

# Data Visualization



**Master in Big Data Solutions 2020-2021**

Víctor Pascual: [victor.pascual@bts.tech](mailto:victor.pascual@bts.tech)

Pere Rovira: [pere.rovira@bts.tech](mailto:pere.rovira@bts.tech)

# Course organization



Víctor Pascual

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Pere Rovira

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ONETANDEM



## Víctor Pascual

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[@vpascual](https://twitter.com/vpascual)



[victor@onetandem.com](mailto:victor@onetandem.com)

- PhD in Computer Science and Digital Communication by the UPF Doctor en Informática y Comunicación digital por la UPF
- Consultant in datavis and data analysis since 2009
- Co-founder at OneTandem

## **Qualification system**

Participation & Attendance: 40%

Active participation in class is expected during the subject. Participation includes:  
Oral presentation of individual Homework assignments.  
Self-assessment and peer review discussion

Assignments: 30%

Continuous assessment by presentation of individual exercises and group exercises in class.

Final project: 30%

A project developed by groups will be done during the last three weeks of the course.

Starting in the 3rd class, we will help you to apply datavis to your Masters project. 1h of each sessions will be devoted to in-group assistance for the project

Software for the course



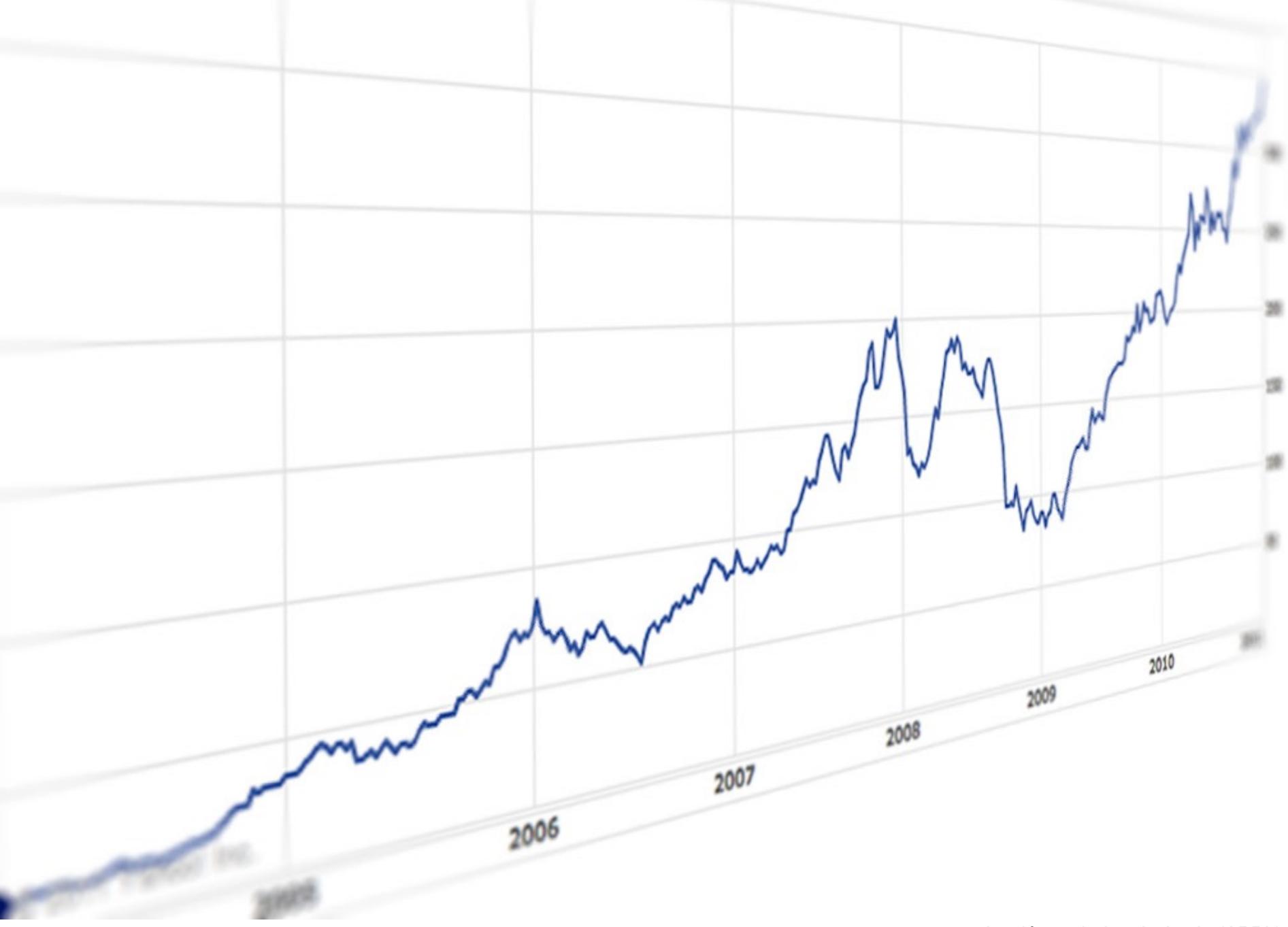
# Today's goals

- Understand the uses of Data Visualization
- Understand the methodology
- Learn the main types of charts

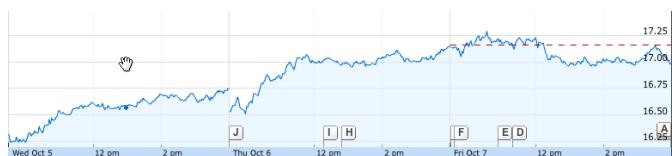
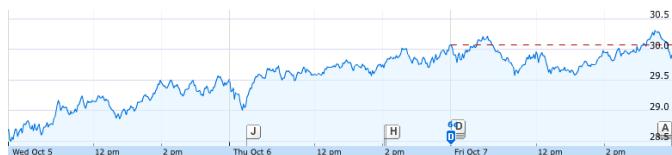
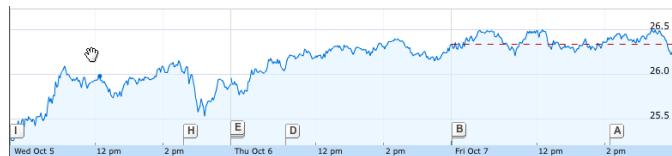
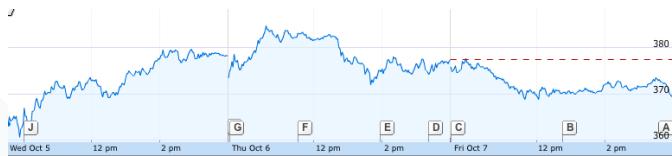
# Introduction to datavis

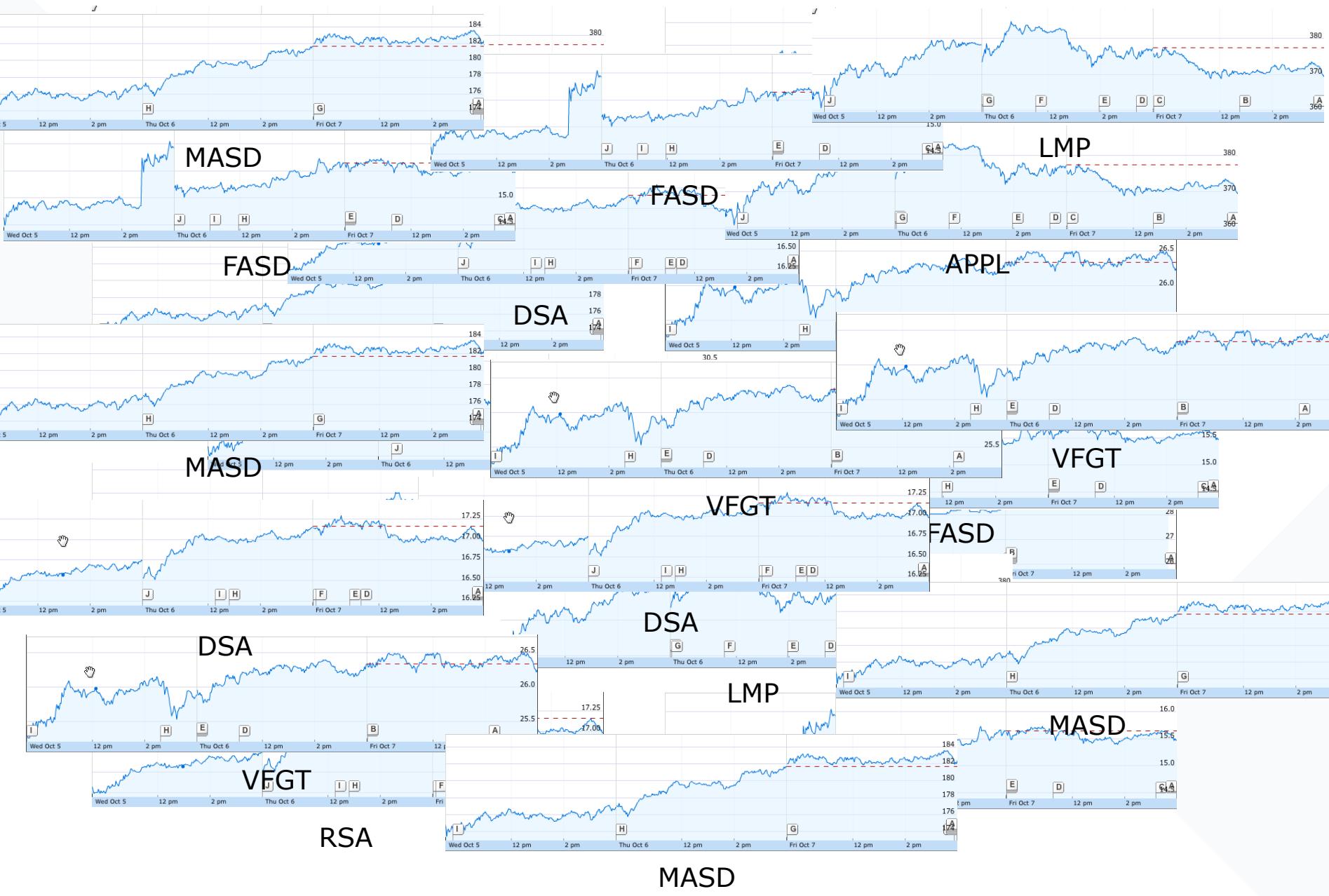
Jan 19, 2011	345.16	346.64	343.85	345.68	346.75
Jan 18, 2011	343.25	344.43	342.00	344.42	345.75
Jan 11, 2011	344.88	344.96	339.47	341.64	345.15
Jan 10, 2011	338.83	343.23	337.17	342.45	345.15
Jan 7, 2011	333.99	336.35	331.90	336.12	341.00
Jan 6, 2011	334.72	335.25	332.90	333.73	334.00
Jan 5, 2011	329.55	334.34	329.50	334.00	334.00
Jan 4, 2011	332.44	332.50	328.15	331.29	329.57
Jan 3, 2011	325.64	330.26	324.84	329.57	322.56
Dec 31, 2010	322.95	323.48	321.31	323.66	323.66
Dec 30, 2010	325.48	325.51	323.05	325.29	325.29
Dec 29, 2010	326.22	326.45	325.10	325.47	325.47
Dec 28, 2010	325.91	326.66	325.06	324.68	324.68
Dec 27, 2010	322.85	325.44	321.52	323.40	323.40
Dec 23, 2010	325.00	325.15	323.17	325.18	325.18
Dec 22, 2010	324.36	325.72	323.55	324.39	324.39
Dec 21, 2010	323.00	324.39	322.05	323.31	323.31
Dec 20, 2010	321.60	323.25	318.23	320.23	320.80
Dec 17, 2010	321.63	321.79	320.23	320.10	321.15
Dec 16, 2010	321.09	322.61	319.19	320.10	320.10

cotización en bolsa de Apple (APPL)



cotización en bolsa de Apple (APPL)

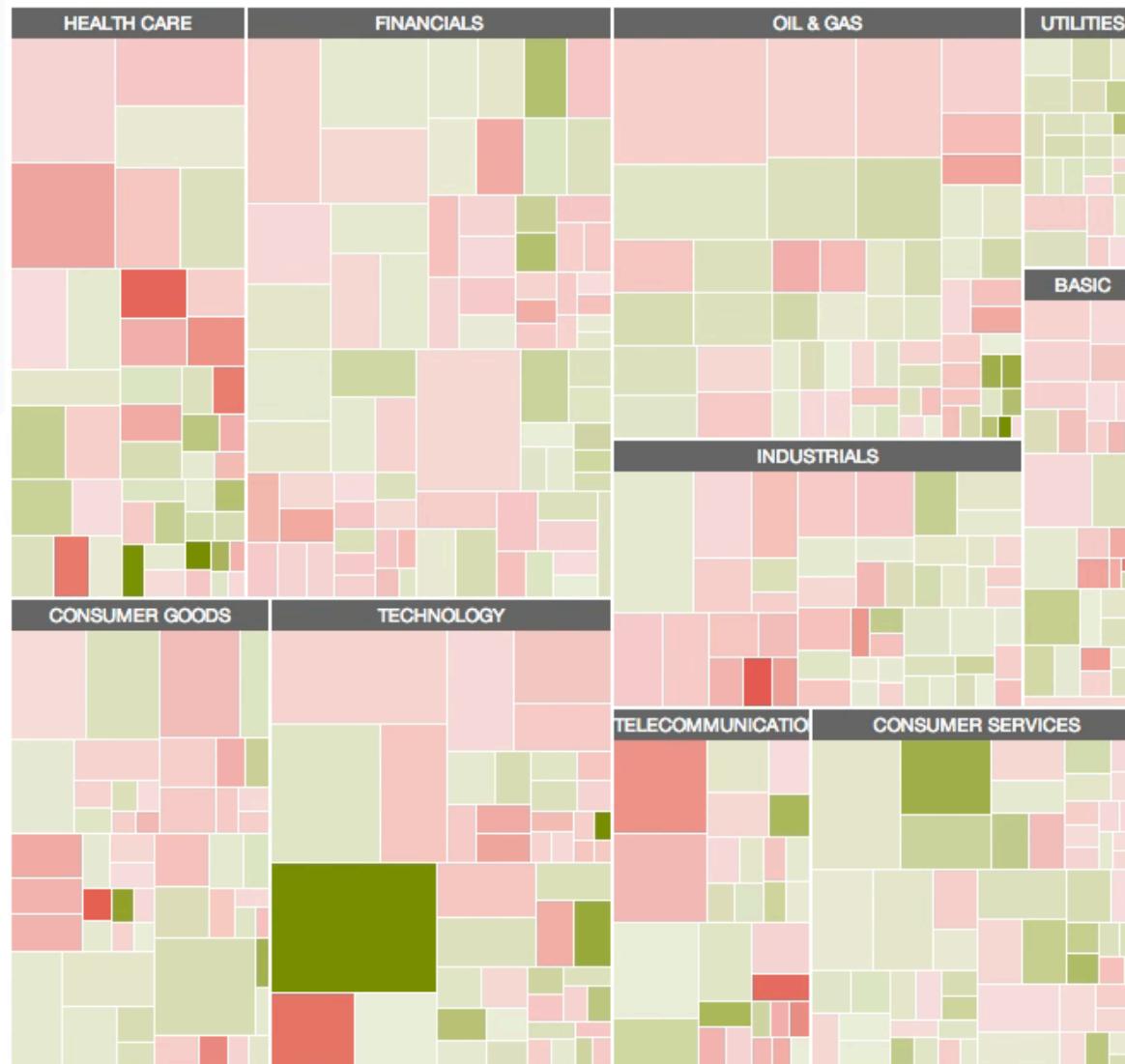




All



Locate Company



DJIA	+0.00% 0.00 ↑	Nasdaq +0.52% 21.37 ↑	S&P 500 +0.17% 3.22 ↑
	16501.65	4148.34	1878.61

