



# Data Visualization



Welcome all

I am Jérôme Baton ( [jerome.baton@epita.fr](mailto:jerome.baton@epita.fr) )

I have been retrieving and presenting data for years,  
mostly a Java+backend specialist, Android, ...  
Speaker

Now :

Proudfessor + enterTRainer

(several subjects in several places),

Author (« Learning Neo4j 3.x », Packt Publishing, 2017)

The major goals of this course are to understand how visual representations can help in the analysis and understanding of complex data, how to design effective visualizations, and how to create an interactive visualization using modern web-based frameworks.

It explores the underlying theory and practical concepts in creating visual representations of large amounts of data. It covers the core topics in data visualization: data representation, visualization toolkits, scientific visualization, medical visualization, information visualization, flow visualization, and volume rendering techniques



Apologies in advance for my accent  
And bad ears

I might pronounce your names badly  
or even the lectures content

Please bear with my puns and jokes

This is still serious matter

Today, we'll start with theory, softwares

Other lectures will be about practice, projects and grading

Sessions details are in the Team folder

# YOU

Are to take notes

As everything is not in the slides

Are not allowed to take  
pictures/movies/streams/sound  
captations



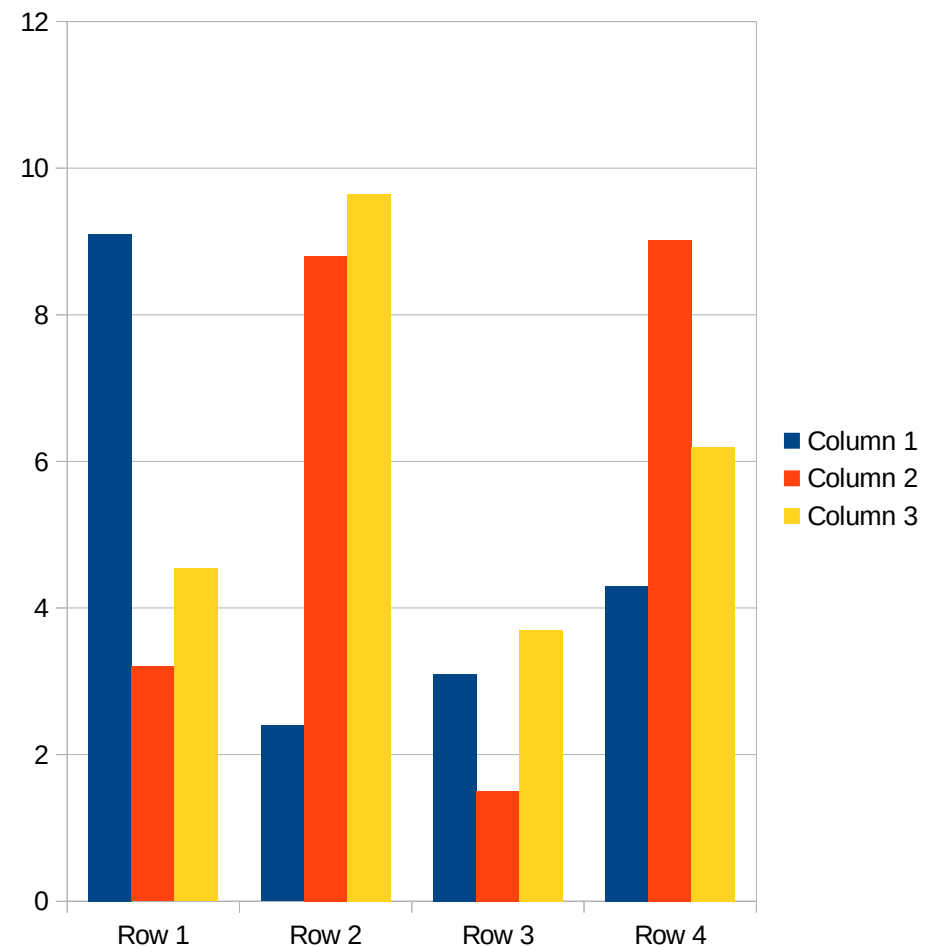
# What is dataviz ?

