Vega-Lite también admite la transformación de datos como la agregación. Al añadir "**aggregate**": "average" a la definición del canal **y**, podemos ver el valor promedio de **a** en cada categoría. Por ejemplo, el valor promedio de la categoría D es  $(1 + 2 + 6) / 3 = 9/3 = 3$

## TRADUCCIÓN: CODIFICACIÓN DE LOS DATOS CON MARCAS VISUALES



Un simple cambio en la marca de **point** a **bar**, cambia al tipo de gráfico:

New document 2

code tree powered by ace

```
1  [
2    "data": {
3      "values": [
4        {"a": "C", "b": 2}, {"a": "C", "b": 7}, {"a": "C", "b": 4},
5        {"a": "D", "b": 1}, {"a": "D", "b": 2}, {"a": "D", "b": 6},
6        {"a": "E", "b": 8}, {"a": "E", "b": 4}, {"a": "E", "b": 7}
7      ]
8    },
9    "mark": "bar",
10   "encoding": {
11     "x": {"field": "a", "type": "nominal"},
12     "y": {"aggregate": "average", "field": "b", "type": "quantitative"}
13   }
14 ]
```

New document 1

object ► encoding ► y ►

object {3} ► data {1} ► values [9] mark : bar

encoding {2} ▼ x {2} field : a type : nominal

y {3} field : b type : quantitative aggregate : average

Copy  < Copy  Diff

Dado que el valor cuantitativo está en **y**, automáticamente se obtiene un gráfico de barras verticales. Si intercambiamos el canal **x** e **y**, obtenemos un gráfico de barras horizontales en su lugar. ¡PRUEBALO!

## TRADUCCIÓN: CODIFICACIÓN DE LOS DATOS CON MARCAS VISUALES

Vamos a usar el editor online de Vega-Lite <https://vega.github.io/editor/>

← → C [vega.github.io/editor/?#/edited](https://vega.github.io/editor/?#/edited) ⭐ |

Vega-Lite ▾ Run Auto Commands Export Share Gist Examples

VEGA-LITE CONFIG

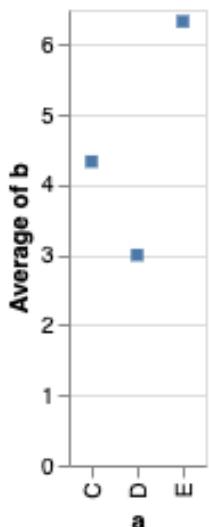
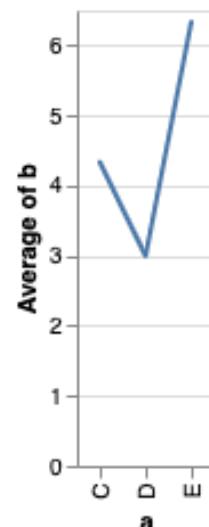
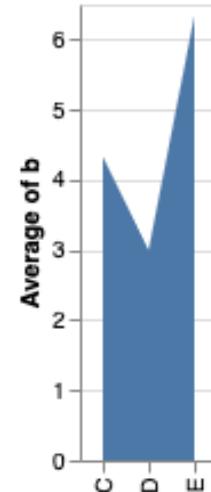
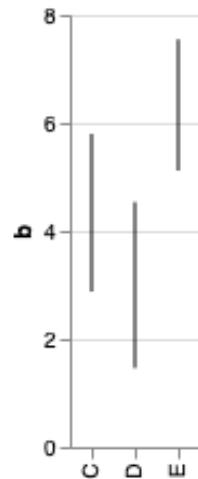
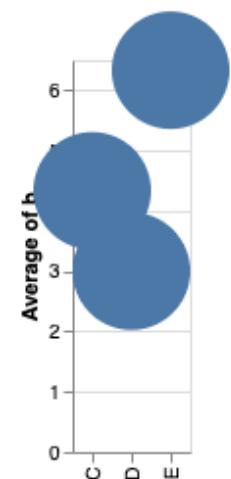
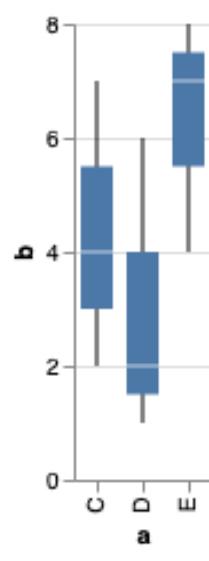
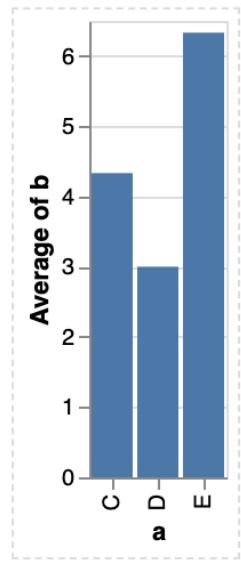
```
1  {
2    "$schema": "https://vega.github.io/schema/vega-lite/v5.json",
3    "data": {
4      "values": [
5        {"a": "C", "b": 2}, {"a": "C", "b": 7}, {"a": "C", "b": 4},
6        {"a": "D", "b": 1}, {"a": "D", "b": 2}, {"a": "D", "b": 6},
7        {"a": "E", "b": 8}, {"a": "E", "b": 4}, {"a": "E", "b": 7}
8      ]
9    },
10   "mark": "bar",
11   "encoding": {
12     "x": {"field": "a", "type": "nominal"},
13     "y": {"aggregate": "average", "field": "b", "type": "quantitative"}
14   }
15 }
```

Average of b

a

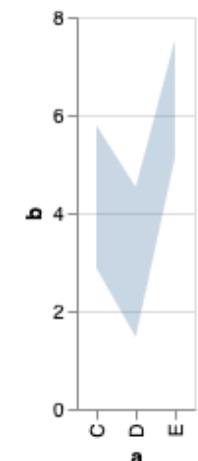
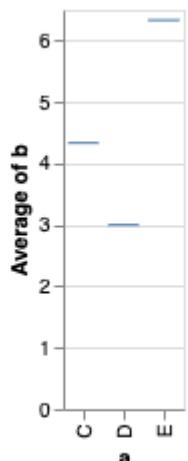
a	Average of b
C	4.5
D	3.0
E	6.5

## TRADUCCIÓN: CODIFICACIÓN DE LOS DATOS CON MARCAS VISUALES



Un simple cambio en la marca de **point** a **bar**, ¿Hay otras marcas?

¡PRUÉBALO!

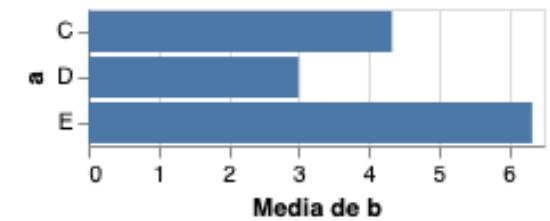


<https://vega.github.io/vega-lite/docs/mark.html#types>

## TRADUCCIÓN: CODIFICACIÓN DE LOS DATOS CON MARCAS VISUALES

### VEGA-LITE CONFIG

```
1  {
2    "$schema": "https://vega.github.io/schema/vega-lite/v5.json",
3    "data": {
4      "values": [
5        {"a": "C", "b": 2}, {"a": "C", "b": 7}, {"a": "C", "b": 4},
6        {"a": "D", "b": 1}, {"a": "D", "b": 2}, {"a": "D", "b": 6},
7        {"a": "E", "b": 8}, {"a": "E", "b": 4}, {"a": "E", "b": 7}
8      ]
9    },
10   "mark": "bar",
11   "encoding": {
12     "y": {"field": "a", "type": "nominal"},
13     "x": {"aggregate": "average", "field": "b", "type": "quantitative", "title": "Media de b"}
14   }
15 }
```



Se ha cambiado el **title** a "Media de b"

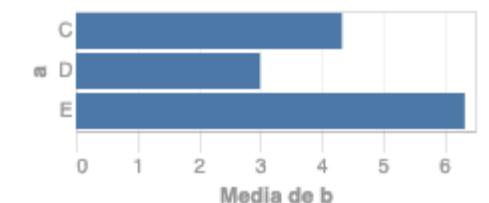
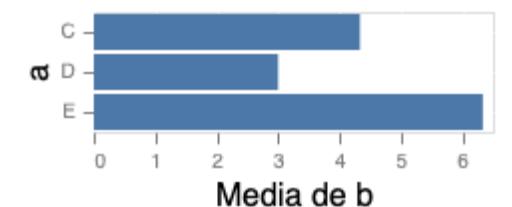
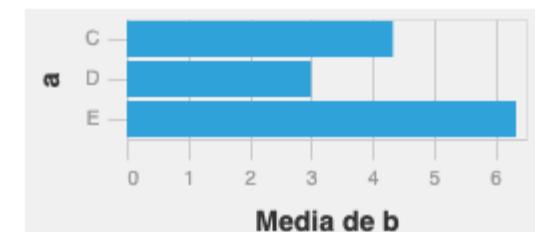
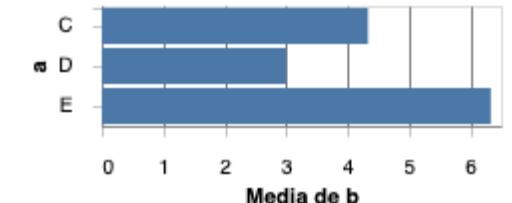
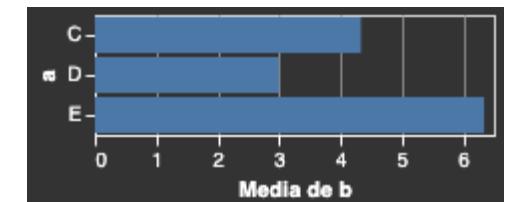
Vega-Lite proporciona automáticamente propiedades predeterminadas para la visualización. Se pueden personalizar estos valores agregando más propiedades. Por ejemplo, para cambiar el título del eje **x** de *Average of b* a *Media de b*, podemos establecer la propiedad del **title** del eje en el canal **x**.