## MarketWatch News Viewer

- 11:00a Ukraine crisis prompts interest in military buys [MARKETWATCH](#)  
[BA](#) [RTN](#)
- 10:58a Turkcell net profit hit by Ukraine operations [MARKETWATCH](#)  
[TKC](#)
- 10:56a Alstom trading halted at regulator's request [MARKETWATCH](#)  
[GE](#)
- 10:25a Honda net profit soars on Japanese sales [MARKETWATCH](#)  
[HMC](#)
- 9:59a WPP revenue up 1.5% as currency swings weigh [MARKETWATCH](#)  
[OMC](#) [WPPGY](#)
- 9:07a RBS pay plan blocked by U.K. government [MARKETWATCH](#)  
[RBS](#)
- 8:45a Gundotra exit casts light on struggles of Google+ [MARKETWATCH](#)  
[GOOG](#)
- 8:25a Pearson upbeat as sales rise

% Change  
-6.0% 0 +6.0%

Since Close

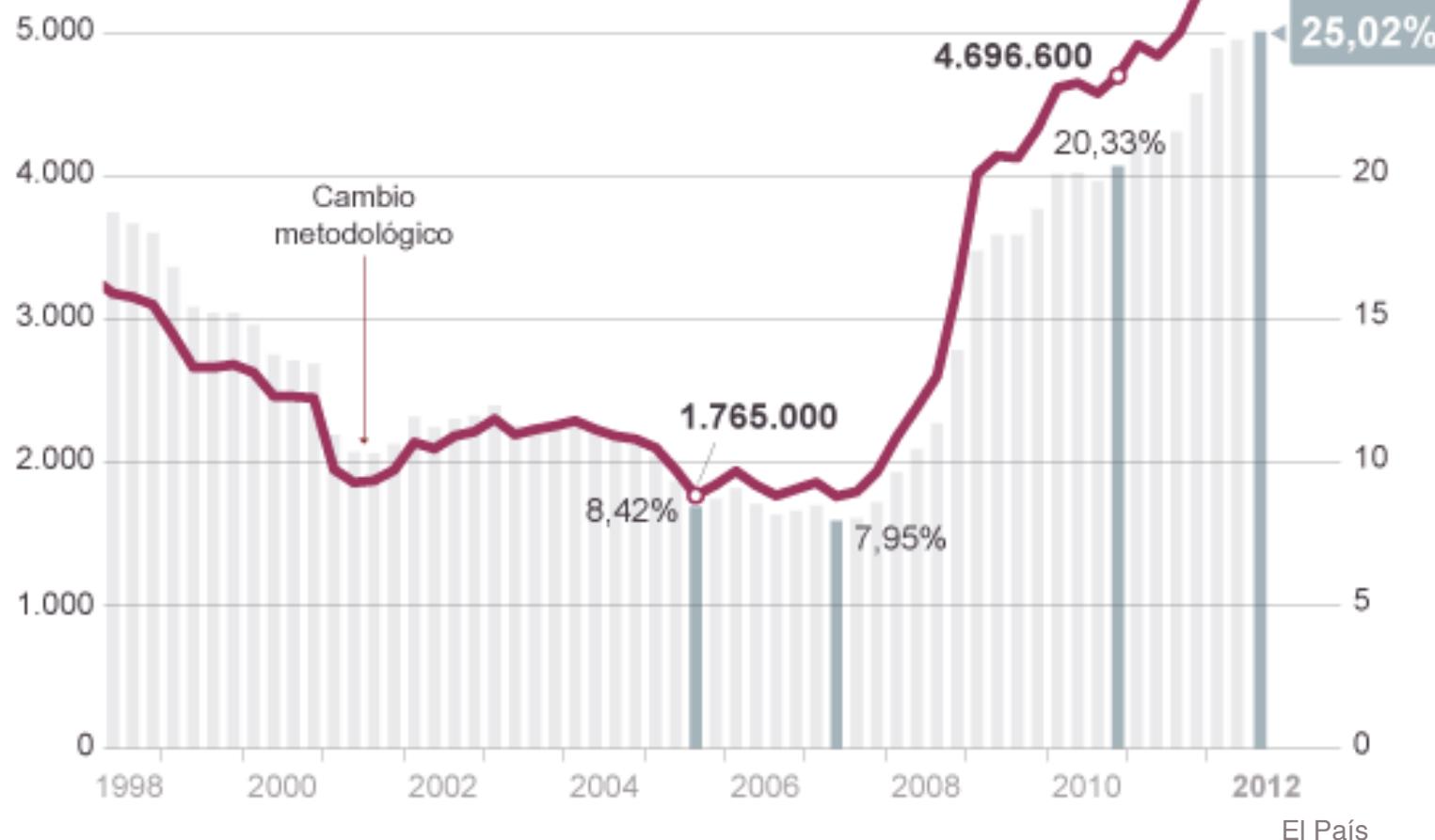
Patent No.: US 6,583,794 B1  
Click Here to License the Map Applet

a graphical representation of **data** or **concepts**,  
which is either an **internal** construct of the mind or  
an **external** artifact supporting **decision** making

## NÚMERO DE PARADOS Y TASA DE PARO

— Número de parados (escala izquierda)

■ Porcentaje de población activa en paro (escala derecha)



# The Jobless Rate for People Like You

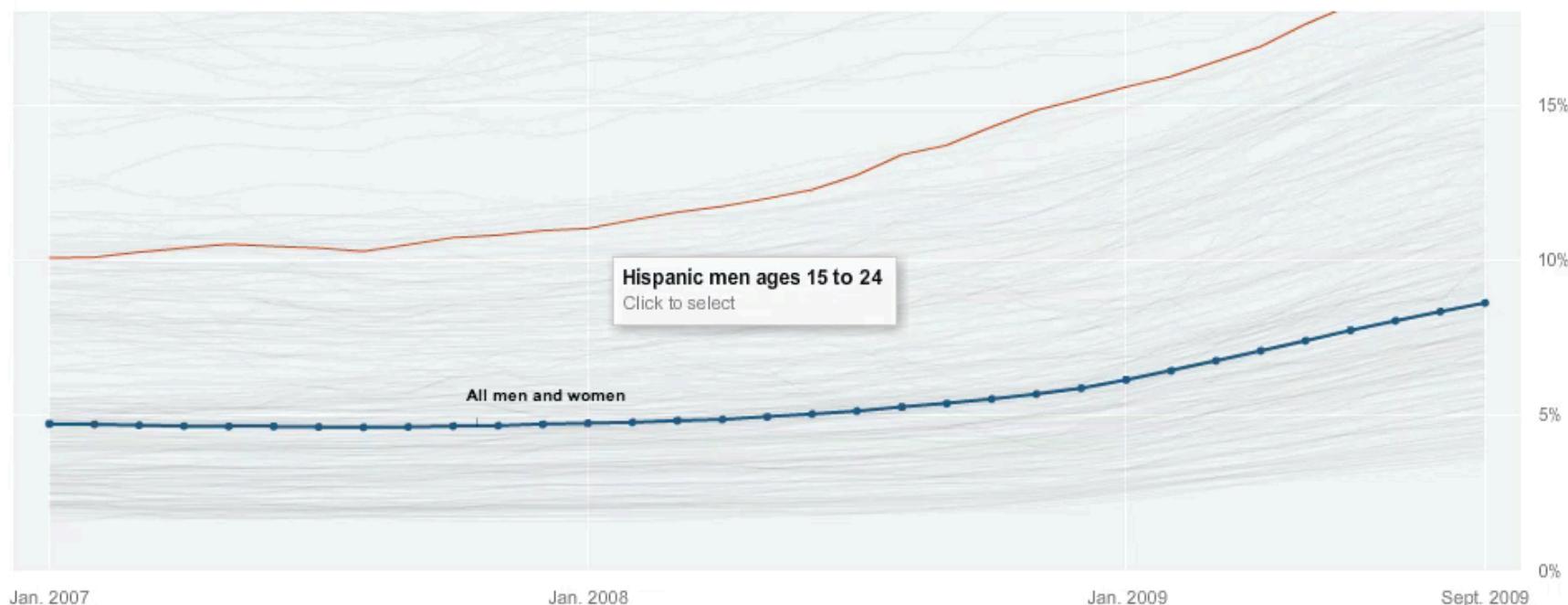
Not all groups have felt the recession equally.

All races	Men and Women	All ages	All education levels
White	Men	Ages 15 to 24	Not a high school graduate
Black	Women	Ages 25 to 44	High school graduate
Hispanic		Age 45 and older	College graduate
All other races			

UNEMPLOYMENT RATE,  
12 MONTH AVG. ENDING SEPT. '09

**8.6%**

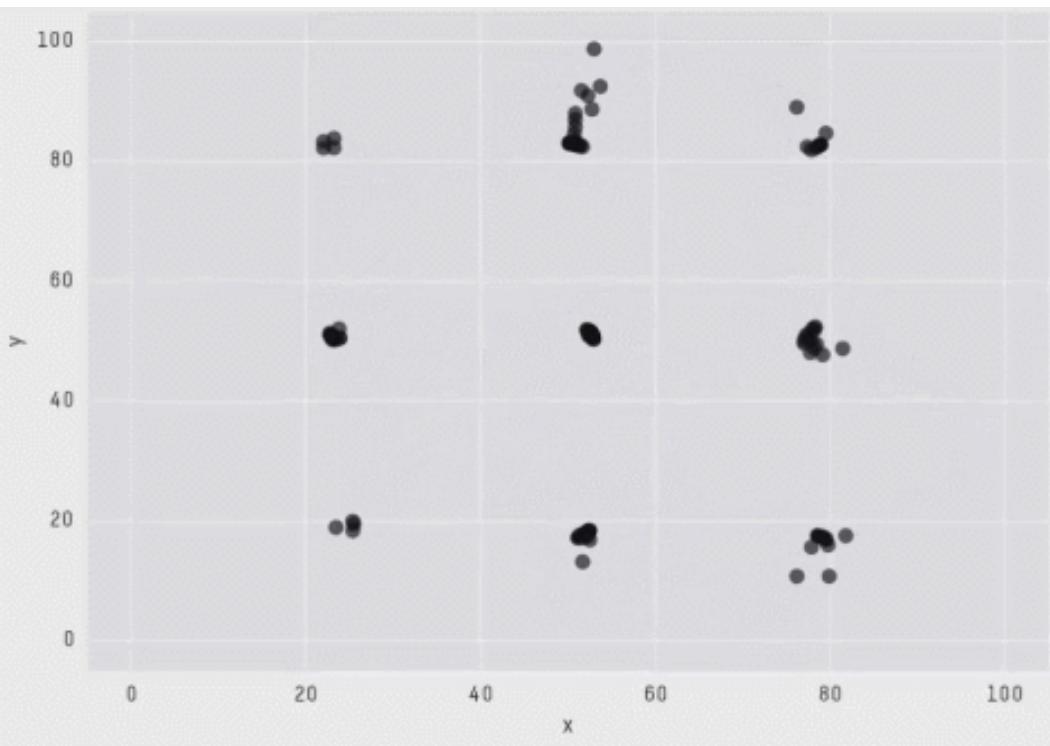
For all men and women



Note: 12-month rates are shown because monthly estimates for small groups are not reliable.

By SHAN CARTER, AMANDA COX and KEVIN QUEALY/The New York Times

“Visualization is suitable when there is a need to  
**augment human capabilities**  
rather than replace people with computational decision-making tools”



X Mean: 54.2603946  
Y Mean: 47.8324012  
X SD : 16.7699249  
Y SD : 26.9301715  
Corr. : -0.0603230

# The goals of data visualization

# Datavis goals

**Explore**: understand the data available, explore freely to look for questions

**Analyze**: look for patterns, relationships,... that help you answer specific questions

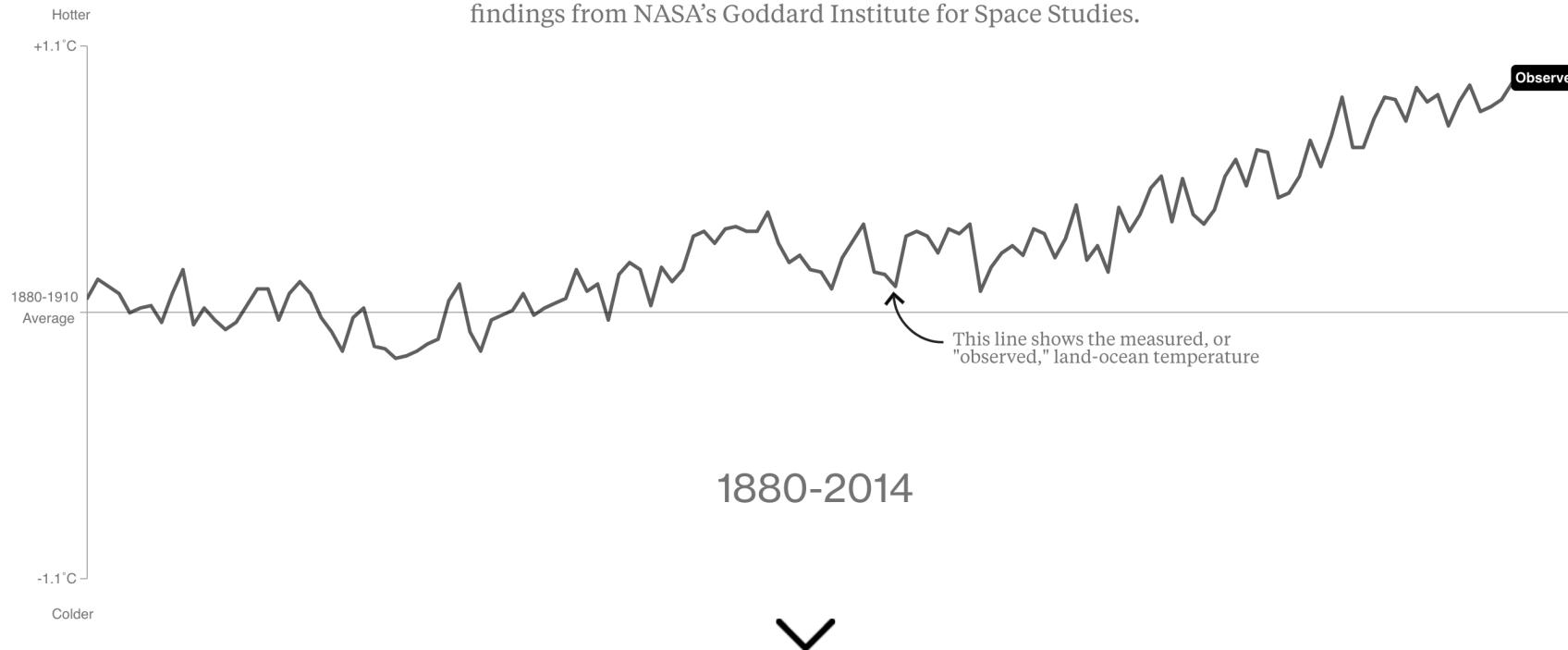
**Explain**: communicate your findings, inspire action, make people think with data,...