**In short data  
vizualisation**

**Like this ---->**

**What for ?**

**Get a better  
understanding of the  
collected data**



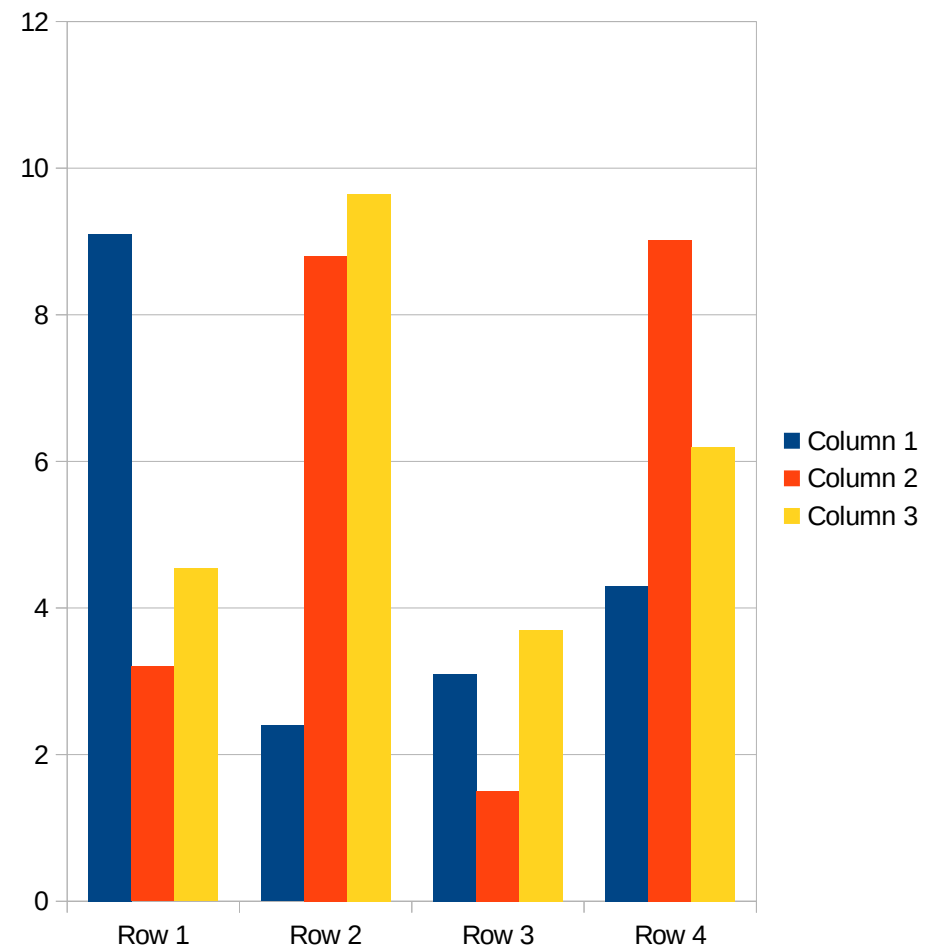


# What is dataviz ?

In short data  
vizualisation

What for ?

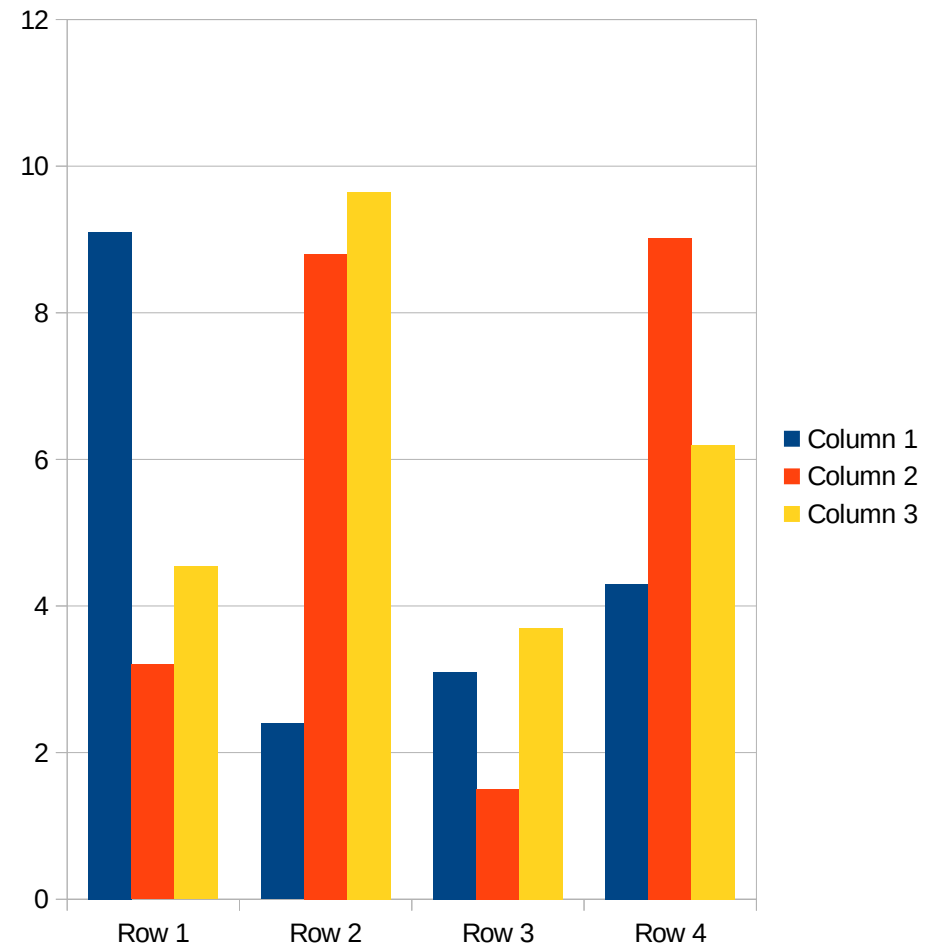
Get a better  
understanding of  
the collected data