## TRADUCCIÓN: CODIFICACIÓN DE LOS DATOS CON MARCAS VISUALES

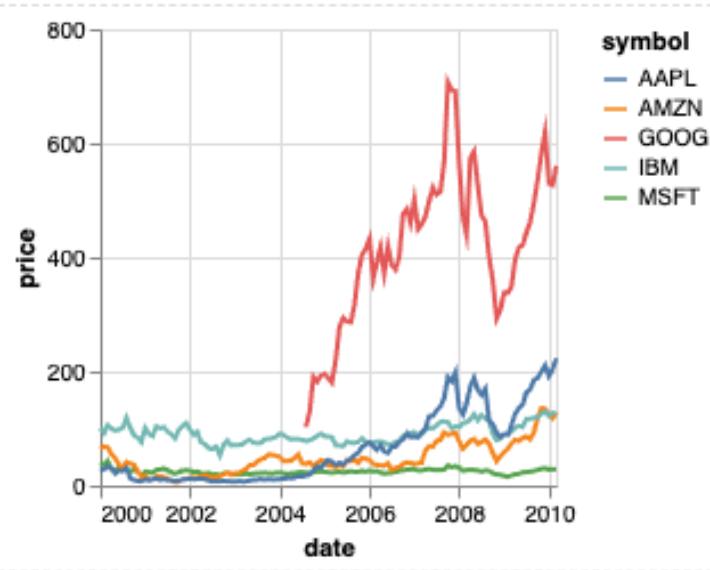
VEGA-LITE CONFIG

```
1  {
2    "$schema": "https://vega.github.io/schema/vega-lite/v5.json",
3    "data": {
4      "values": [
5        {"a": "C", "b": 2}, {"a": "C", "b": 7}, {"a": "C", "b": 4},
6        {"a": "D", "b": 1}, {"a": "D", "b": 2}, {"a": "D", "b": 6},
7        {"a": "E", "b": 8}, {"a": "E", "b": 4}, {"a": "E", "b": 7}
8      ]
9    },
10   "mark": "bar",
11   "encoding": {
12     "y": {"field": "a", "type": "nominal"},
13     "x": {"aggregate": "average", "field": "b", "type": "quantitative", "title":
14       "Media de b"}
15   }
}
```

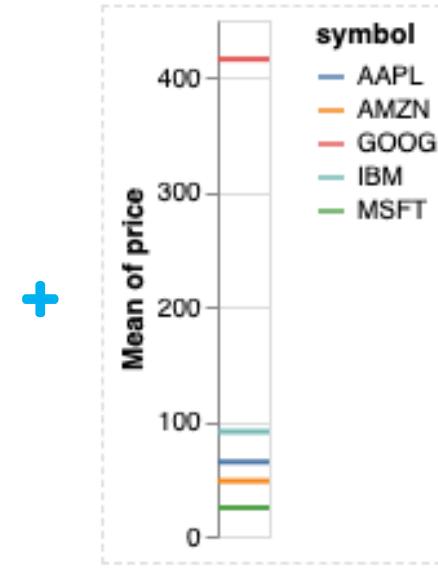
Vega-Lite proporciona estilos temáticos automáticamente



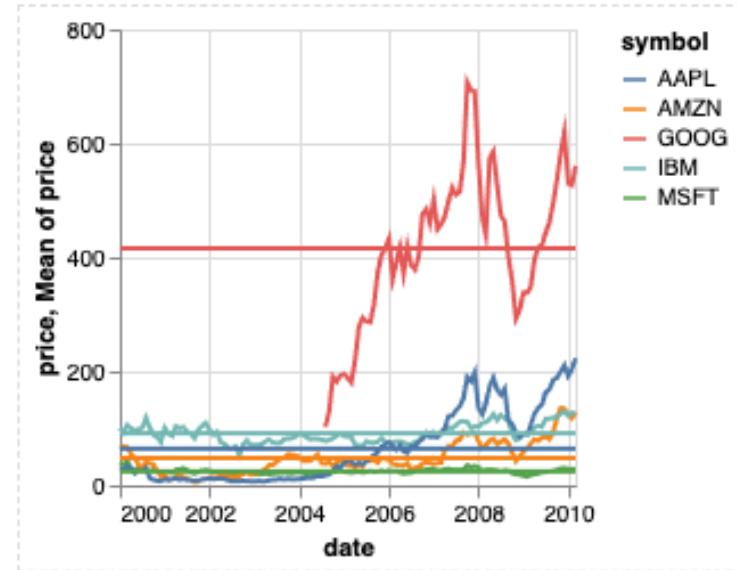
## TRADUCCIÓN: USO DE CAPAS



```
{
  "data": {"url": "data/stocks.csv"},
  "mark": "line",
  "encoding": {
    "x": {"field": "date", "type": "temporal"},
    "y": {"field": "price", "type": "quantitative"},
    "color": {"field": "symbol", "type": "nominal"}
  }
}
```



```
+ {
  "data": {"url": "data/stocks.csv"},
  "mark": "rule",
  "encoding": {
    "y": {
      "field": "price",
      "type": "quantitative",
      "aggregate": "mean"
    },
    "size": {"value": 2},
    "color": {"field": "symbol", "type": "nominal"}
  }
} ==
```



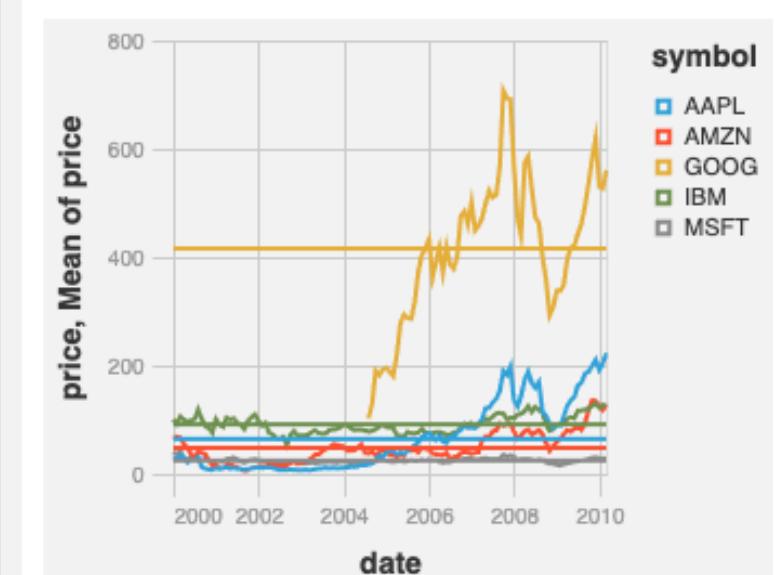
```
{
  "data": {"url": "data/stocks.csv"},
  "layer": [
    {
      "mark": "line",
      "encoding": {
        "x": {"field": "date", "type": "temporal"},
        "y": {"field": "price", "type": "quantitative"},
        "color": {"field": "symbol", "type": "nominal"}
      }
    },
    {
      "mark": "rule",
      "encoding": {
        "y": {"field": "price", "aggregate": "mean"},
        "size": {"value": 2},
        "color": {"field": "symbol", "type": "nominal"}
      }
    }
  ]
}
```

A veces, es útil superponer un gráfico sobre otro. Puede lograr esto utilizando el operador de **layer**.

## TRADUCCIÓN: USO DE CAPAS

VEGA-LITE CONFIG

```
1  {
2      "data": {"url": "data/stocks.csv"},
3      "layer": [
4          {
5              "mark": "line",
6              "encoding": {
7                  "x": {"field": "date", "type": "temporal"},
8                  "y": {"field": "price", "type": "quantitative"},
9                  "color": {"field": "symbol", "type": "nominal"}
10             }
11         },
12         {
13             "mark": "rule",
14             "encoding": {
15                 "y": {"field": "price", "aggregate": "mean"},
16                 "size": {"value": 2},
17                 "color": {"field": "symbol"}
18             }
19         }
20     ]
21 }
```



¿Cómo se podrá hacer este gráfico?

## TRADUCCIÓN: CODIFICACIÓN

Vega-Lite | Run Auto | Commands | Export | Share | Gist | Examples

VEGA-LITE CONFIG

```
1  {
2    "$schema": "https://vega.github.io/schema/vega-lite/v5.json",
3    "data": {"url": "data/cars.json"},
4    "encoding": {
5      "x": {"field": "Year", "timeUnit": "year"},
6      "y": {
7        "type": "quantitative",
8        "scale": {"zero": false},
9        "axis": {"title": "Miles per Gallon (95% CIs)"}
10     }
11   },
12   "layer": [
13     {
14       "mark": {
15         "type": "errorband",
16         "extent": "ci",
17         "borders": {
18           "opacity": 0.5,
19           "strokeDash": [6, 4]
20         }
21       },
22       "encoding": {
23         "y": {"field": "Miles_per_Gallon"}
24       }
25     },
26     {
27       "mark": "line",
28       "encoding": {
29         "y": {"field": "Miles_per_Gallon", "aggregate": "mean"}
30       }
31     }
32   ]
33 }
```

Miles per Gallon (95% CIs)

Year (year)

¿Cuáles son las propiedades de las marcas?