# Explain

## What's Really Warming the World?

By Eric Roston  and Blacki Migliozzi  | June 24, 2015

Skeptics of manmade climate change offer various natural causes to explain why the Earth has warmed 1.4 degrees Fahrenheit since 1880. But can these account for the planet's rising temperature? Scroll down to see how much different factors, both natural and industrial, contribute to global warming, based on findings from NASA's Goddard Institute for Space Studies.



# Explain

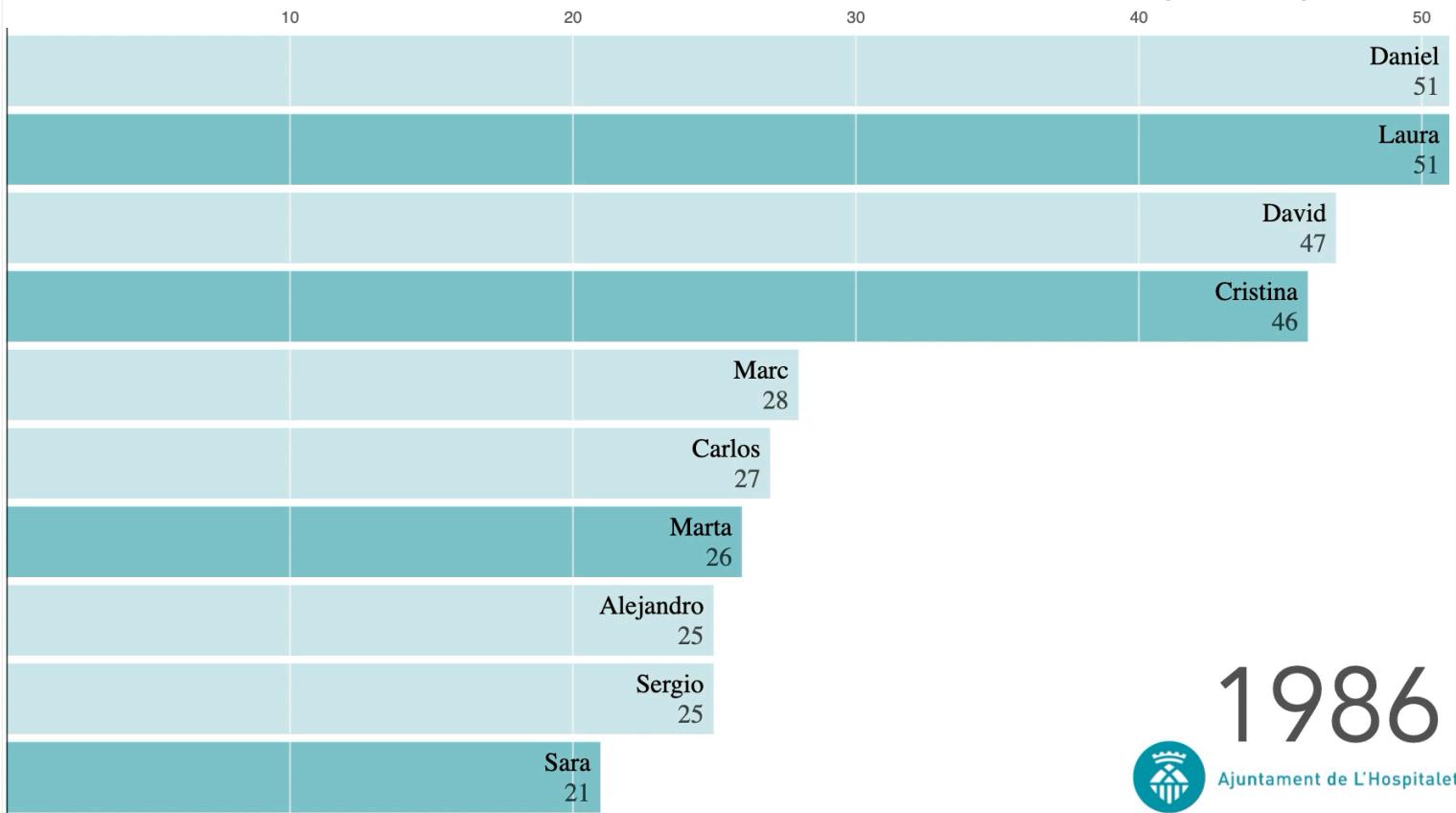
# Going gray

The world's population is getting older. Japan is on the forefront of this demographic trend that will affect Germany, China and Italy in coming years.

MAY 1, 2019

# Explain

## Els 10 noms més utilitzats a l'Hospitalet, any a any

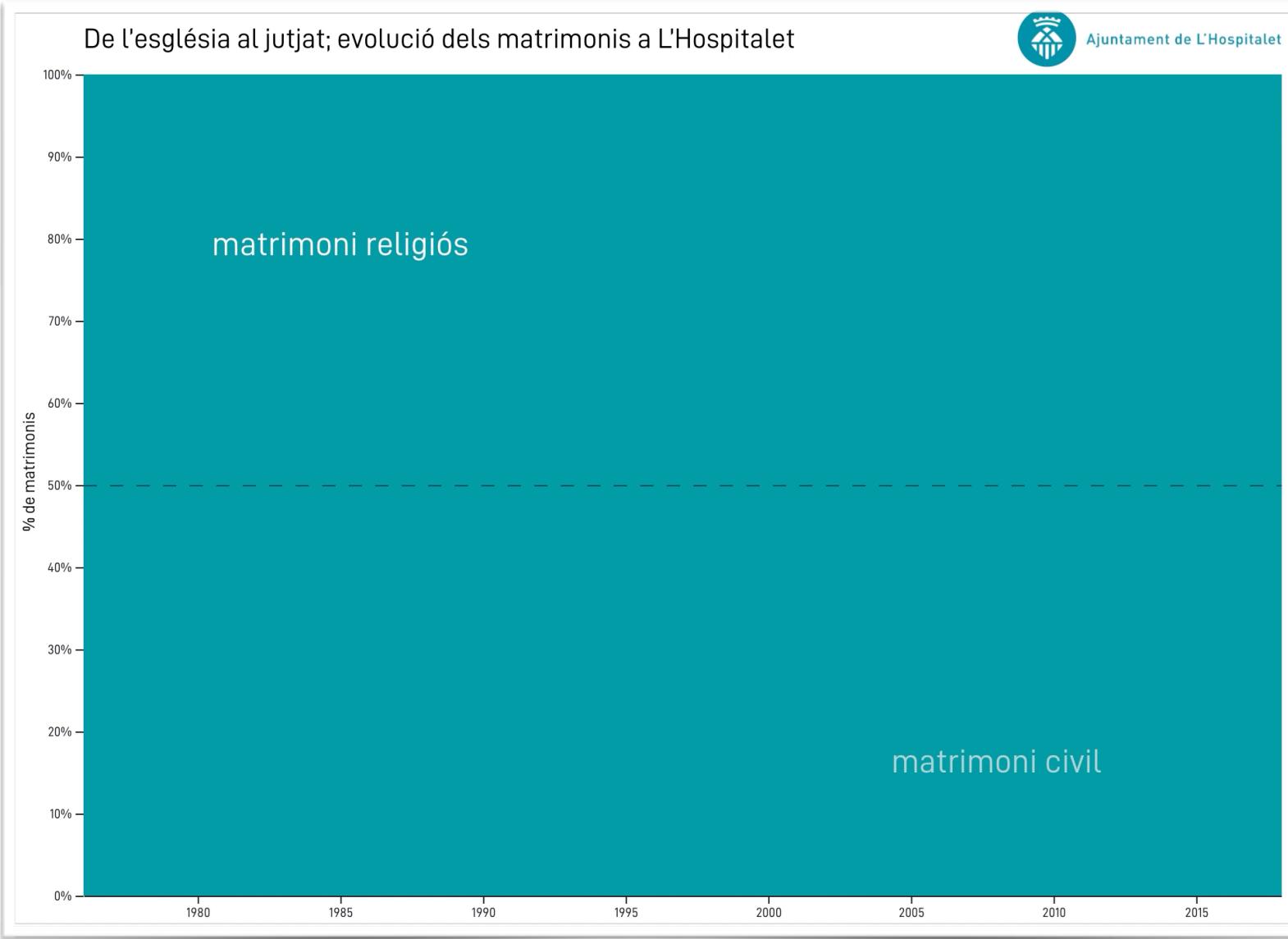


1986



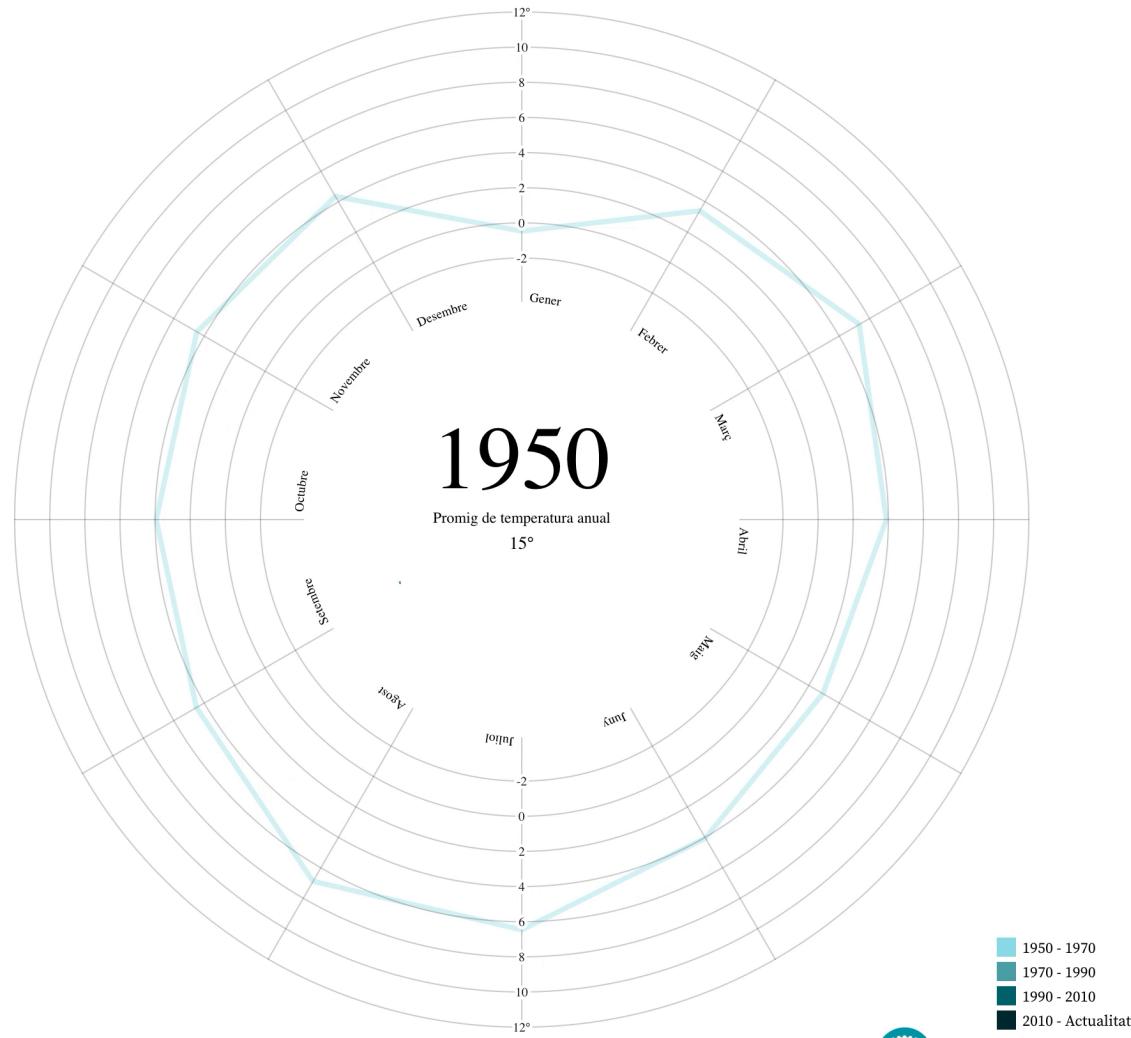
Ajuntament de L'Hospitalet

# Explain



# Explain

L'escalfament del planeta a escala local. Temperatures per any comparades amb 1950



Fonts: Observatori Fabra i Estació meteorològica de L'Hospitalet  
Sèries climàtiques històriques del Servei metereològic de Catalunya



Ajuntament de L'Hospitalet

# Explain

**COTEC**  
FUNDACIÓN  
COTEC  
PARA LA INNOVACIÓN

Suscripción fundacion.cotec@cotec.es [Twitter](#) [Facebook](#) [LinkedIn](#) [YouTube](#) [Instagram](#) [Slideshare](#)

La Economía Intangible en España [CONTEXTO](#) [ESPAÑA](#) [CCAA](#) [INFORMES](#) [RECURSOS](#)

## La economía intangible en España

Evolución y distribución por territorios y sectores (1995-2016)



# Explore

## Commonwealth COVID-19 Dashboard

Last update: Wednesday, 7 October 2020 9:58 GMT

### Commonwealth Indicators i



### Commonwealth Regions i

The Commonwealth	Cases				Deaths			
	↓ Total	7-day avg (last 30 days)	Latest daily data	Daily % change	Total	7-day avg (last 30 days)	Latest daily data	Daily % change
Asia	7,531,466		78,401	-1.3% ▼	116,713		1,044	-2.4% ▼
Africa	923,551		2,365	-1.6% ▼	20,888		74	2.0% ▲
Europe	535,363		12,061	9.6% ▲	42,508		54	1.3% ▲
Caribbean and Americas	193,741		2,399	2.6% ▲	9,972		43	3.4% ▲
Pacific	29,252		20	4.4% ▲	929		2	-31.6% ▼

# Explore

## The WEF Nexus Index (2019)

A country-level composite indicator developed using the water-energy-food (WEF) nexus as its guiding framework

[Home](#) [About](#) [Contact](#)



Select a country to see details



Choose an indicator:

**WEF Nexus Index**

Water     Energy     Food



# Analyze



# Analyze

## Dashboard para product managers

Escoge tu categoría de producto para ver los resultados de tu área

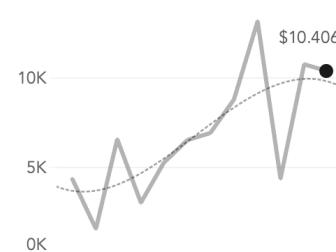
Categoría de producto

(All)