# What is dataviz ?

**In short data  
vizualisation**

**What for ?  
Get a better  
understanding of the  
collected data**



# What is this dataviz ?

**In short data  
vizualisation**

Could be  
sales data,

could be IOT-generated data

Could be a random pic

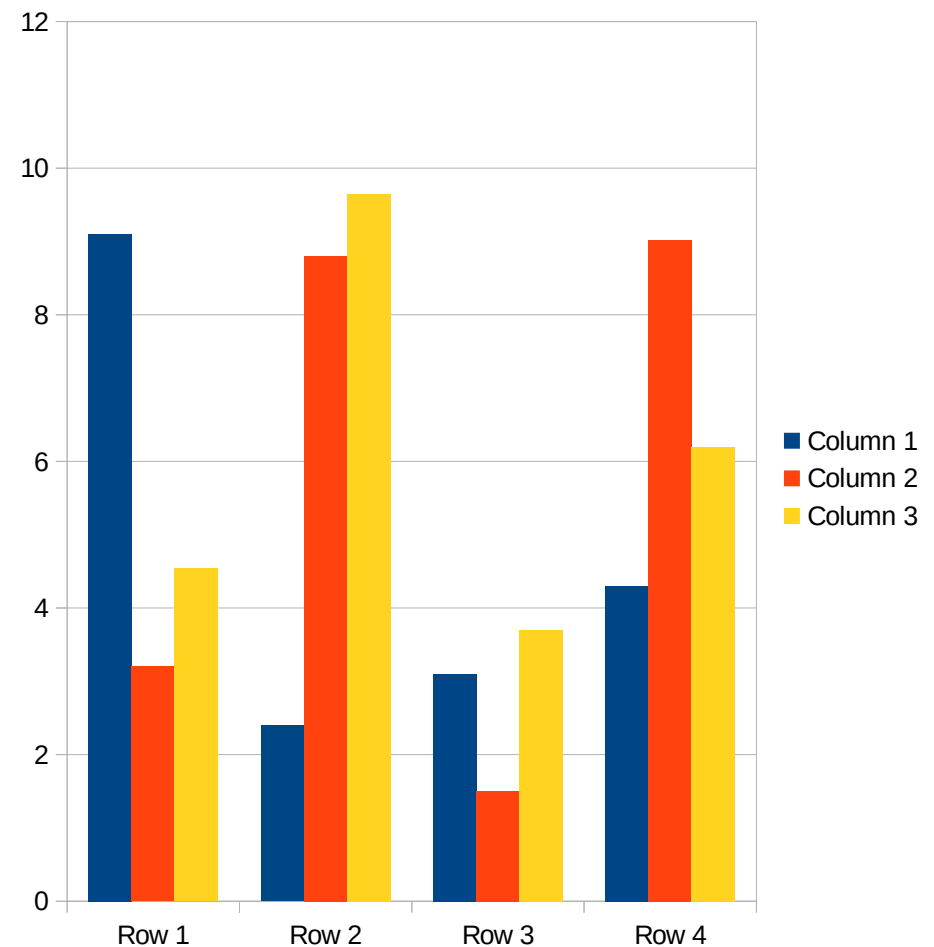
**What for ?**


**Get a better  
understanding of the  
collected data**

# What is this dataviz ?

**This could be a chart of  
the sales on three  
continents in four months**

**Or many different things**





**One could represent many different data  
With the same chart**

**Beware not to use the same chart again and  
again** (in your project ... wink wink)

# **Understanding why we need data visualization**

**Out of all of our logical capabilities, we understand things best through the processing of visual information.**

**When data is represented visually, the probability of understanding complex builds and numbers increases**

**Mario Döbler and Tim Großmann**

# Understanding why we need data visualization

**Visualizing data has many advantages, such as the following:**

- **Complex data can be easily understood**
- **A simple visual representation of outliers, target audiences, and future markets can be created**
- **Storytelling can be done using dashboards and animations**
- **Data can be explored through interactive visualizations**

# Understanding why we need data visualization

**Sometimes the data is available but you still need the right tool to interpret it.**



**A chart is a tool**

From « They live » (John Carpenter, 1988)