¡PRUEBALO!

## TRADUCCIÓN: CODIFICACIÓN DE LOS DATOS CON MARCAS VISUALES

Desde el editor online de Vega-Lite <https://vega.github.io/editor/> se puede exportar a diferentes formatos

### Export



PNG is a bitmap image format which is made up of a fixed number of pixels. They have a fixed resolution and cannot be scaled.

[Download](#)



JSON is a lightweight data-interchange format.

Compiled Vega  Vega-Lite

Include config

The downloaded spec will be formatted.

[Download](#)



SVG is a vector image format which uses geometric forms to represent different parts as discrete objects and are infinitely scalable.

[Open](#)

[Download](#)



PDF is a vector format usually used for documents. This might take a few seconds. Please be patient. Use absolute URLs to ensure that the data is loaded correctly. Your chart is sent to [render-vega.vercel.app](https://render-vega.vercel.app) for processing.

[Download](#)

**Note:** To get a PDF, open the SVG which you can print as a PDF from your browser.

## TRADUCCIÓN: CODIFICACIÓN DE LOS DATOS CON MARCAS VISUALES

Vamos a usar el editor online de Vega-Lite <https://vega.github.io/editor/> para explorar un conjunto de datos

The screenshot shows the Vega-Lite online editor interface. At the top, there is a navigation bar with links for Vega-Lite, Run (Auto), Commands, Export, Share, Gist, Examples, Help, Settings, and Sign in with GitHub. Below the navigation bar, there are two tabs: VEGA-LITE and CONFIG. The VEGA-LITE tab is active, showing a code editor with the following JSON specification:

```
1 {  
2   "$schema": "https://vega.github.io/schema/vega-lite/v5.json"  
3 }
```

The CONFIG tab is also visible. To the right of the code editor, a large red error message is displayed:

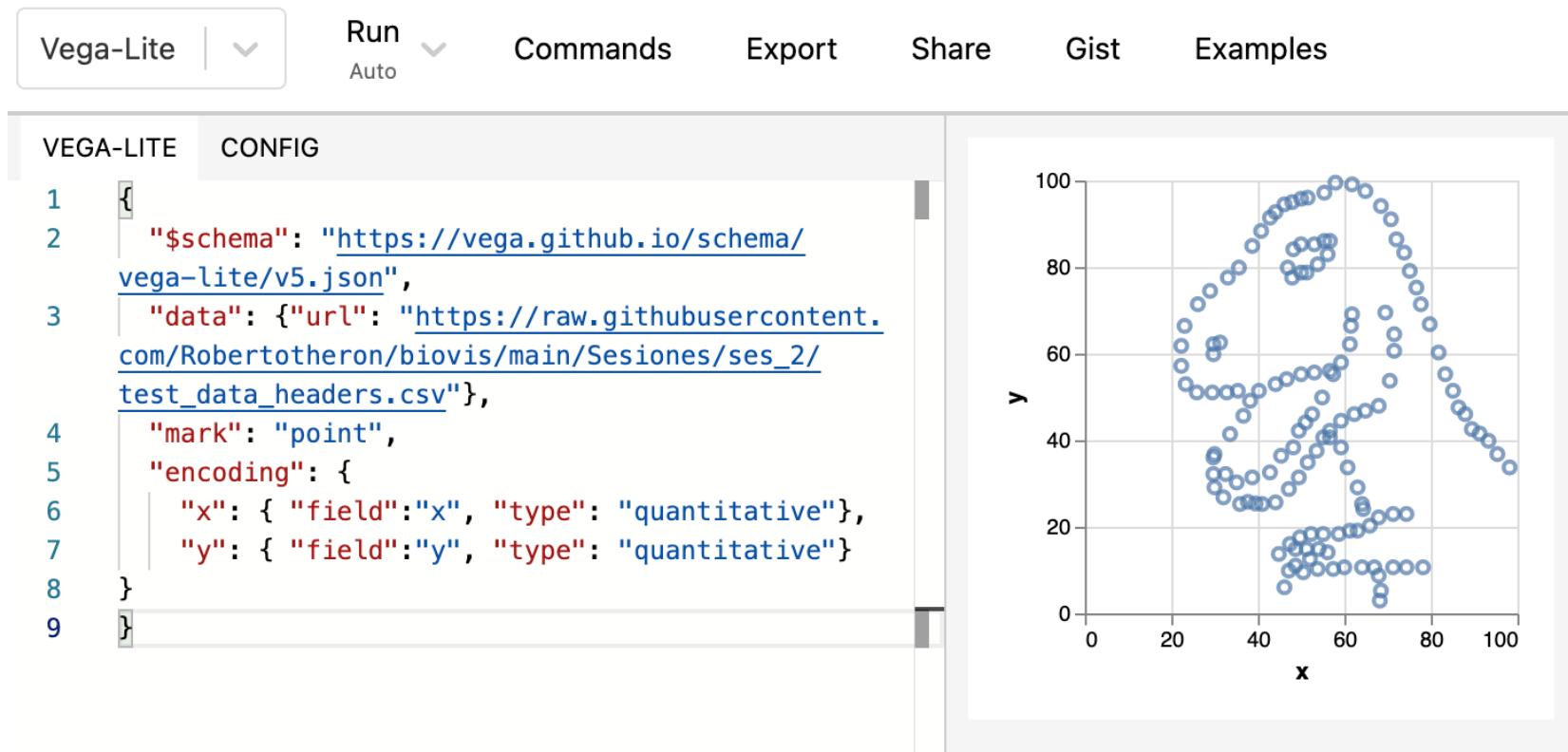
Invalid specification  
{"\$schema":"https://vega.github.io/schema/vega-lite/v5.json"}.  
Make sure the specification includes at least one of the following  
properties: "mark", "layer", "facet", "hconcat", "vconcat", "concat",  
or "repeat".

## TRADUCCIÓN: CODIFICACIÓN DE LOS DATOS CON MARCAS VISUALES

Vamos a usar el editor online de Vega-Lite <https://vega.github.io/editor/> para explorar un conjunto de datos

NOTA: se cargan los datos desde un fichero csv alojado en Github:

[https://raw.githubusercontent.com/Robertoheron/biovis/main/Sesiones/ses\\_2/test\\_data\\_headers.csv](https://raw.githubusercontent.com/Robertoheron/biovis/main/Sesiones/ses_2/test_data_headers.csv)



## TRADUCCIÓN: CODIFICACIÓN DE LOS DATOS CON MARCAS VISUALES

EJERCICIO: vamos explorar los datos desde un fichero csv alojado en Github:

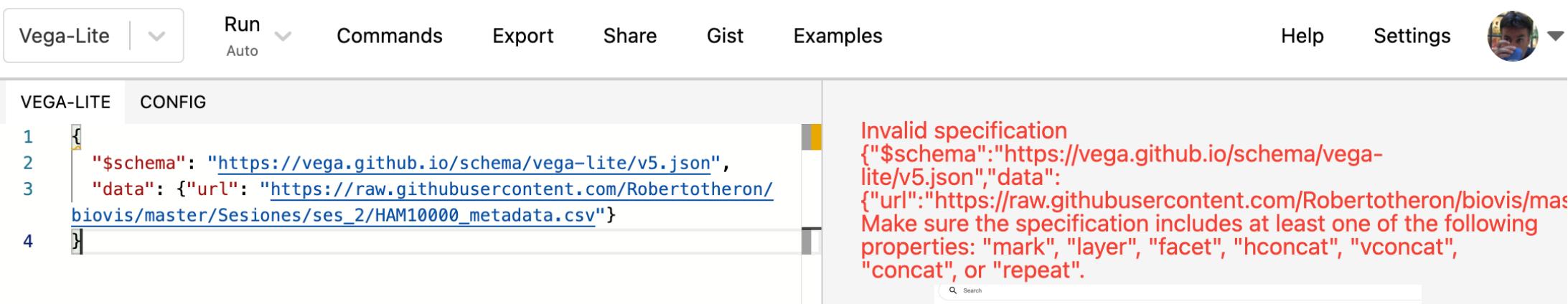
[https://raw.githubusercontent.com/Robertoheron/biovis/master/Sesiones/ses\\_2/HAM10000\\_metadata.csv](https://raw.githubusercontent.com/Robertoheron/biovis/master/Sesiones/ses_2/HAM10000_metadata.csv)

Vega-Lite | ▾ Run Auto Commands Export Share Gist Examples Help Settings

VEGA-LITE CONFIG

```
1 {  
2   "$schema": "https://vega.github.io/schema/vega-lite/v5.json",  
3   "data": {"url": "https://raw.githubusercontent.com/Robertoheron/biovis/master/Sesiones/ses_2/HAM10000_metadata.csv"}  
4 }
```

Invalid specification  
{"\$schema":"https://vega.github.io/schema/vega-lite/v5.json","data":  
{"url":"https://raw.githubusercontent.com/Robertoheron/biovis/master/Sesiones/ses\_2/HAM10000\_metadata.csv"}  
Make sure the specification includes at least one of the following properties: "mark", "layer", "facet", "hconcat", "vconcat", "concat", or "repeat".