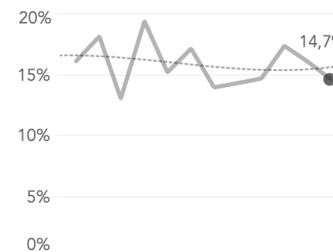
**Sales** total: \$420.433



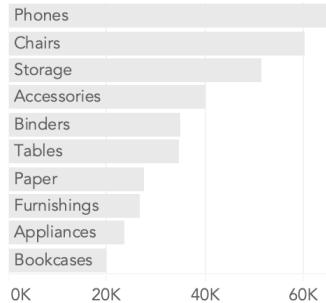
**Profit** total: \$82.075



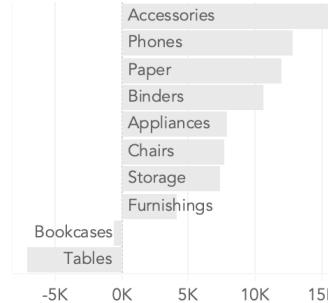
**Discount avg** 15,9%



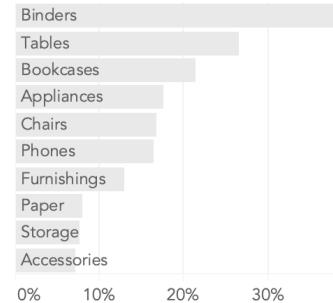
**Sales** for top 10 subcategories



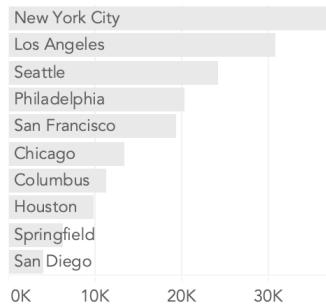
**Profit** for top 10 subcategories



**Discount avg** for top 10 subcategories



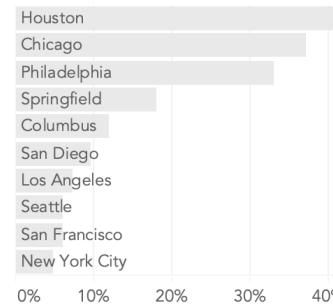
**Sales** for top 10 cities



**Profit** for top 10 subcategories



**Discount avg** for top 10 cities



# Explain

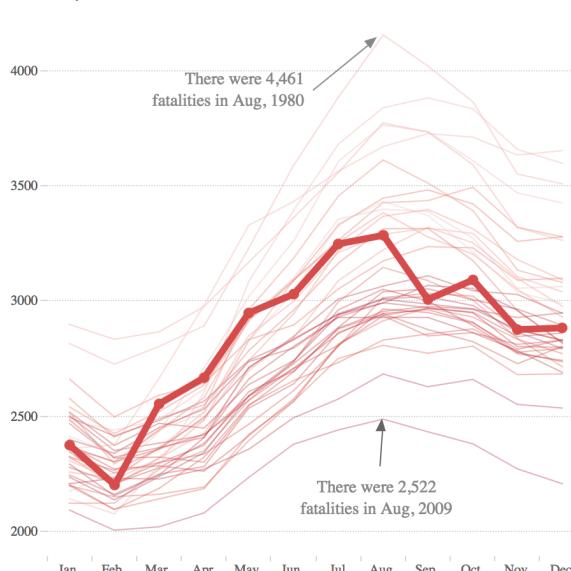
## Fewer people are dying on US roads, but seasonal trends persist.

There have been 1,263,670 road fatalities in the US between 1979 and 2011. This dashboard explores the seasonality in the data.

Data from the National Highway Traffic Safety Administration:  
<http://www-nrd.nhtsa.dot.gov/Cats/Index.aspx>

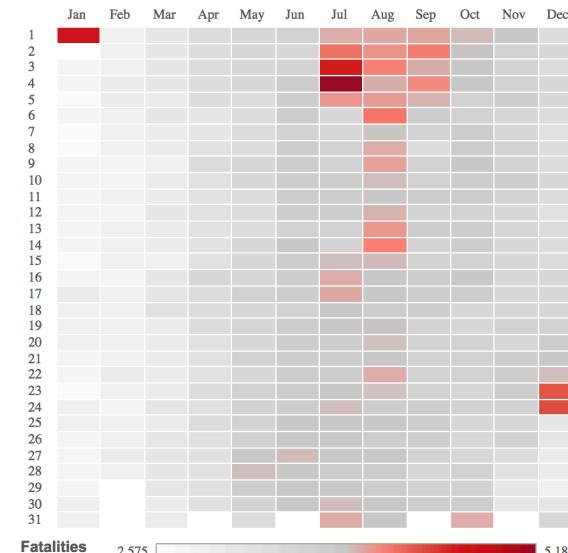
1. Every year sees the same peaks (**August**) and troughs (**February**) in fatalities

Fatalities by month. — Single year — Average (all years)

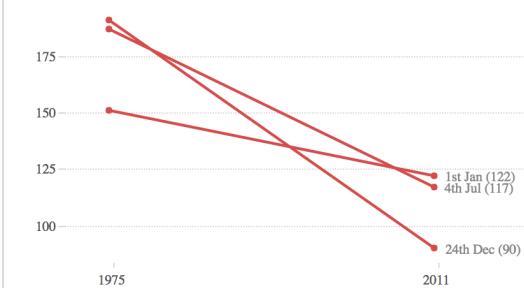


2. Three holidays (**New Year, July 4th, Christmas**) are particularly lethal

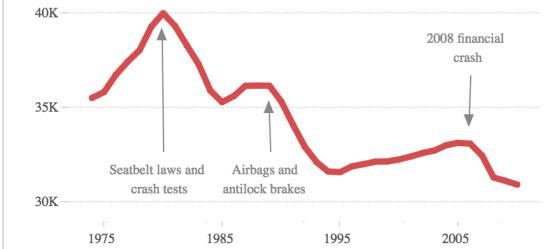
Highlight table of fatalities by day and month for years: All



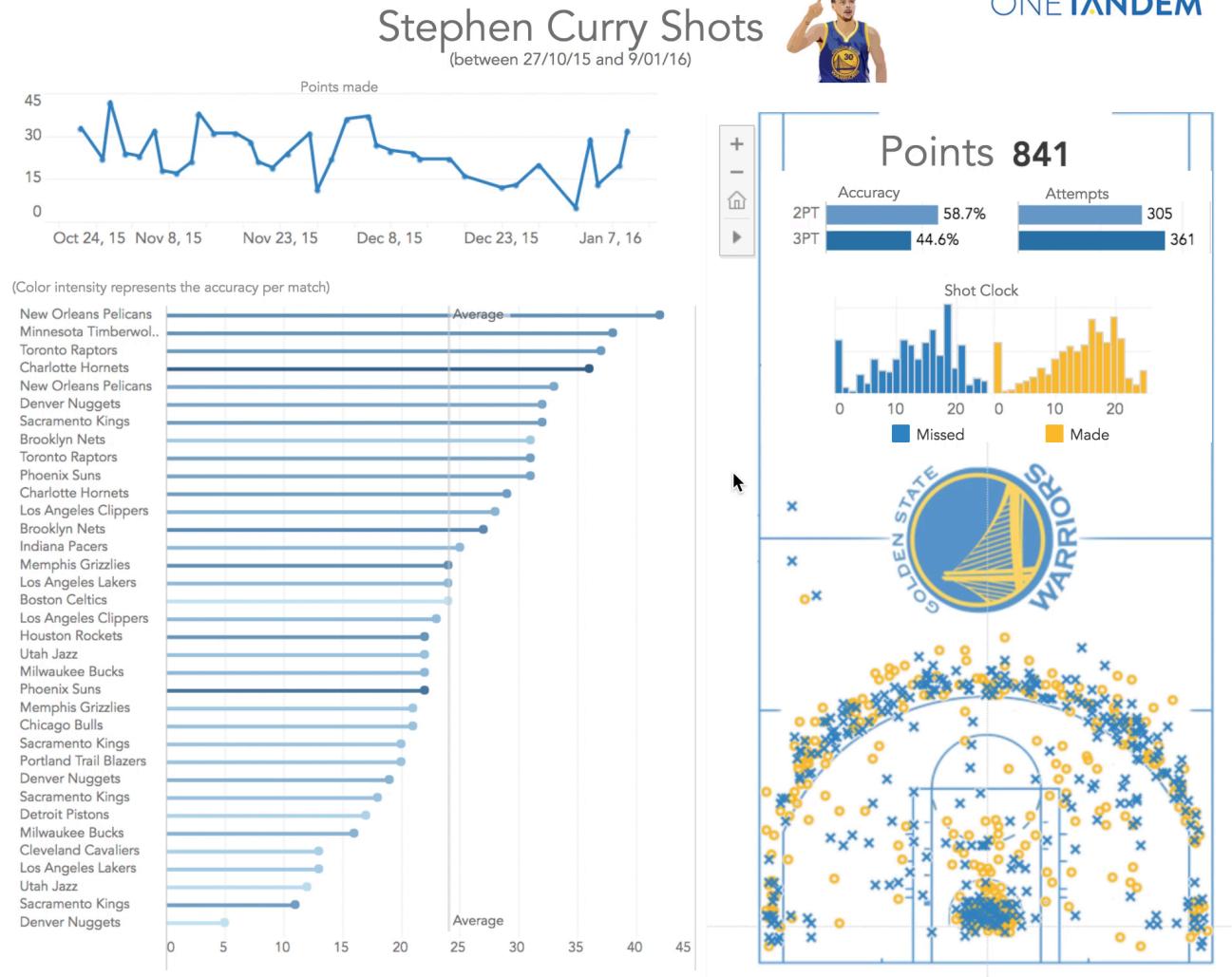
3. Fortunately, those holidays are getting safer...



... which is part of an overall reduction in fatalities



# Explain



# Design principles

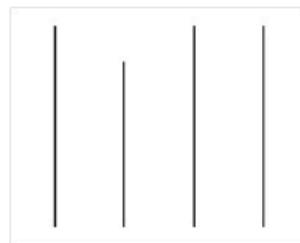
Iconic memory  
pre-attentive

Working memory  
processes 5 to 9 information elements

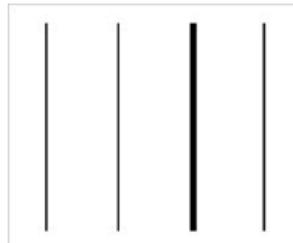
Long term memory  
habits, cultural

# Pre-attentive attributes

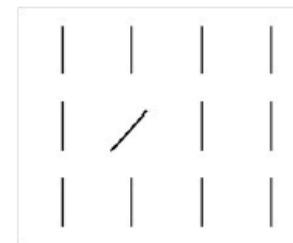
## Form



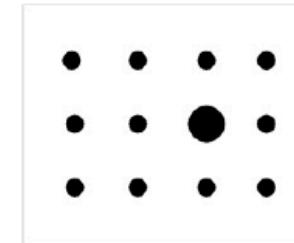
Length



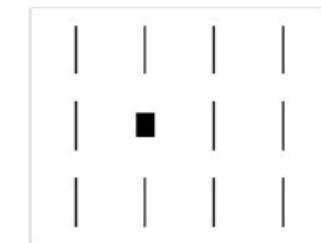
Width



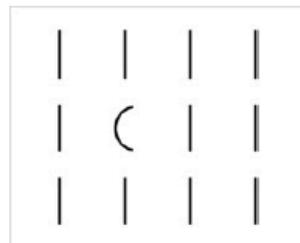
Orientation



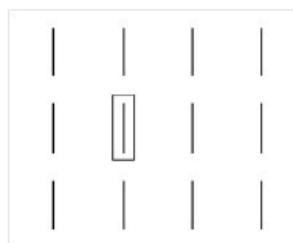
Size



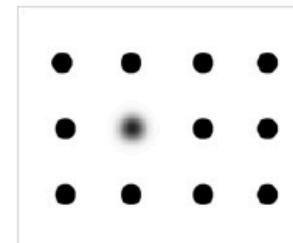
Shape



Curvature

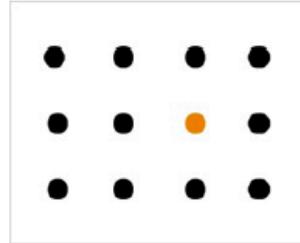


Enclosure

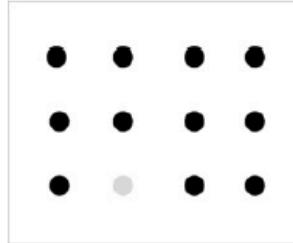


Blur

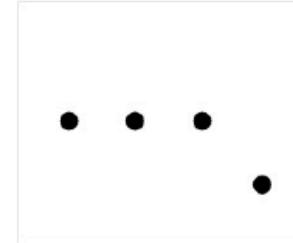
## Color



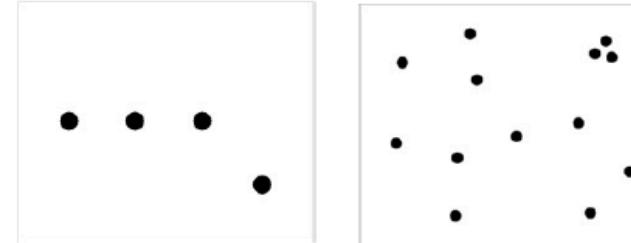
Hue



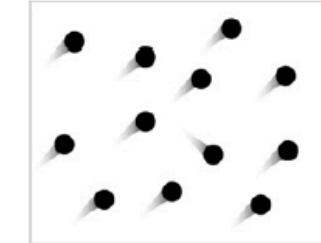
Intensity



2-D position



Spatial Grouping



Direction of Motion

## Position

## Motion

# ¿QUÉ ES?

948513628394758192

940374835293049282

619203485168473029

# ¿QUÉ ES?

948513628394758192  
940374835293049282  
619203485168473029

948513628394**7**58192  
9403**7**4835293049282  
619203485168**47**3029

# ¿QUÉ ES?

948513628394758192  
940374835293049282  
619203485168473029

948513628394**7**58192  
9403**7**4835293049282  
619203485168**47**3029

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948513628394758192  
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619203485168**47**3029