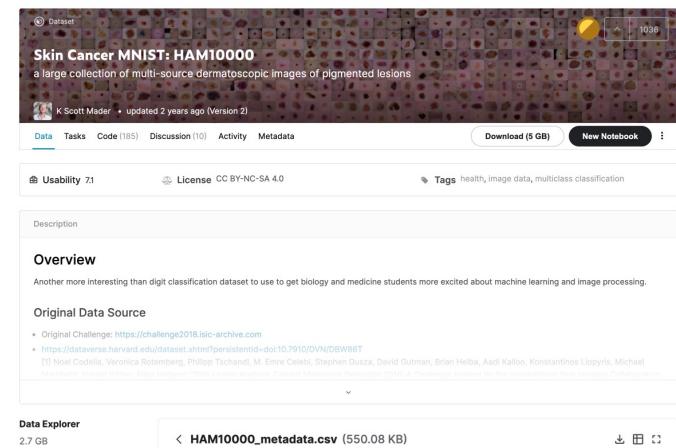
Los datos proceden de Kaggle:

### Skin Cancer MNIST: HAM10000

a large collection of multi-source dermatoscopic images of pigmented lesions

Puedes ver el resto del dataset en:

<https://www.kaggle.com/kmader/skin-cancer-mnist-ham10000>



## TRADUCCIÓN: CODIFICACIÓN DE LOS DATOS CON MARCAS VISUALES

NOTA: en la parte inferior izquierda del editor online de Vega-Lite, se pueden ver los conjuntos de datos cargados

Vega 5.19.1, Vega-Lite 5.0.0, Vega-Tooltip 0.25.0, Editor 0.94.2

LOGS DATA VIEWER SIGNAL VIEWER ▾

source\_0 | ▾ < 1 2 3 4 ... 201 >

lesion_id	image_id	dx	dx_type	age	sex	localization
"HAM_0000118"	"ISIC_0027419"	"bkl"	"histo"	"80.0"	"male"	"scalp"
"HAM_0000118"	"ISIC_0025030"	"bkl"	"histo"	"80.0"	"male"	"scalp"

## TRADUCCIÓN: CODIFICACIÓN DE LOS DATOS CON MARCAS VISUALES

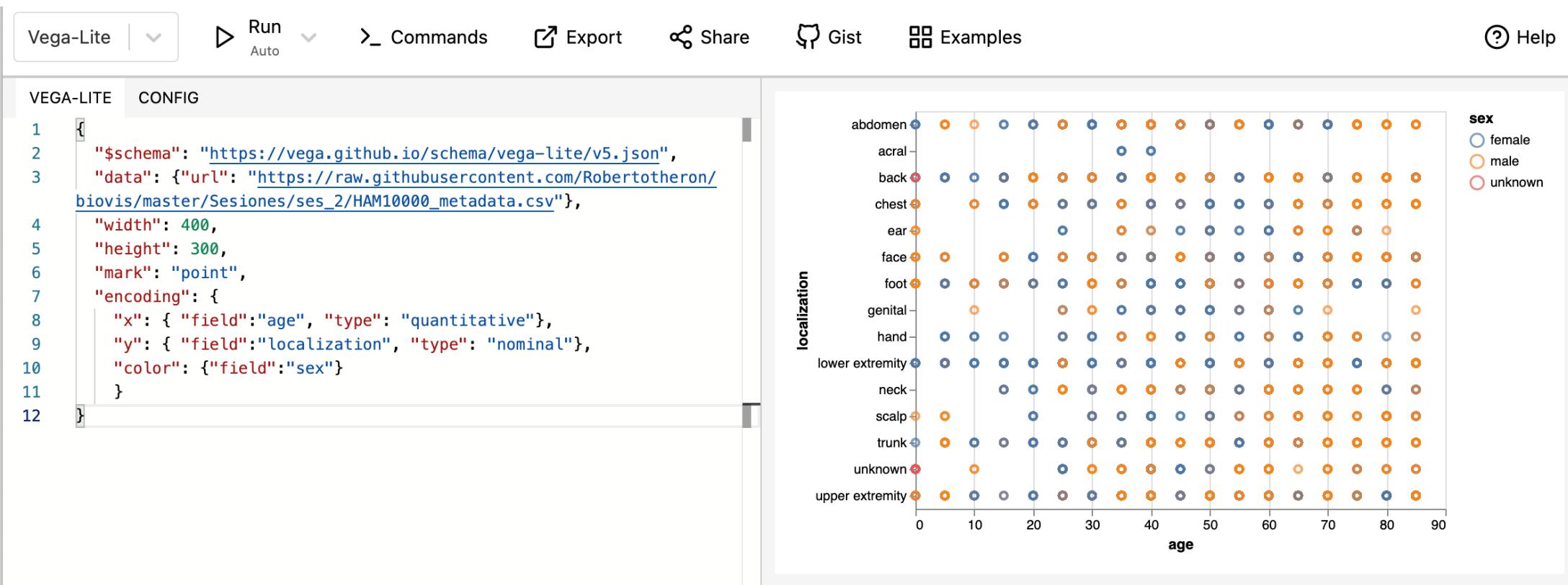
EJERCICIO: vamos explorar los datos desde un fichero csv alojado en Github:

¿cómo se puede obtener el gráfico de la derecha?



## TRADUCCIÓN: CODIFICACIÓN DE LOS DATOS CON MARCAS VISUALES

EJERCICIO: vamos explorar los datos Skin Cancer MNIST: HAM10000  
¿cómo se puede obtener el gráfico de la derecha?



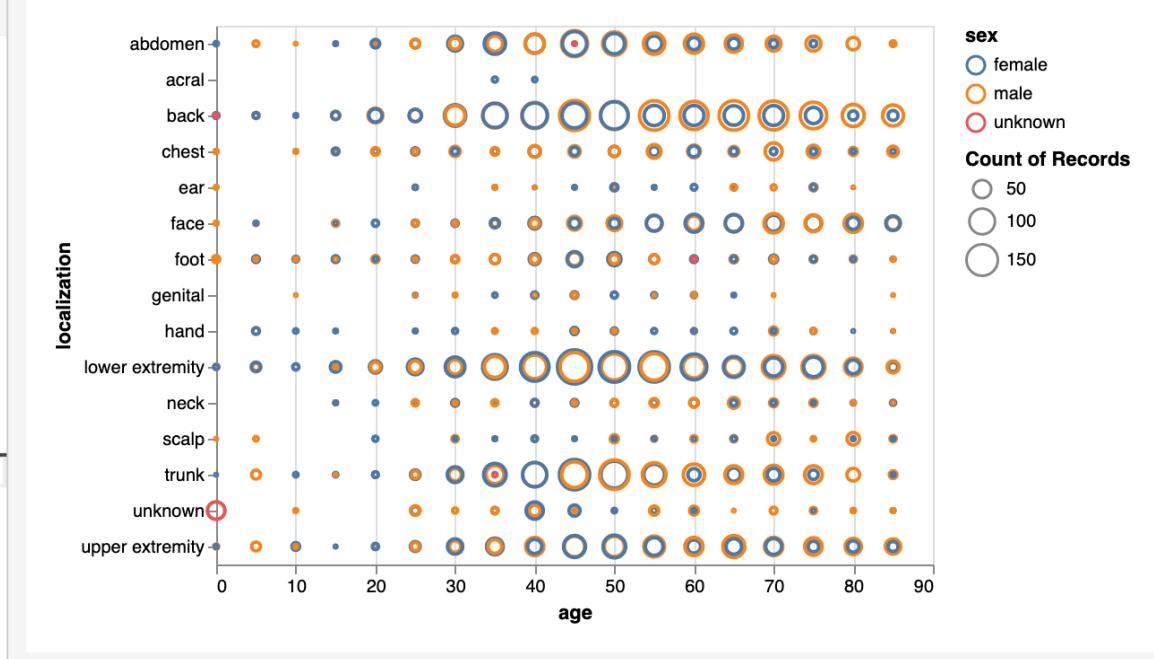
## TRADUCCIÓN: CODIFICACIÓN DE LOS DATOS CON MARCAS VISUALES

EJERCICIO: vamos explorar los Skin Cancer MNIST: HAM10000

¿y AHORA?

VEGA-LITE CONFIG

```
1  {
2    "$schema": "https://vega.github.io/schema/vega-lite/v5.json",
3    "data": {"url": "https://raw.githubusercontent.com/Robertoheron/
4      biovis/master/Sesiones/ses_2/HAM10000_metadata.csv"},
5    "width": 400,
6    "height": 300,
7    "mark": "point",
8    "encoding": {
9      "x": { "field": "age", "type": "quantitative" },
10     "y": { "field": "localization", "type": "nominal" },
11     "color": {"field": "sex"},  
12   }
13 }
```



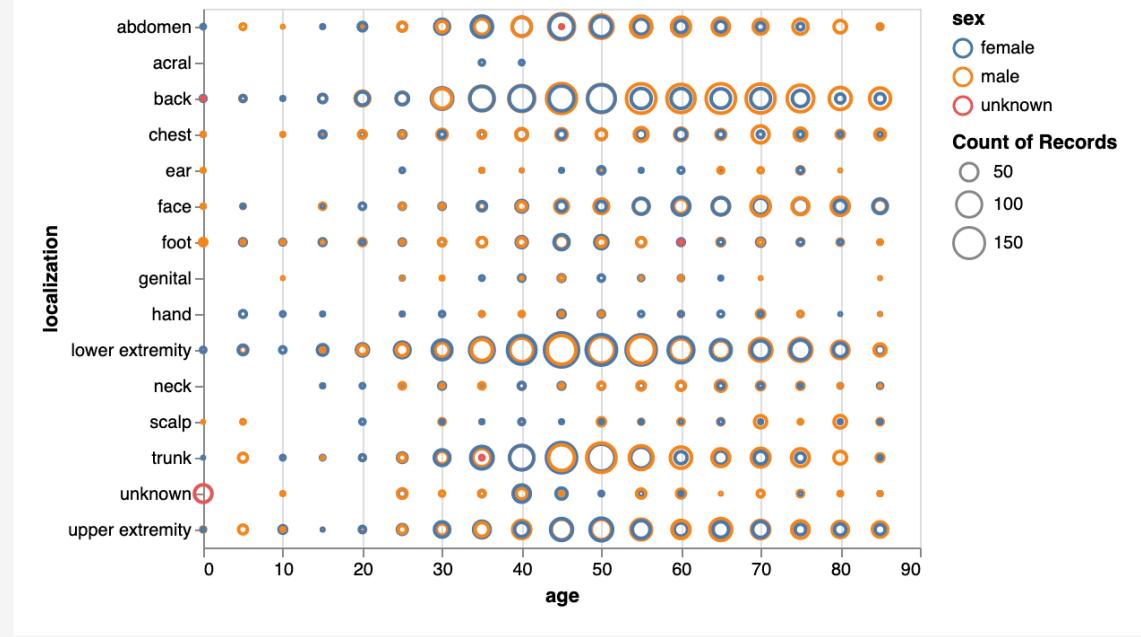
## TRADUCCIÓN: CODIFICACIÓN DE LOS DATOS CON MARCAS VISUALES

EJERCICIO: vamos explorar los Skin Cancer MNIST: HAM10000

¿y AHORA?

VEGA-LITE CONFIG

```
1  {
2    "$schema": "https://vega.github.io/schema/vega-lite/v5.json",
3    "data": {"url": "https://raw.githubusercontent.com/Robertoheron/
4      biovis/master/Sesiones/ses_2/HAM10000_metadata.csv"},
5    "width": 400,
6    "height": 300,
7    "mark": "point",
8    "encoding": {
9      "x": { "field": "age", "type": "quantitative" },
10     "y": { "field": "localization", "type": "nominal" },
11     "color": { "field": "sex" },
12     "size": { "aggregate": "count" }
13   }
```



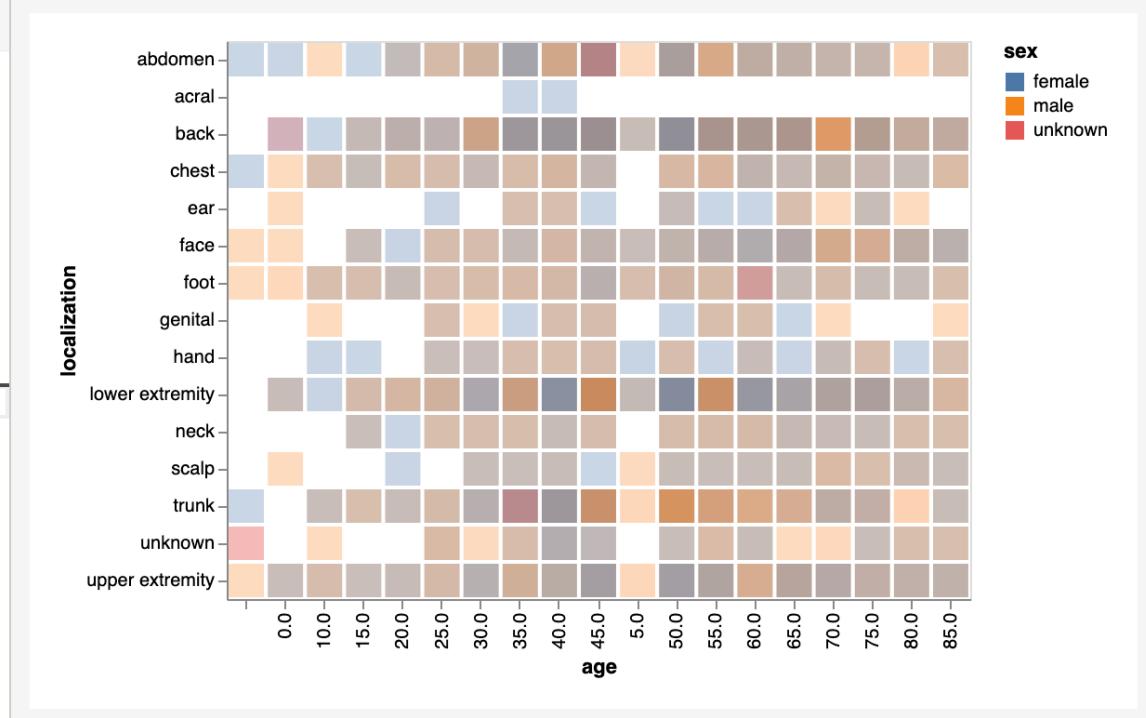
## TRADUCCIÓN: CODIFICACIÓN DE LOS DATOS CON MARCAS VISUALES

EJERCICIO: vamos explorar los Skin Cancer MNIST: HAM10000

¿y AHORA?

VEGA-LITE CONFIG

```
1 {  
2   "$schema": "https://vega.github.io/schema/vega-lite/v5.json",  
3   "data": {"url": "https://raw.githubusercontent.com/Robertoheron/  
biovis/master/Sesiones/ses_2/HAM10000_metadata.csv"},  
4   "width": 400,  
5   "height": 300,  
6 }  
7  
8 ¿?  
9  
10  
11  
12 }  
13 }
```



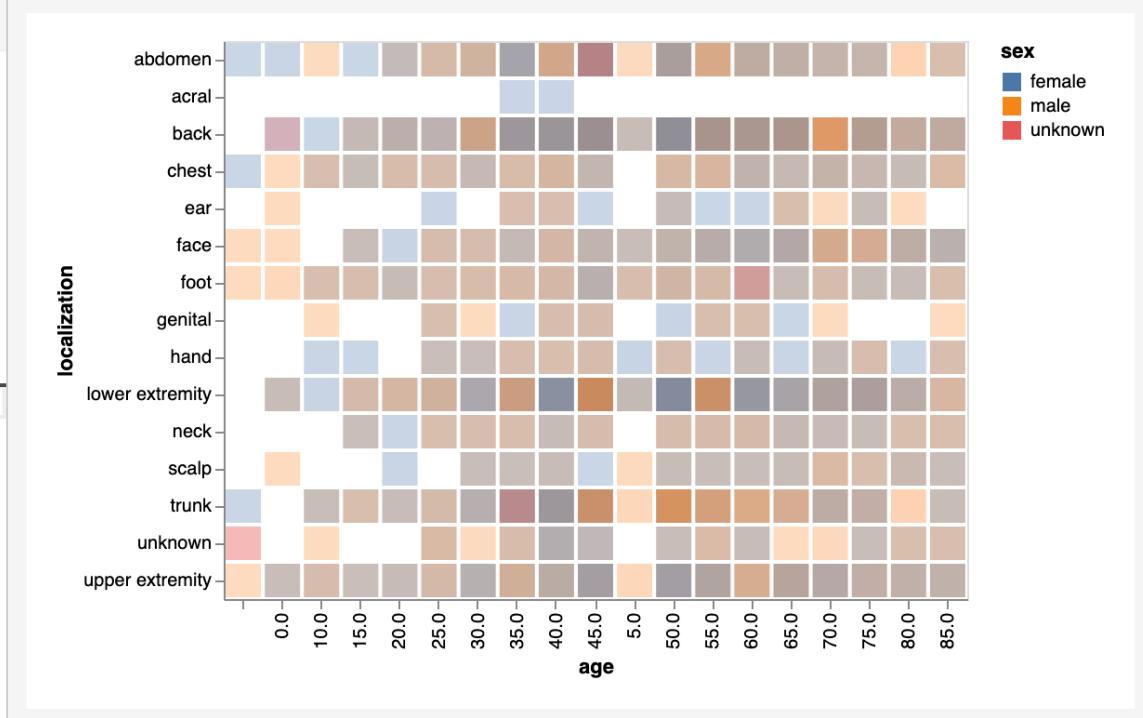
## TRADUCCIÓN: CODIFICACIÓN DE LOS DATOS CON MARCAS VISUALES

EJERCICIO: vamos explorar los Skin Cancer MNIST: HAM10000

¿y AHORA?