# ¿QUÉ ES?

948513628394758192  
940374835293049282  
619203485168473029

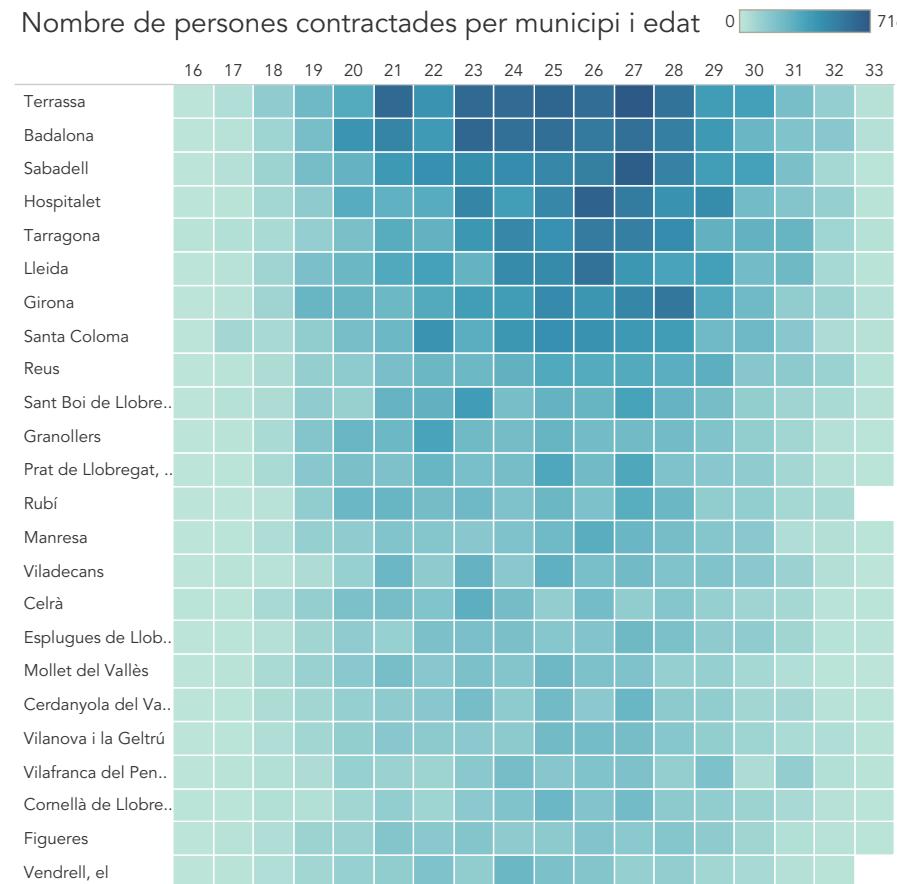
948513628394**7**58192  
9403**7**4835293049282  
619203485168**47**3029

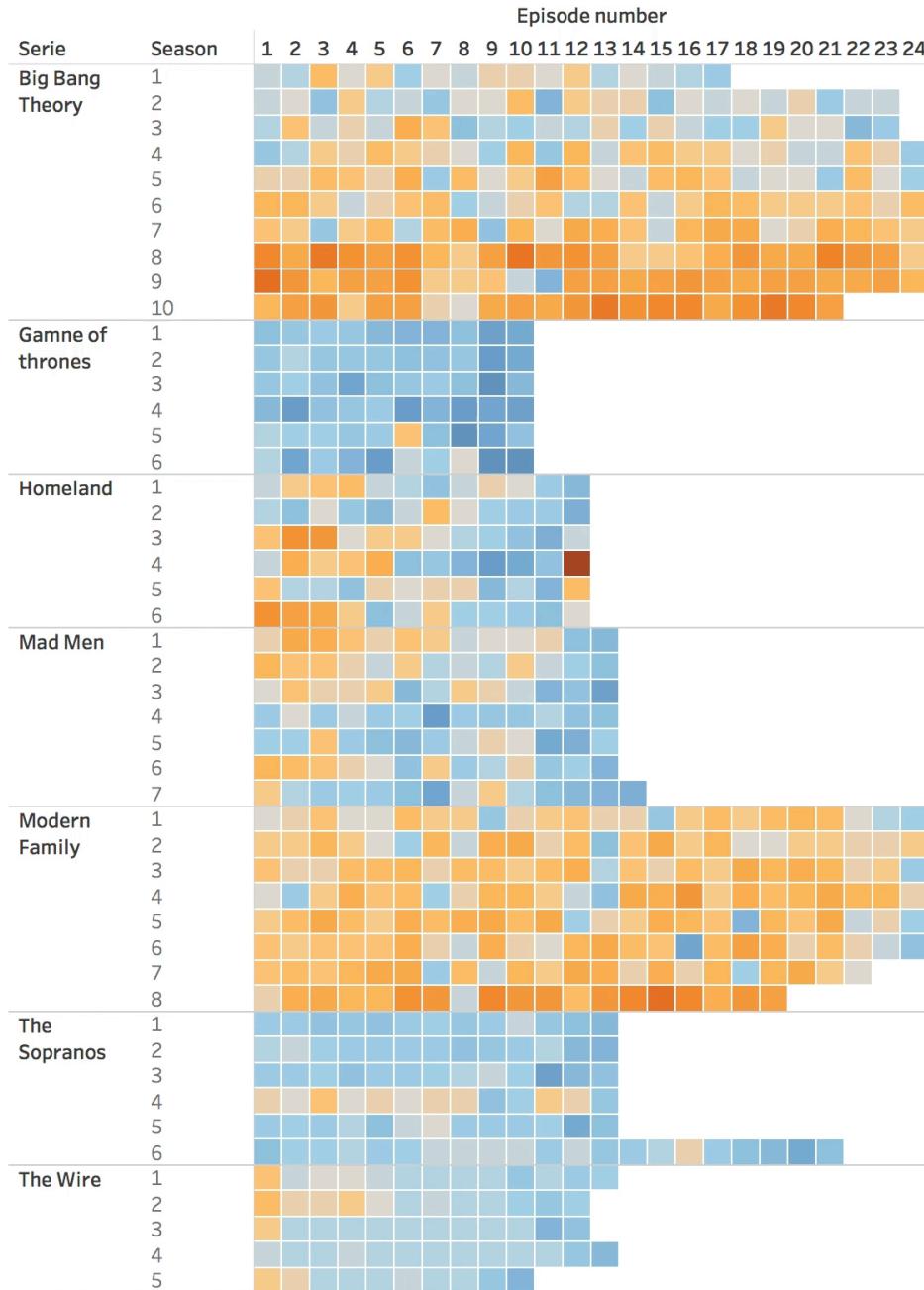
948513628394**7**58192  
9403**7**4835293049282  
619203485168**47**3029

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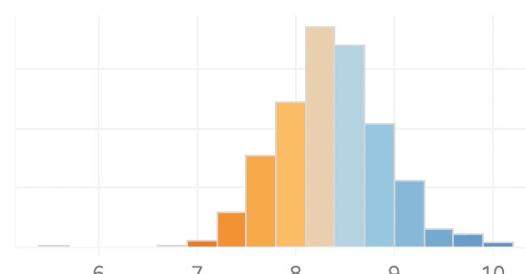
948513628394**7**58192  
9403**7**4835293049282  
619203485168**47**3029

# Quantitative color palette

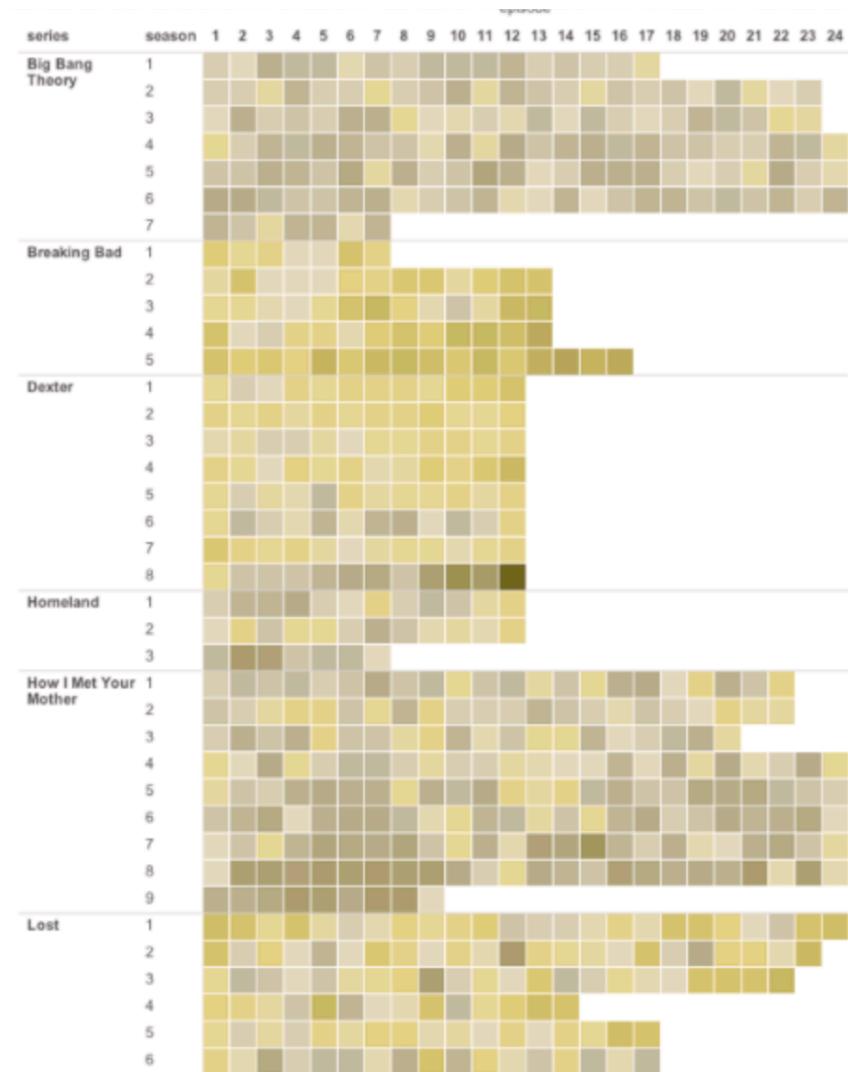




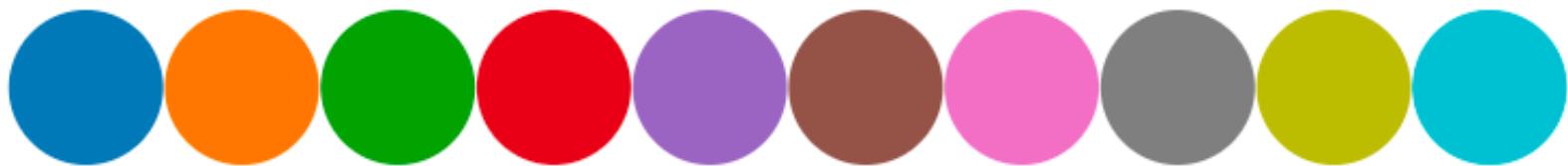
Episode rating histogram



Detail of the evolution of the rating



## Categorical color palette



## Less is more

Above all else show data.

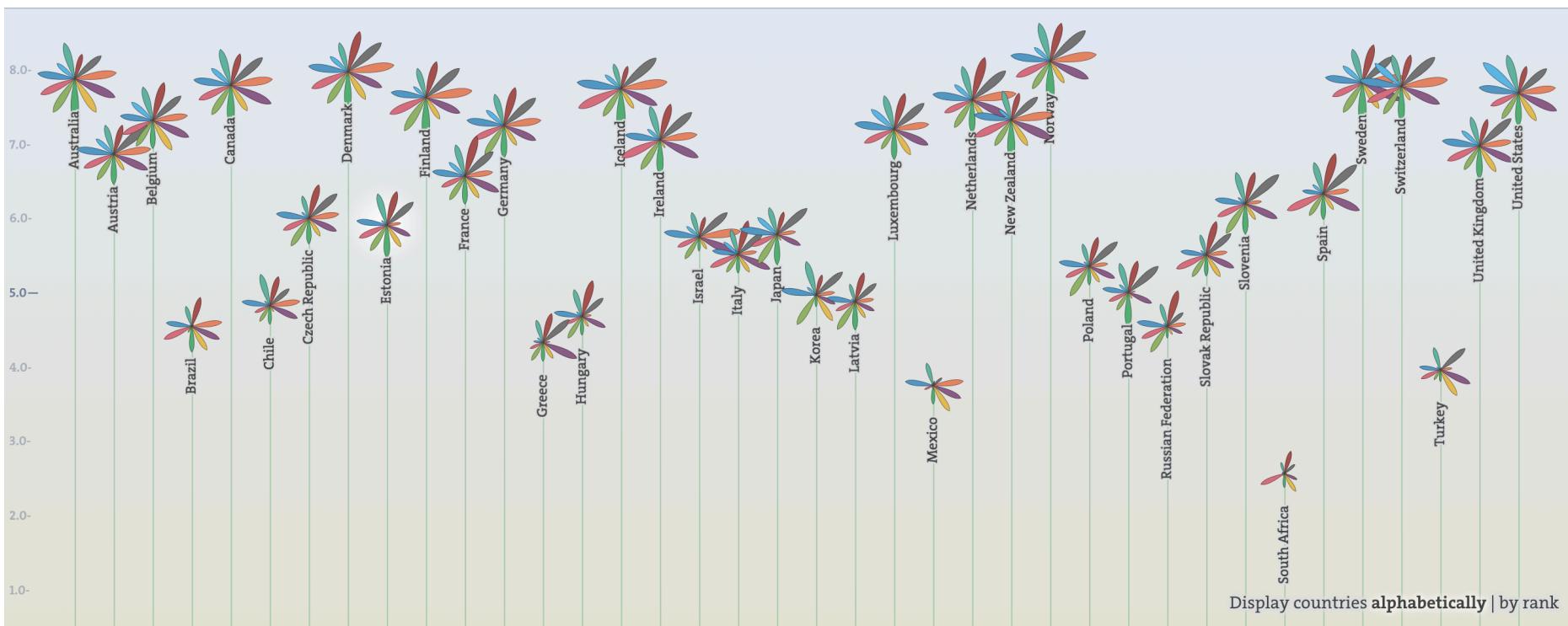
Graphical excellence is that which gives to the viewer the greatest number of ideas in the shortest time with the least ink in the smallest space.

# Remove to improve (the **data-ink** ratio)

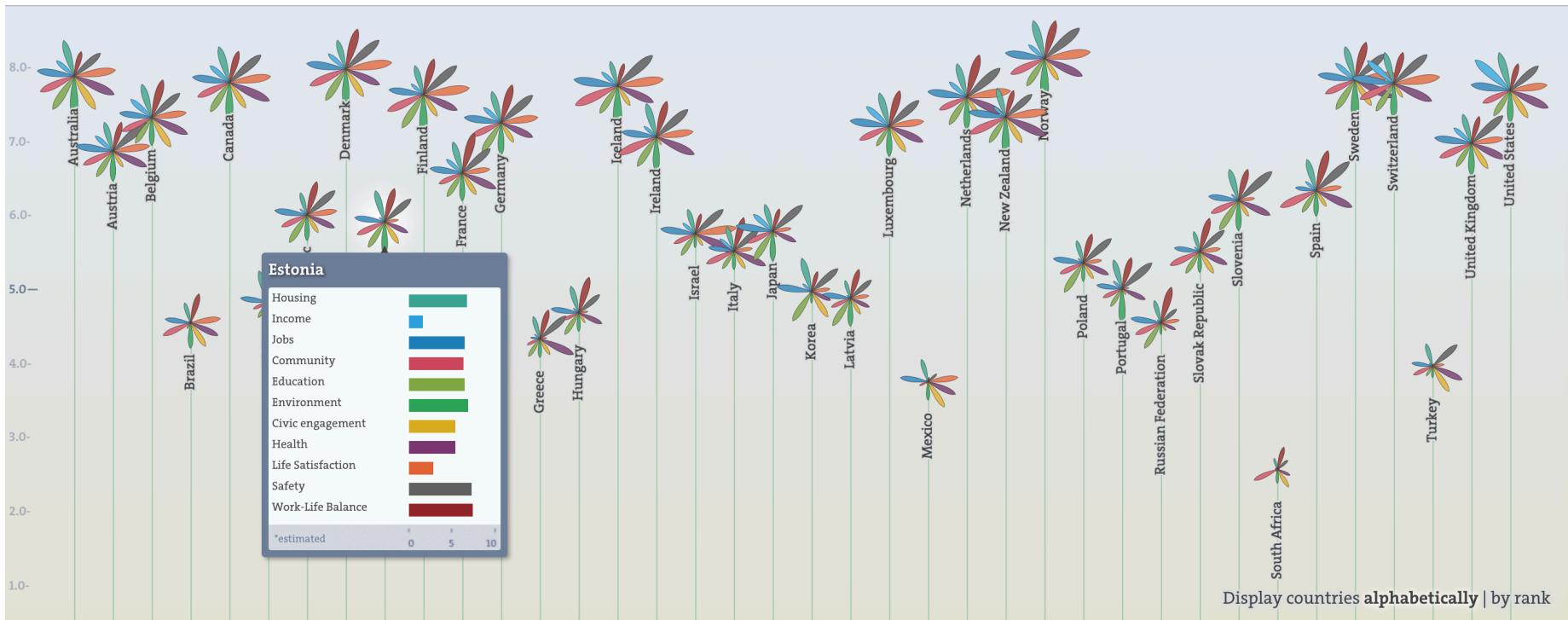
Created by Darkhorse Analytics

[www.darkhorseanalytics.com](http://www.darkhorseanalytics.com)

# Function vs aesthetics



# Function vs aesthetics



# Form vs need

## Unemployment rates by region (in October)

Percentage change  
compared to previous month

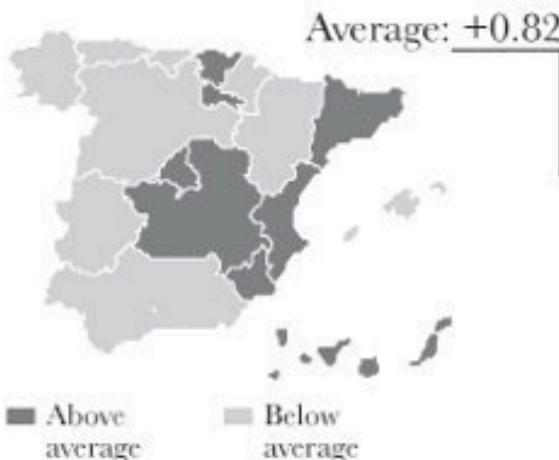
- +0.83% a +3.42%
- +0.82% (average)
- +0.82% a -4.27%



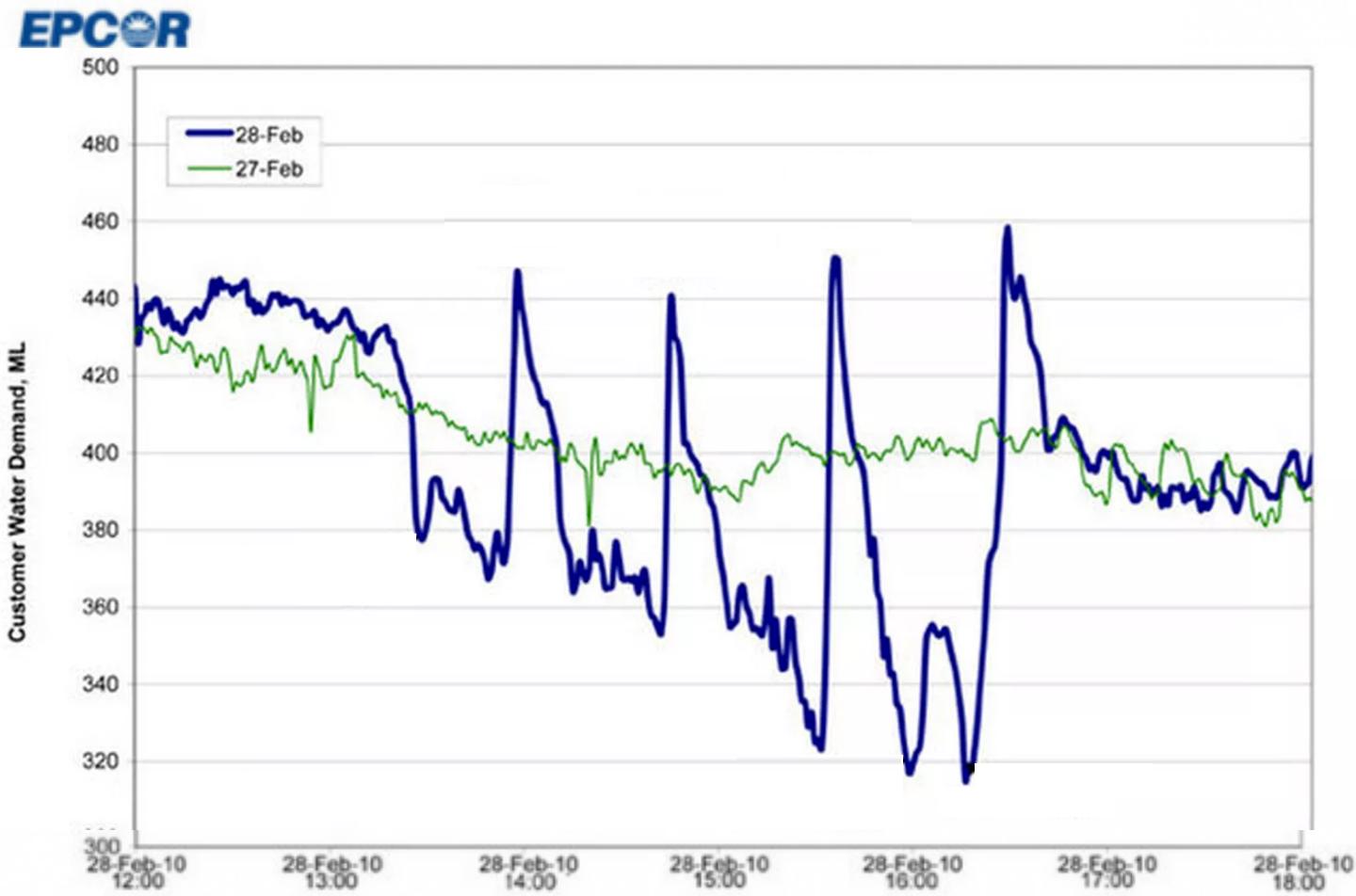
# Form vs need

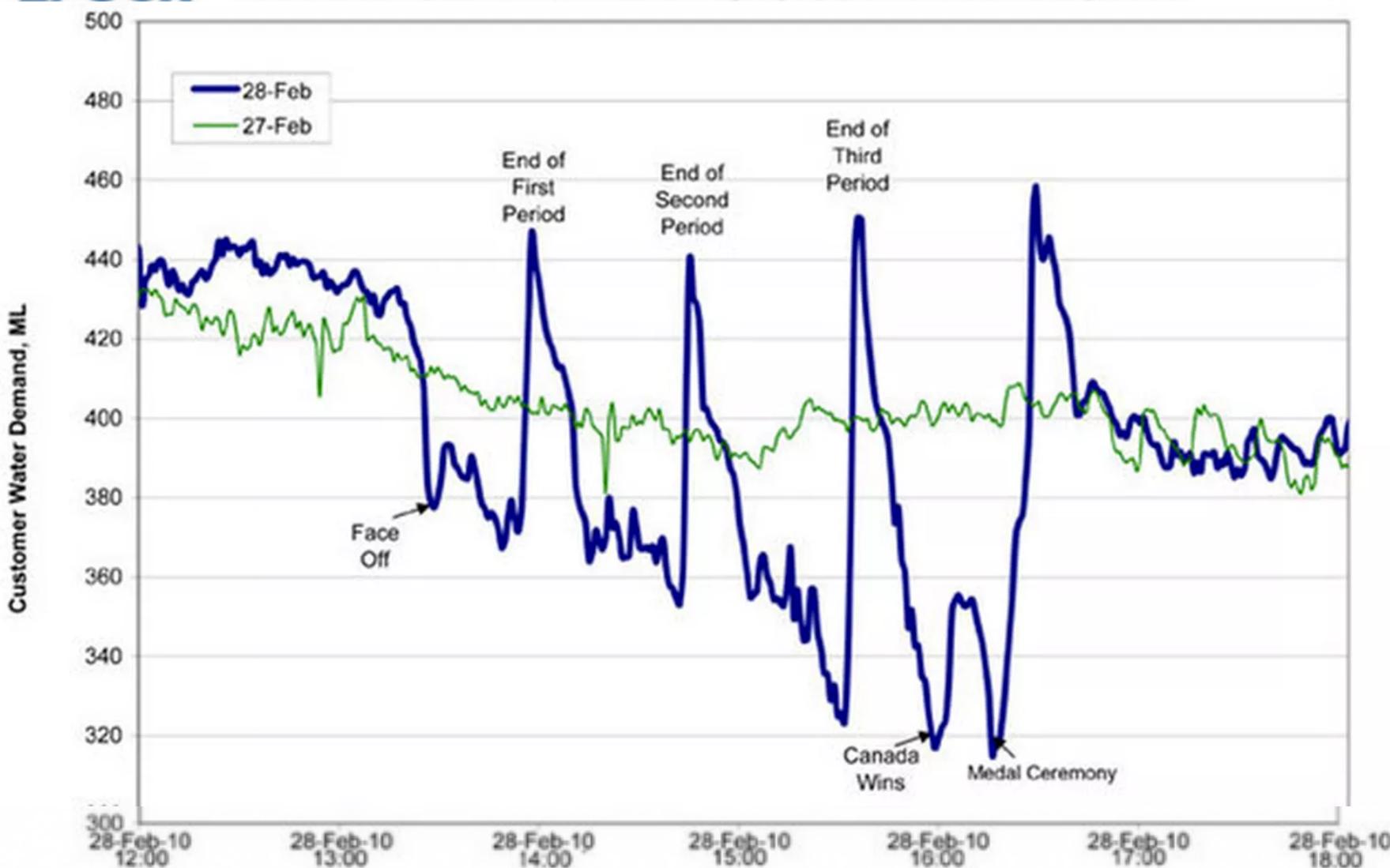
## Unemployment rates by region (in October)

Percentage change  
compared to previous month



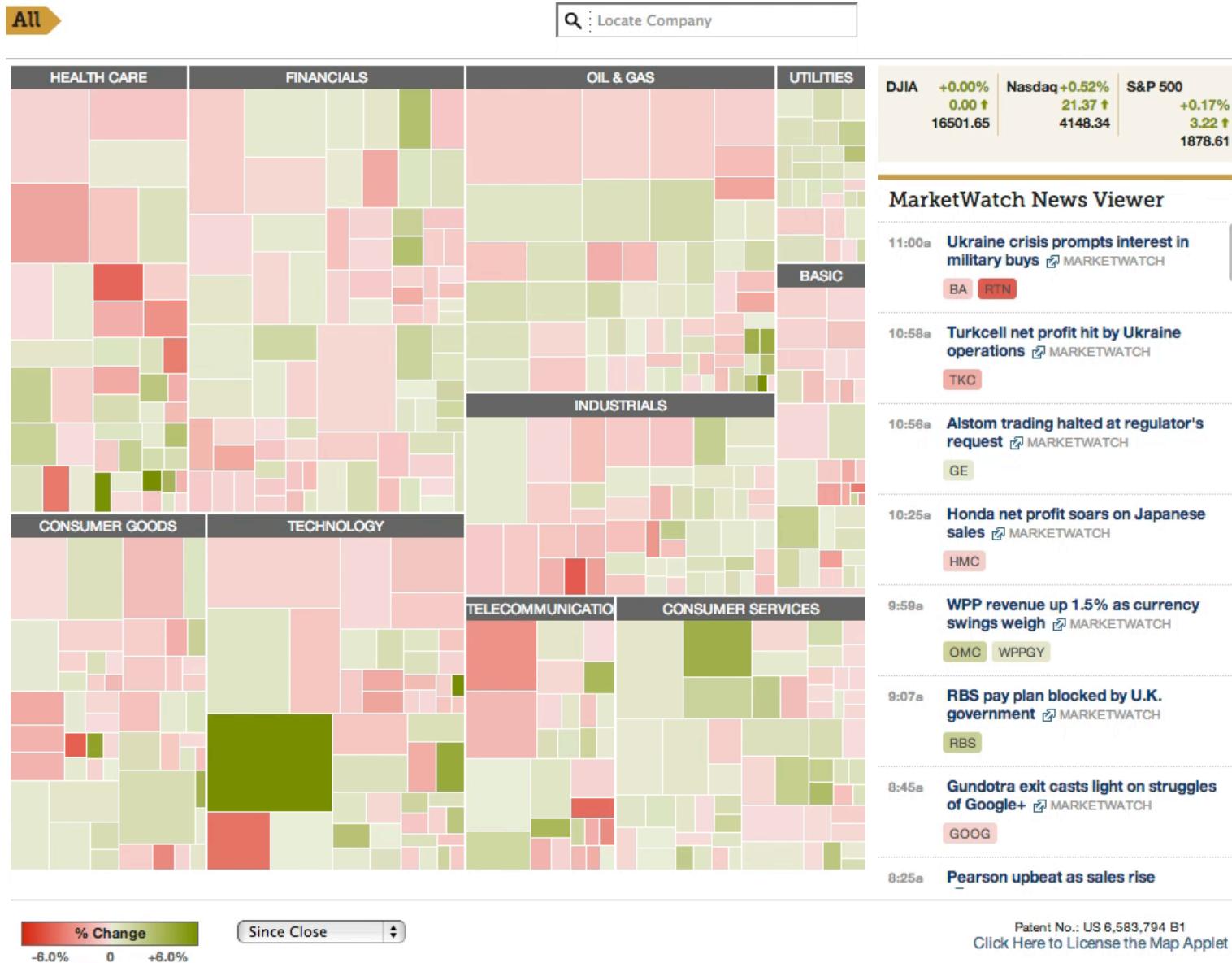
Canarias	+3.42
Aragón	+2.48
Madrid	+2.33
C. Valenciana	+2.08
Melilla	+1.93
Ceuta	+1.81
Murcia	+1.78
C.-La Mancha	+1.78
Cataluña	+1.39
La Rioja	+1.02
País Vasco	+0.84
C. y León	+0.77
Cantabria	+0.54
Navarra	+0.39
Andalucía	-0.30
Galicia	-0.39
Asturias	-0.82
Extremadura	-1.86
Baleares	-4.27