VEGA-LITE CONFIG

```
1 {  
2   "$schema": "https://vega.github.io/schema/vega-lite/v5.json",  
3   "data": {"url": "https://raw.githubusercontent.com/Robertoheron/  
4   biovis/master/Sesiones/ses_2/HAM10000_metadata.csv"},  
5   "width": 400,  
6   "height": 300,  
7   "mark": "bar",  
8   "encoding": {  
9     "x": {"field": "age", "type": "ordinal"},  
10    "y": {"field": "localization", "type": "nominal"},  
11    "color": {"field": "sex"},  
12    "fillOpacity": {"aggregate": "count"}  
13 }
```



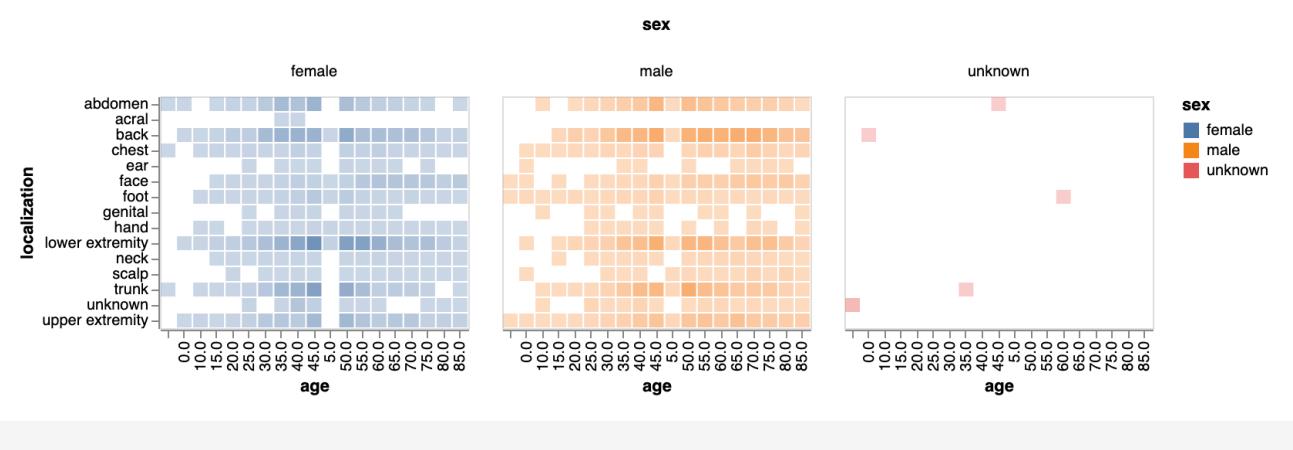
## TRADUCCIÓN: CODIFICACIÓN DE LOS DATOS CON MARCAS VISUALES

EJERCICIO: vamos explorar los Skin Cancer MNIST: HAM10000

¿y AHORA?

VEGA-LITE CONFIG

```
1 {  
2   "$schema": "https://vega.github.io/schema/vega-lite/v5.json",  
3   "data": {"url": "https://raw.githubusercontent.com/Robertoheron/  
4     biovis/master/Sesiones/ses_2/HAM10000_metadata.csv"},  
5   "width": 200,  
6   "height": 150,  
7   "mark": "bar",  
8   "encoding": {  
9     "x": {"field": "age", "type": "ordinal"},  
10    "y": {"field": "localization", "type": "nominal"},  
11    "color": {"field": "sex"},  
12    "fillOpacity": {"aggregate": "count"}  
13  }  
14 }
```



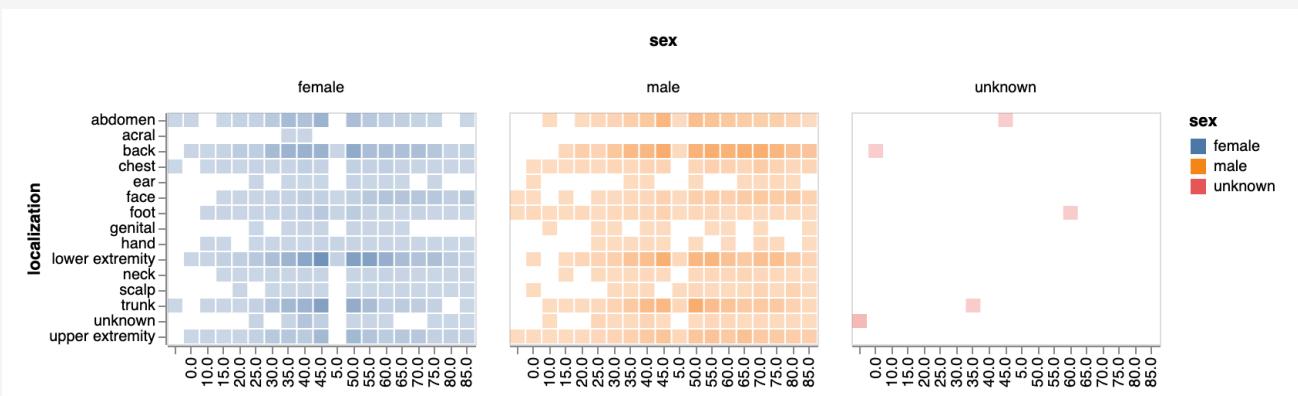
# TRADUCCIÓN: CODIFICACIÓN DE LOS DATOS CON MARCAS VISUALES

EJERCICIO: vamos explorar los Skin Cancer MNIST: HAM10000

¿y AHORA?

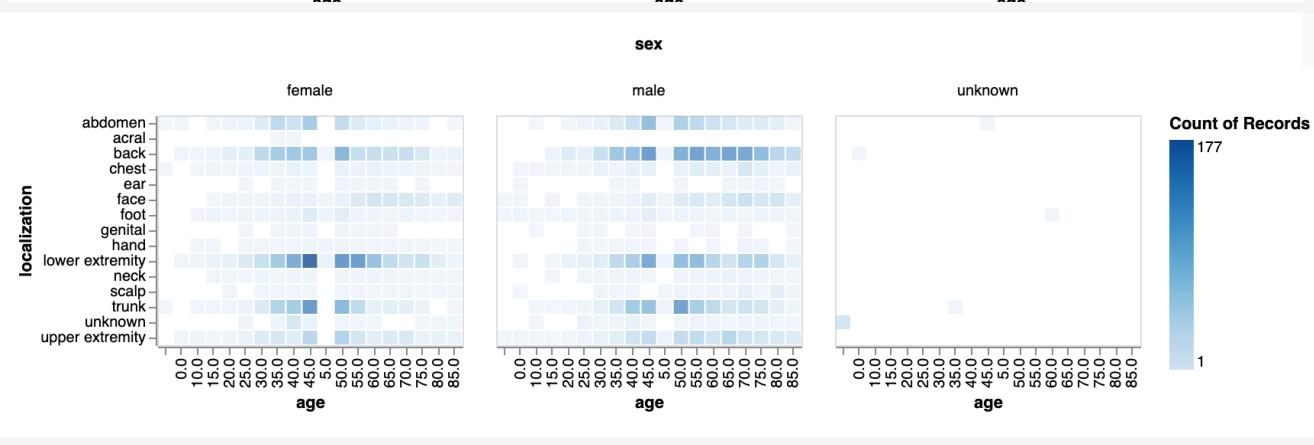
VEGA-LITE CONFIG

```
1 {
2   "$schema": "https://vega.github.io/schema/vega-lite/v5.json",
3   "data": {"url": "https://raw.githubusercontent.com/Robertoheron/
4     biovis/master/Sesiones/ses_2/HAM10000_metadata.csv"},
5   "width": 200,
6   "height": 150,
7   "mark": "bar",
8   "encoding": {
9     "column": {"field": "sex", "type": "nominal"},
10    "x": {"field": "age", "type": "ordinal"},
11    "y": {"field": "localization", "type": "nominal"},
12    "color": {"field": "sex"},
13    "fillOpacity": {"aggregate": "count"}}
```



VEGA-LITE CONFIG

```
1 {
2   "$schema": "https://vega.github.io/schema/vega-lite/v5.json",
3   "data": {"url": "https://raw.githubusercontent.com/Robertoheron/
4     biovis/master/Sesiones/ses_2/HAM10000_metadata.csv"},
5   "width": 200,
6   "height": 150,
7   "mark": "bar",
8   "encoding": {
9     "column": {"field": "sex", "type": "nominal"},
10    "x": {"field": "age", "type": "ordinal"},
11    "y": {"field": "localization", "type": "nominal"},
12    "color": [{"aggregate": "count"}],
13    "fillOpacity": {"aggregate": "count"}}
```



# TRADUCCIÓN: CODIFICACIÓN DE LOS DATOS CON MARCAS VISUALES

EJERCICIO: vamos explorar los Skin Cancer MNIST: HAM10000

¿y AHORA?