**EPCOR** Water Consumption in Edmonton During Olympic Gold Medal Hockey Game

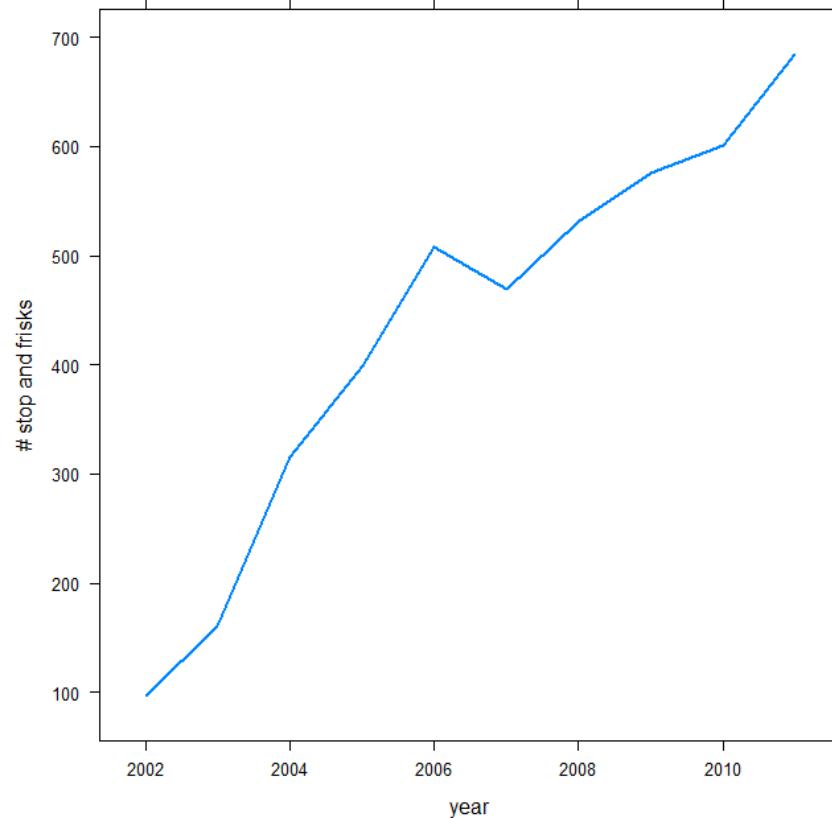
# Shneiderman's mantra

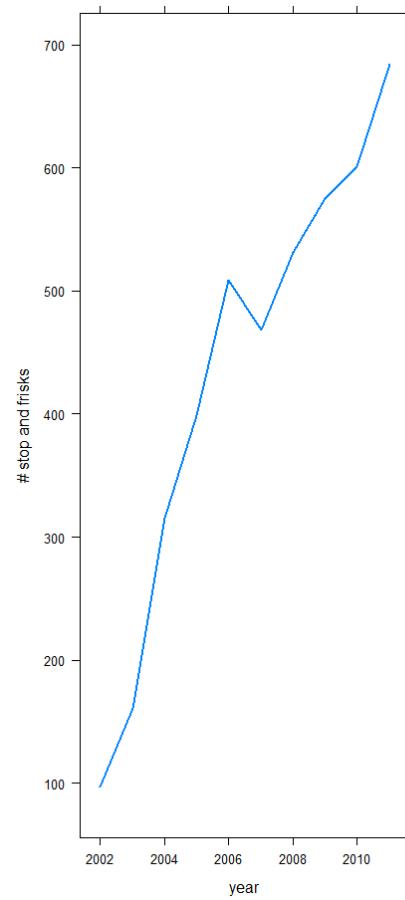
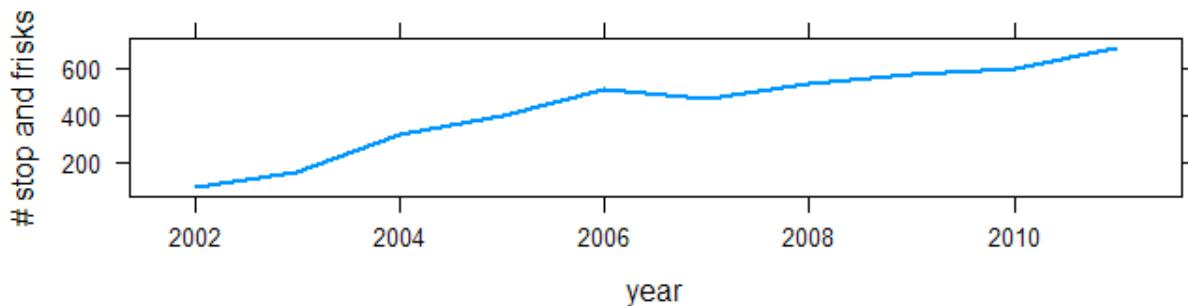
Overview first,  
zoom and filter,  
then details on demand.

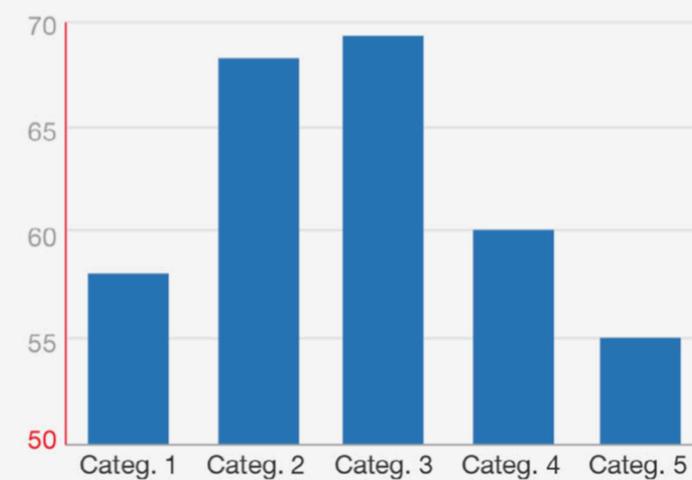
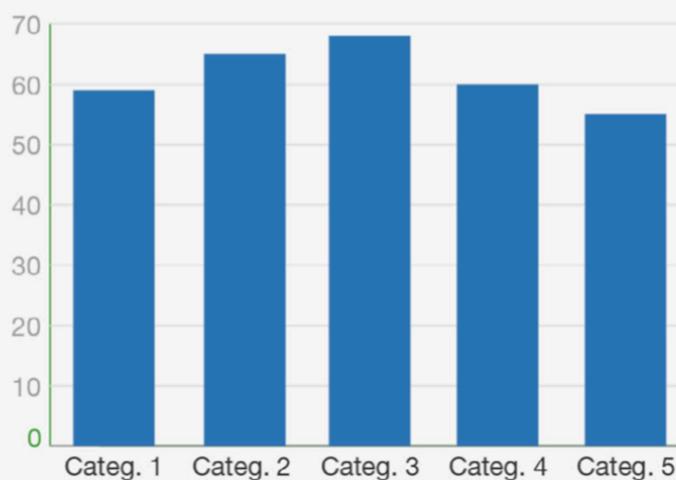


# Common mistakes

# Proportions









## ESPAÑA SEGUIRÁ A LA CABEZA DEL CRECIMIENTO

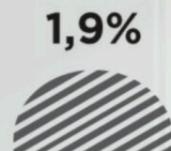
### PREVISIÓN DE CRECIMIENTO DEL PIB EN 2018



España



Economías avanzadas



Eurozona

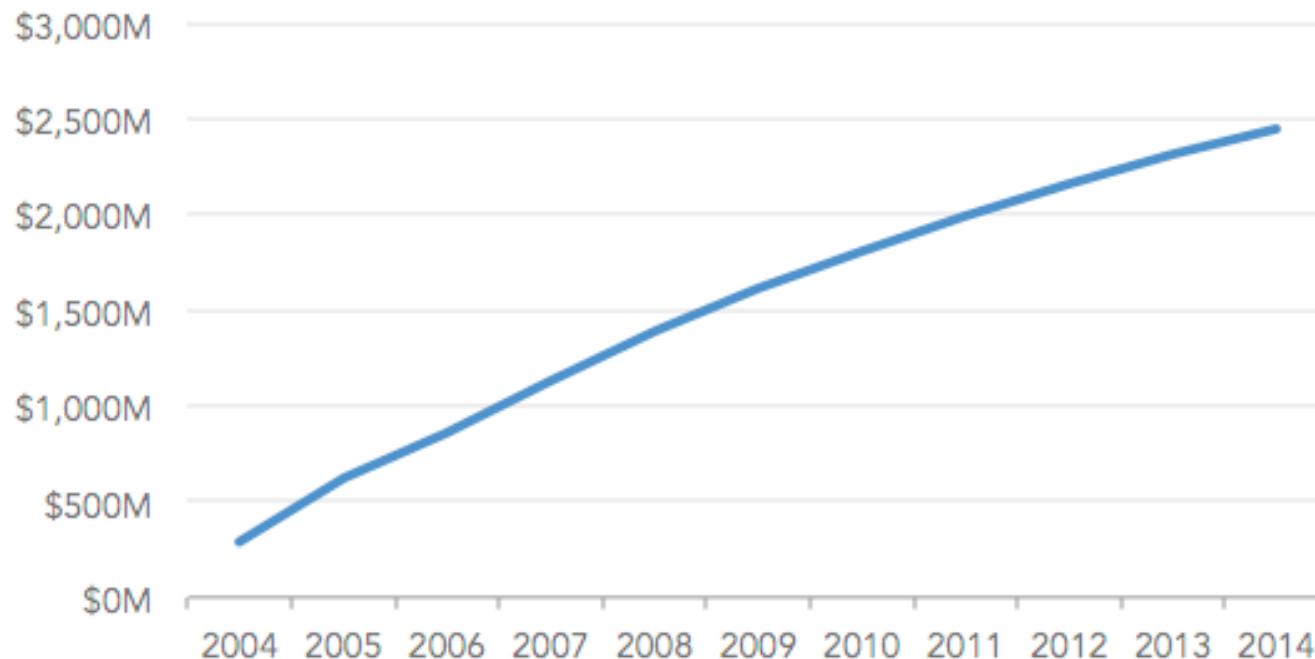
### ESPAÑA LÍDERARÁ

en 2017 y 2018 el crecimiento entre los principales países desarrollados

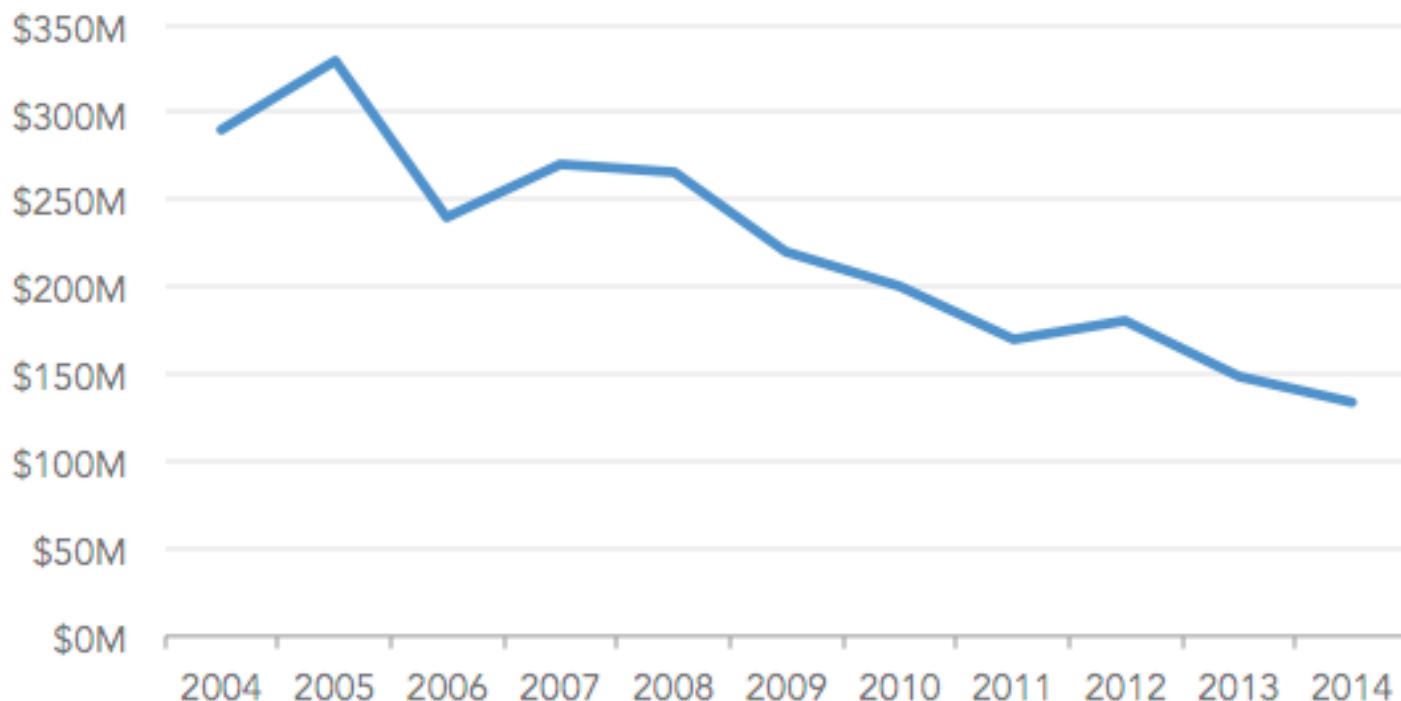
Fuente: Borrador del Plan Presupuestario 2018. Ministerio de Hacienda y Función Pública. Perspectivas Económicas Mundiales (WEO). Octubre 2017  
Mariano Rajoy Brey @marianorajoy 29 dic. 2017  
España es hoy una economía más competitiva, que está creciendo y creando empleo por encima de las mejores previsiones. #EspañaLograLaRecuperación