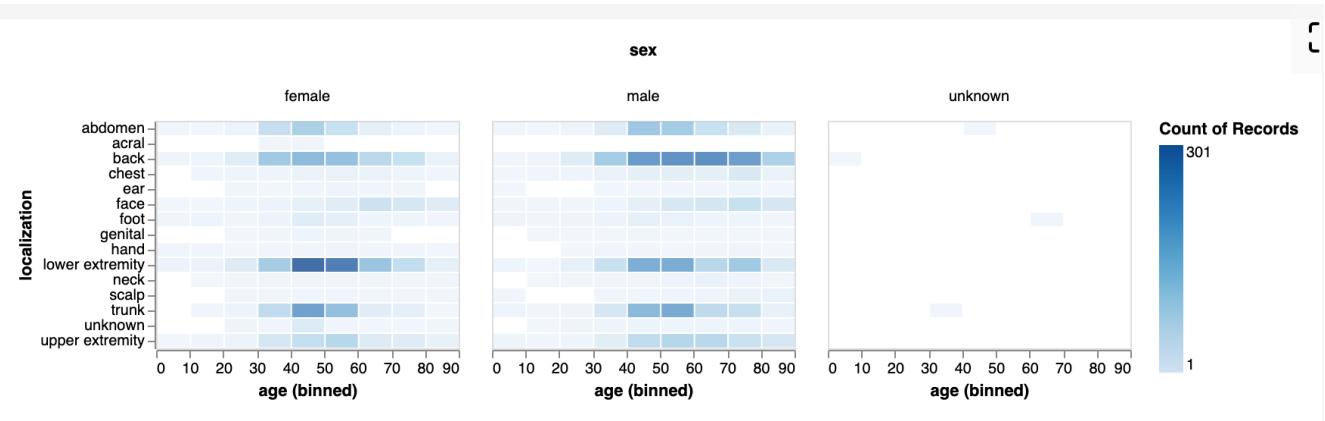
VEGA-LITE CONFIG

```
1 {  
2   "$schema": "https://vega.github.io/schema/vega-lite/v5.json",  
3   "data": {"url": "https://raw.githubusercontent.com/Robertoheron/  
4     biovis/master/Sesiones/ses_2/HAM10000_metadata.csv"},  
5   "width": 200,  
6   "height": 150,  
7   "mark": "bar",  
8   "encoding": {  
9     "column": {"field": "sex", "type": "nominal"},  
10    "x": {"field": "age", "type": "ordinal"},  
11    "y": {"field": "localization", "type": "nominal"},  
12    "color": {"aggregate": "count"},  
13    "fillOpacity": {"aggregate": "count"}  
14 }
```



VEGA-LITE CONFIG

```
1 {  
2   "$schema": "https://vega.github.io/schema/vega-lite/v5.json",  
3   "data": {"url": "https://raw.githubusercontent.com/Robertoheron/  
4     biovis/master/Sesiones/ses_2/HAM10000_metadata.csv"},  
5   "width": 200,  
6   "height": 150,  
7   "mark": "bar",  
8   "encoding": {  
9     "column": {"field": "sex", "type": "nominal"},  
10    "x": {"field": "age", "type": "quantitative", "bin": true},  
11    "y": {"field": "localization", "type": "nominal"},  
12    "color": {"aggregate": "count"},  
13    "fillOpacity": {"aggregate": "count"}  
14 }
```

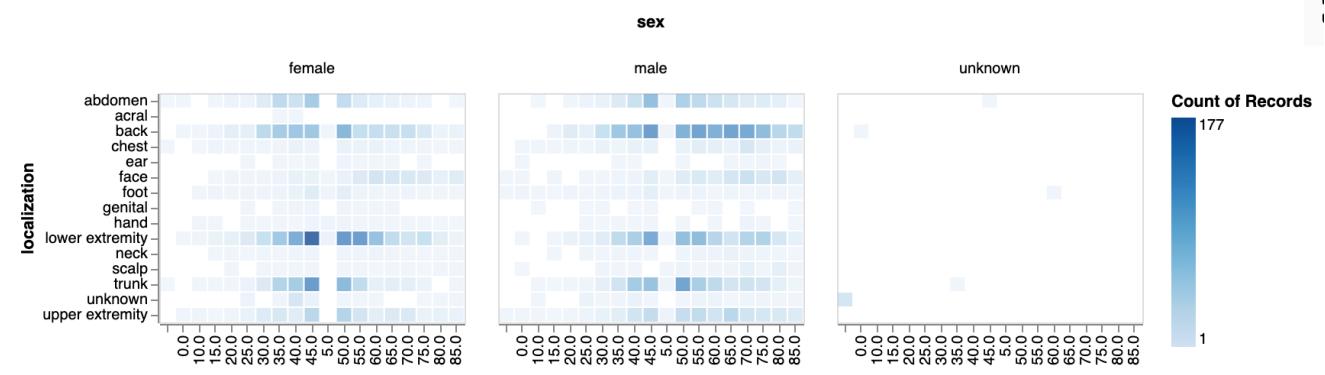


## TRADUCCIÓN: CODIFICACIÓN DE LOS DATOS CON MARCAS VISUALES

EJERCICIO: vamos explorar los Skin Cancer MNIST: HAM10000

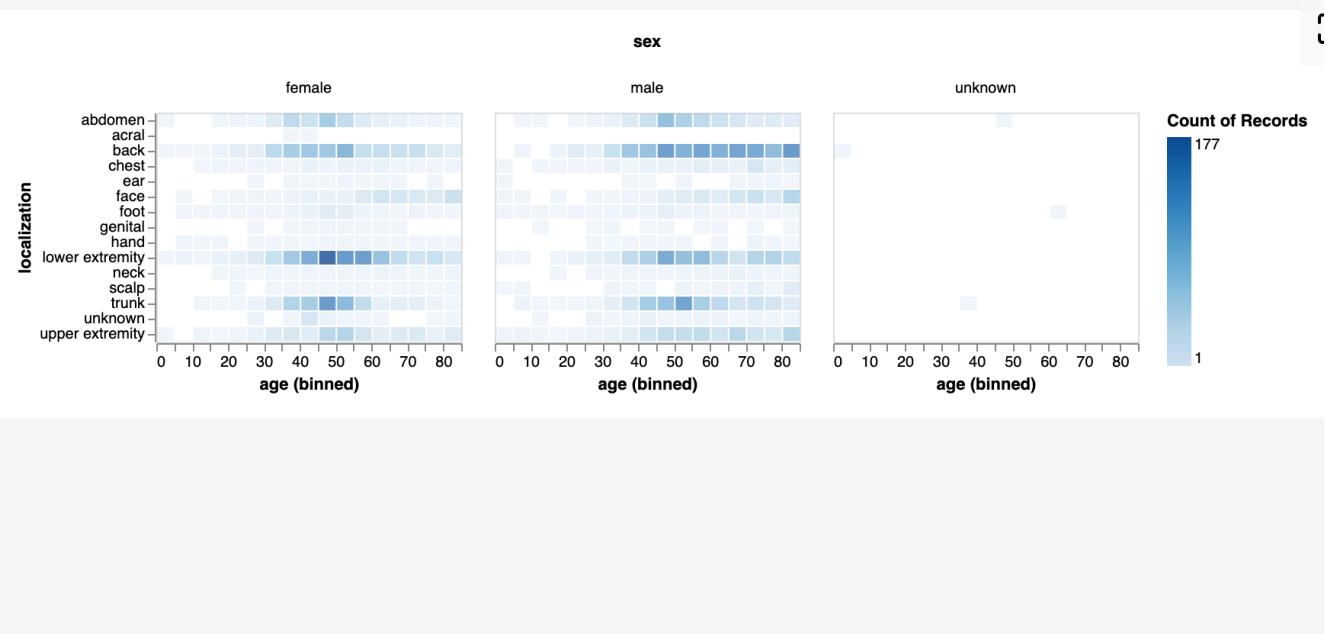
VEGA-LITE CONFIG

```
1 {  
2   "$schema": "https://vega.github.io/schema/vega-lite/v5.json",  
3   "data": {"url": "https://raw.githubusercontent.com/Robertoheron/  
4     biovis/master/Sesiones/ses_2/HAM10000_metadata.csv"},  
5   "width": 200,  
6   "height": 150,  
7   "mark": "bar",  
8   "encoding": {  
9     "column": {"field": "sex", "type": "nominal"},  
10    "x": {"field": "age", "type": "ordinal"},  
11    "y": {"field": "localization", "type": "nominal"},  
12    "color": {"aggregate": "count"},  
13    "fillOpacity": {"aggregate": "count"}  
14 }
```



VEGA-LITE CONFIG

```
1 {  
2   "$schema": "https://vega.github.io/schema/vega-lite/v5.json",  
3   "data": {"url": "https://raw.githubusercontent.com/Robertoheron/  
4     biovis/master/Sesiones/ses_2/HAM10000_metadata.csv"},  
5   "width": 200,  
6   "height": 150,  
7   "mark": "bar",  
8   "encoding": {  
9     "column": {  
10       "field": "sex",  
11       "type": "nominal"  
12     },  
13     "x": {"field": "age",  
14       "type": "quantitative",  
15       "bin": {"maxbins": 18  
16     }  
17     },  
18     "y": {"field": "localization",  
19       "type": "nominal"},  
20     "color": {"aggregate": "count"},  
21     "fillOpacity": {"aggregate": "count"}  
22 }
```



## TRADUCCIÓN: CODIFICACIÓN DE LOS DATOS CON MARCAS VISUALES

EJERCICIO: vamos explorar los Skin Cancer MNIST: HAM10000

VEGA-LITE CONFIG

```
1 {  
2   "$schema": "https://vega.github.io/schema/vega-lite/v5.json",  
3   "data": {"url": "https://raw.githubusercontent.com/Robertoheron/  
4     biovis/master/Sesiones/ses_2/HAM10000_metadata.csv"},  
5   "width": 200,  
6   "height": 150,  
7   "mark": "bar",  
8   "encoding": {  
9     "column": {"field": "sex", "type": "nominal"},  
10    "x": { "field": "age", "type": "ordinal"},  
11    "y": { "field": "localization", "type": "nominal"},  
12    "color": [{"aggregate": "count"}],  
13    "fillOpacity": {"aggregate": "count"}  
14 }
```



Prueba a sustituir el valor de “**mark**” por:

```
"mark": {"type": "bar", "tooltip": {"content": "data"}},
```

## TRADUCCIÓN: TRANSFORMACIONES

EJERCICIO: vamos explorar el conjunto de datos **Cars** que incluye Vega

 [github.com/vega/vega/blob/master/docs/data/cars.json](https://github.com/vega/vega/blob/master/docs/data/cars.json)

 [master](#)  [vega / docs / data / cars.json](#)

 [jheer](#) Update data from vega-datasets.