# Use the right KPIs

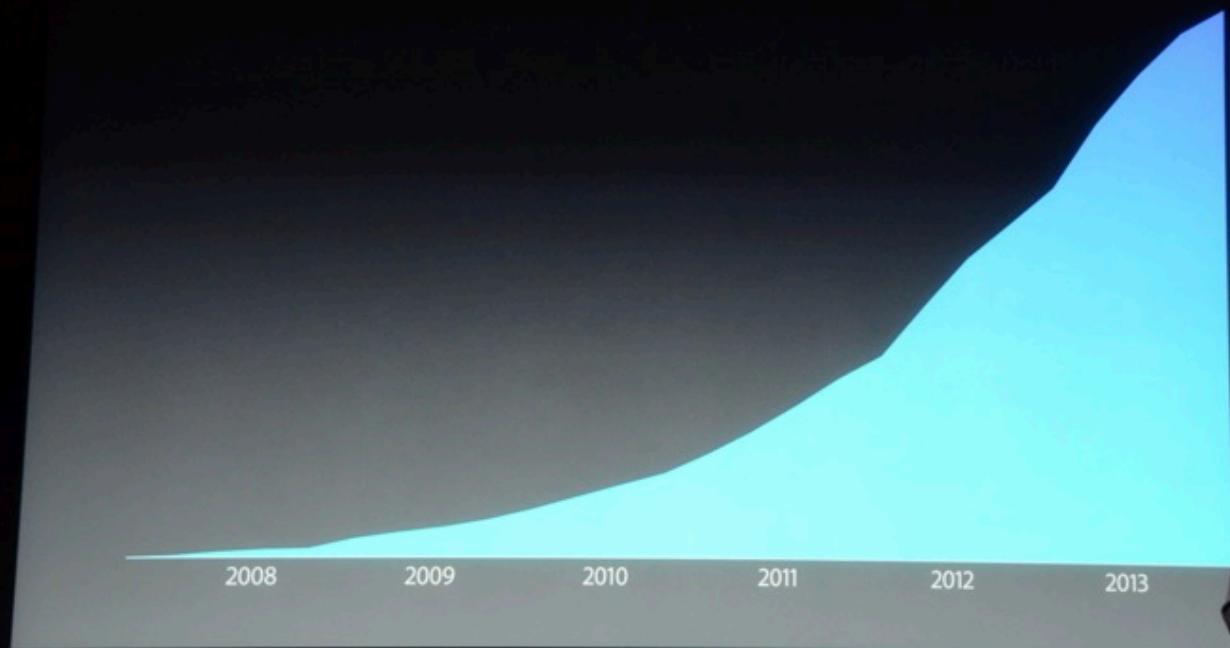
**Cumulative Annual Revenue**



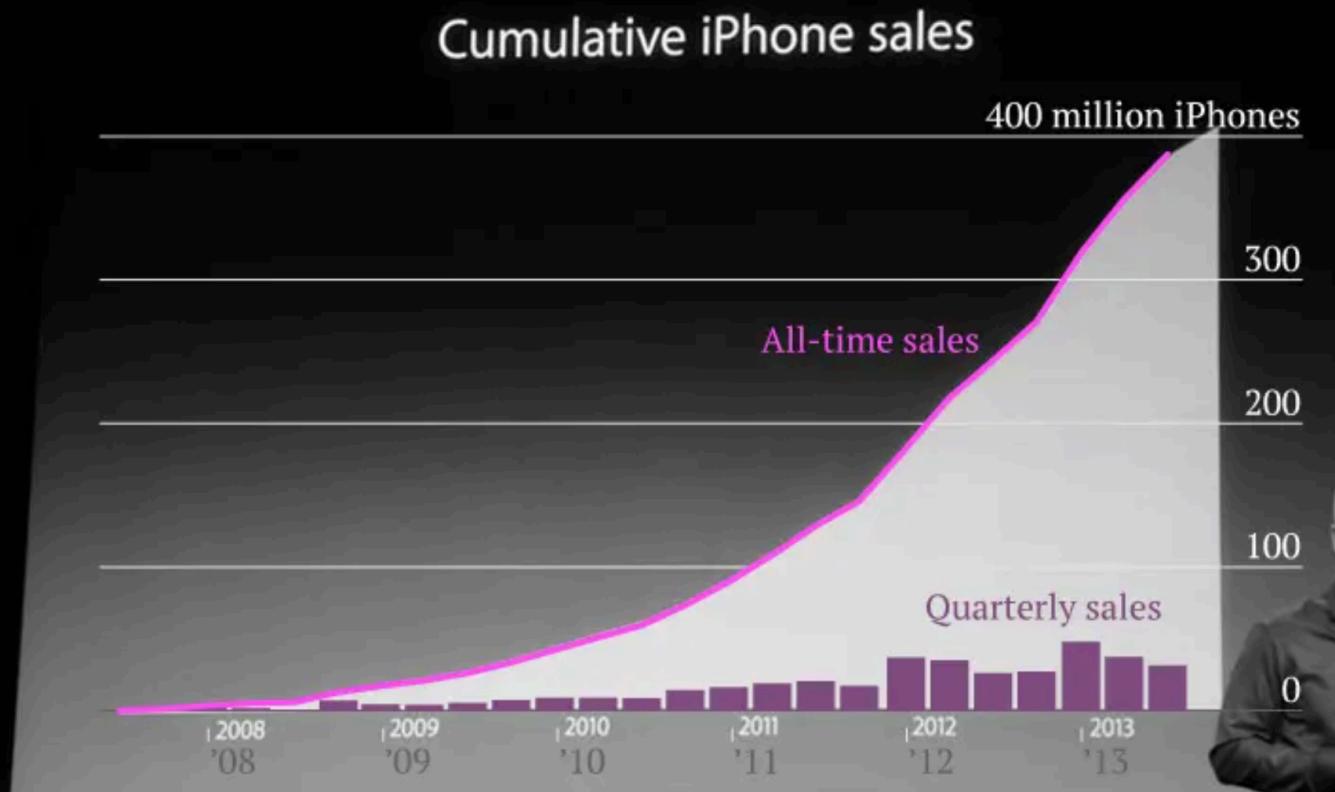
## Annual Revenue



## Cumulative iPhone sales



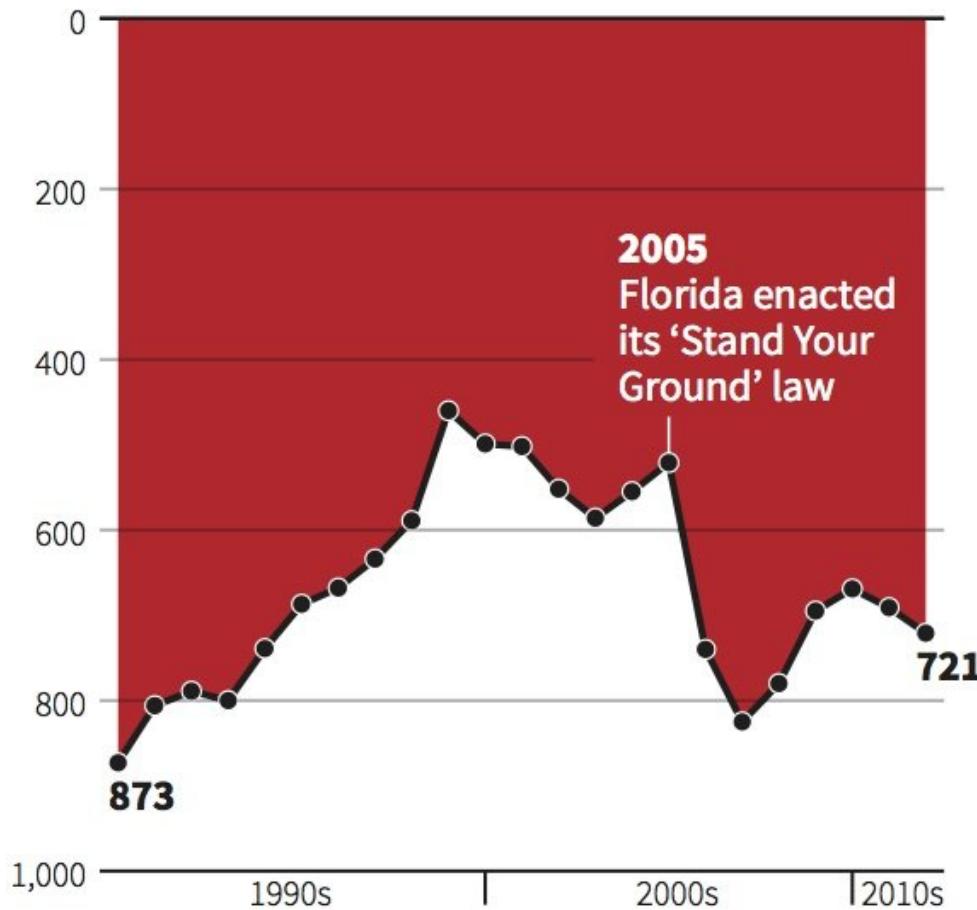
THE VERGE



Quartz | qz.com  
Data: Apple  
Photo: The Verge

# Gun deaths in Florida

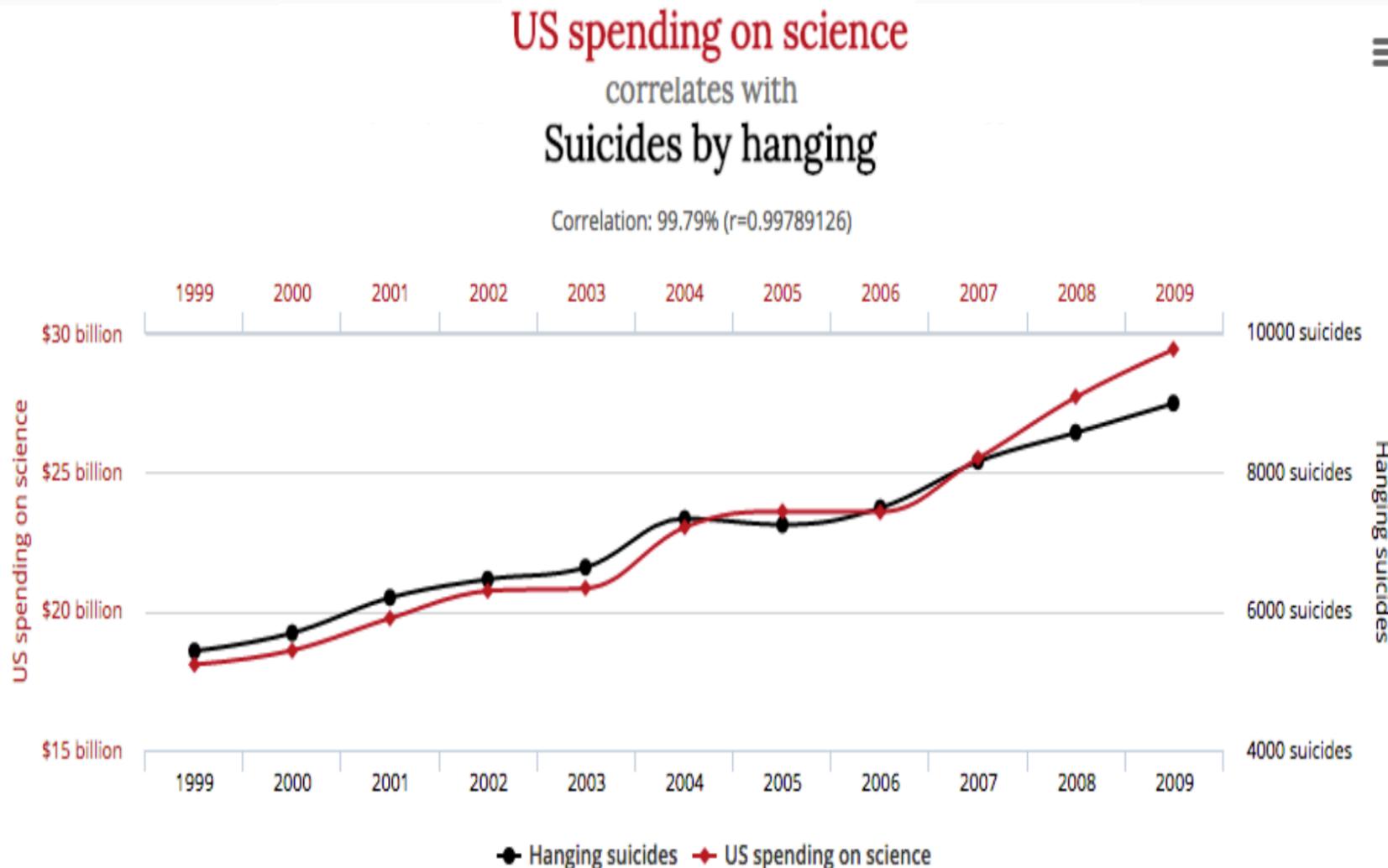
Number of murders committed using firearms



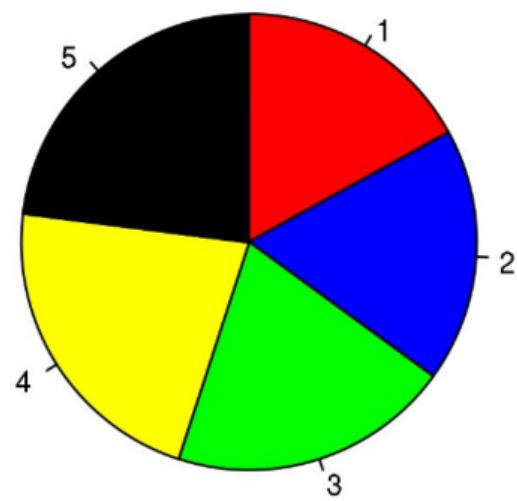
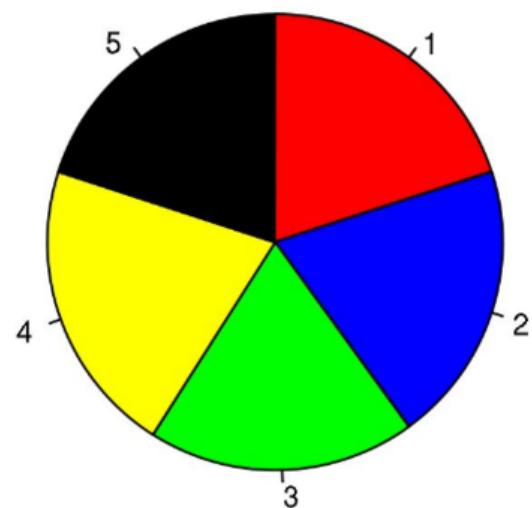
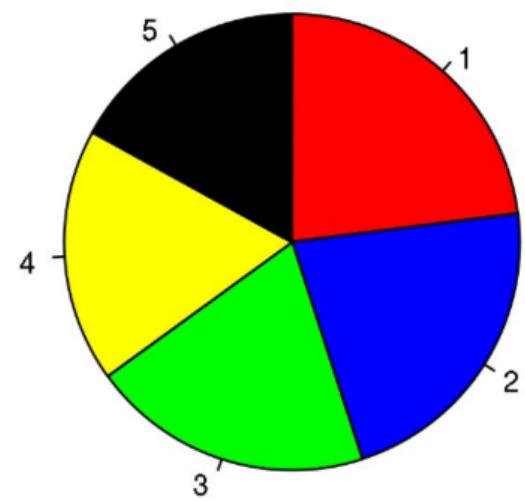
Source: Florida Department of Law Enforcement

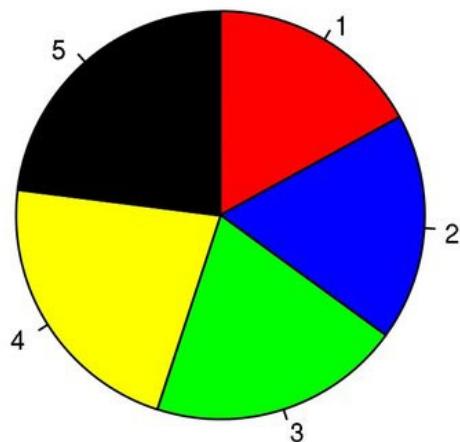
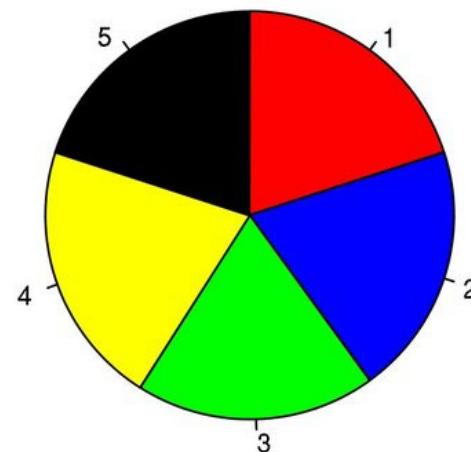
C. Chan 16/02/2014

REUTERS



# Pie charts...

**A****B****C**

**A****B****C**