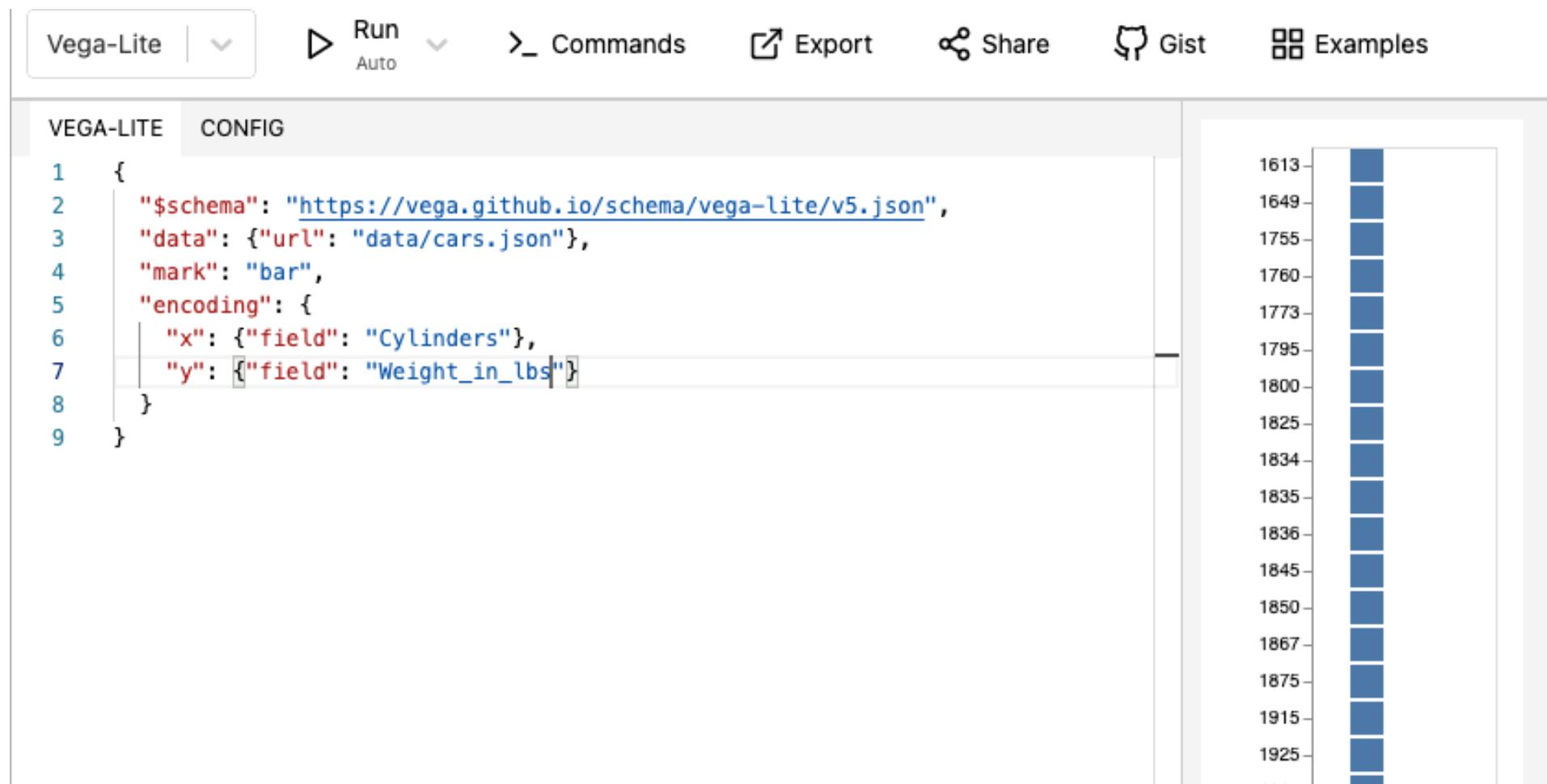
 [1 contributor](#)

4468 lines (4468 sloc) | 98.1 KB

```
1  [
2    {
3      "Name": "chevrolet chevelle malibu",
4      "Miles_per_Gallon": 18,
5      "Cylinders": 8,
6      "Displacement": 307,
7      "Horsepower": 130,
8      "Weight_in_lbs": 3504,
9      "Acceleration": 12,
10     "Year": "1970-01-01",
11     "Origin": "USA"
12   },
13   {
14     "Name": "buick skylark 320",
15     "Miles_per_Gallon": 15,
16     "Cylinders": 8.
```

## TRADUCCIÓN: TRANSFORMACIONES

EJERCICIO: vamos explorar el conjunto de datos **Cars** que incluye Vega



## TRADUCCIÓN: TRANSFORMACIONES

EJERCICIO: vamos explorar el conjunto de datos **Cars** que incluye Vega

vega.github.io/editor/#/edited

Vega-Lite | ▾ Run Auto Commands Export Share Gist Examples

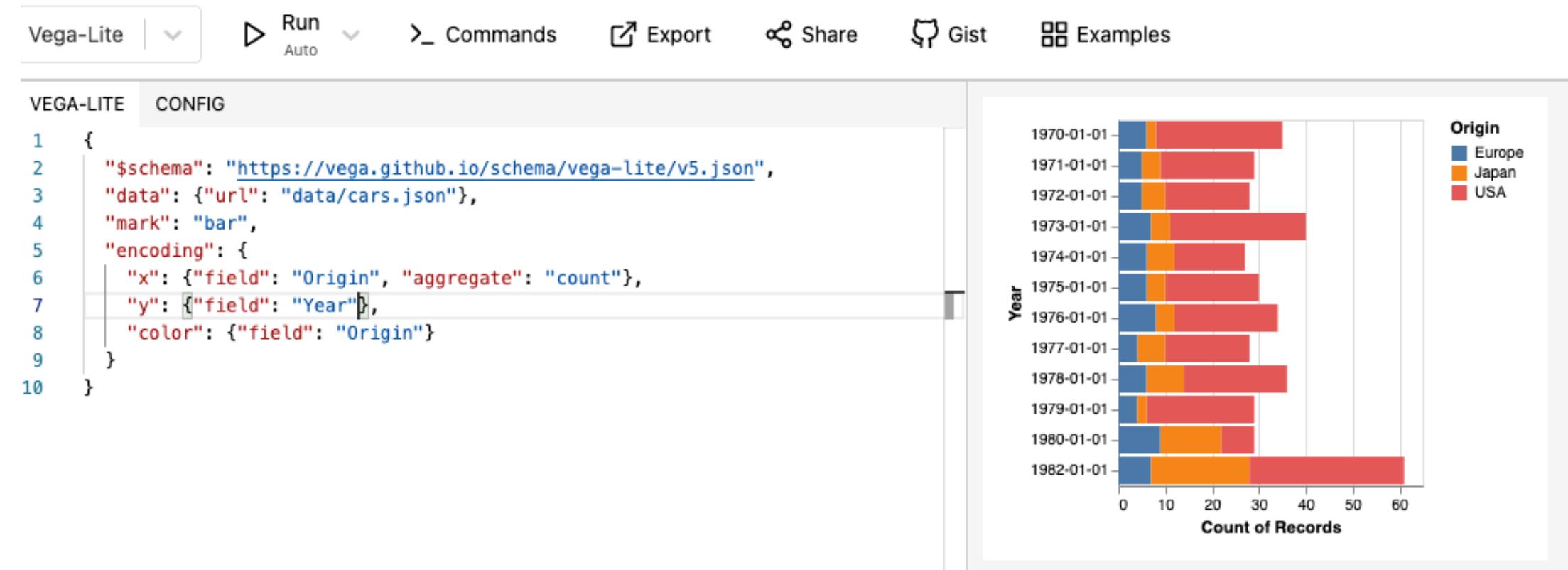
VEGA-LITE CONFIG

```
1 {  
2   "$schema": "https://vega.github.io/schema/vega-lite/v5.json",  
3   "data": {"url": "data/cars.json"},  
4   "mark": "bar",  
5   "encoding": {  
6     "x": {"field": "Cylinders"},  
7     "y": {"field": "Weight_in_lbs", "aggregate": "count"}  
8   }  
9 }
```

Cylinders	Count of Records
3	~5
4	~210
5	~5
6	~85
8	~110

## TRADUCCIÓN: TRANSFORMACIONES

EJERCICIO: vamos explorar el conjunto de datos **Cars** que incluye Vega



## TRADUCCIÓN: TRANSFORMACIONES

EJERCICIO: vamos explorar el conjunto de datos **Cars** que incluye Vega