# The power of charts

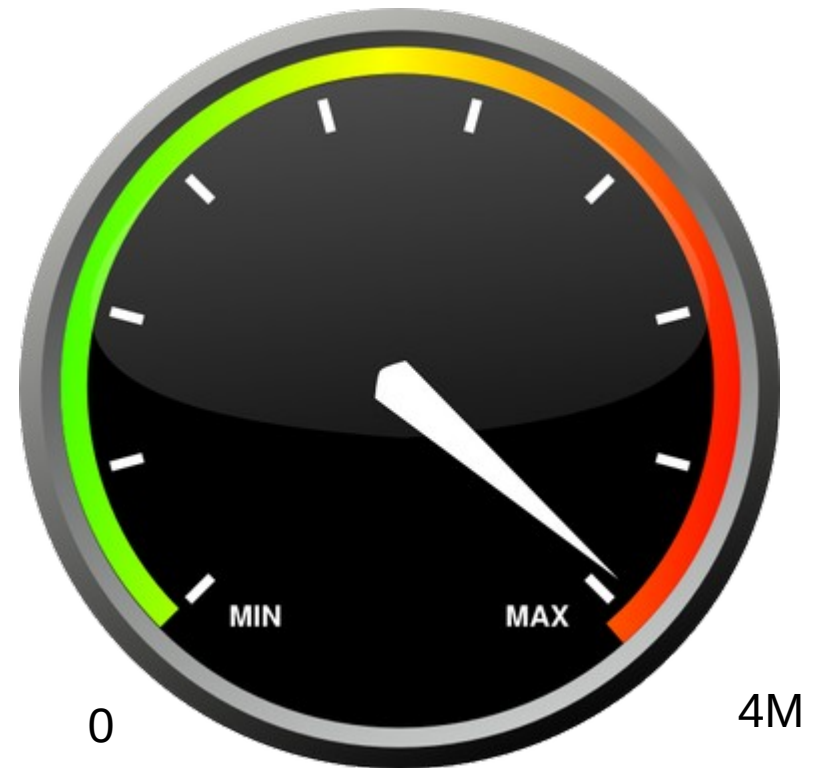
DEMO

# This ...

**Value**  
**4 M**

# Is different of

**Even though they display the same value**



**The first conveys an information  
(rough data)**

**The second conveys an information and eases  
interpretation  
(interpreted data)**

**There is a difference between 'nice blue' and  
'OMG, ITS GONNA EXPLODE'**

# KEY SENTENCE

**If there is one thing you should remember from this lecture in 20 years, it is this :**

## **KEY SENTENCE**

**If there is one thing you should remember from this lecture in 20 years, it is this :**

**A PICTURE IS WORTH A THOUSAND WORDS !**

**(sorry I screamt)**

about, above, across, after, again, ago, against, air, all, alone, along, already, almost, among, and, angry, another, answer, any, anyone, anything, anytime, appear, apple, are, area, arm, army, around, arrive, art, as, ask, at, attack, aunt, autumn, away. baby, base, back, bad, bag, ball, bank, basket, bath, be, bean, bear, beautiful, beer, bed, bedroom, behave, before, begin, behind, bell, below, besides, best, better, between, big, bird, birth, birthday, bit, bite, black, bleed, block, blood, blow, blue, board, boat, body, boil, bone, book, border, born, borrow, both, bottle, bottom, bowl, box, boy, branch, brave, bread, break, breakfast, breathe, bridge, bright, bring, brother, brown, brush, build, burn, business, bus, busy, but, buy, by. cake, call, can, candle, cap, car, care, are, careful, careless, carry, case, cat, catch, central, century, certain, chair, chance, change, chase, cheap, cheese, chicken, child, children, chocolate, choice, choose, circle, city, class, clever, clean, clear, climb, clock, cloth, clothes, cloud, cloudy, close, coffee, coat, coin, cold, collect, colour, comb, comfortable, common, compare, come, complete, computer, condition, continue, control, cook, cool, copper, corn, corner, correct, cost, contain, count, country, course, cover, crash, cross, cry, cup, cupboard, cut. dance, dangerous, dark, daughter, day, dead, decide, decrease, deep, deer, depend, desk, destroy, develop, die, different, difficult, dinner, direction, dirty, discover, dish, direction, do, dog, door, double, down, draw, dream, dress, drink, drive, drop, dry, duck, dust, duty. each, ear, early, earn, earth, east, easy, eat, education, effect, egg, eight, either, electric, elephant, else, empty, end, enemy, enjoy, enough, enter, equal, entrance, escape, even, evening, event, ever, every, everyone, exact, everybody, examination, example, except, excited, exercise, expect, expensive, explain, extremely, eye. face, fact, fail, fall, false, family, famous, far, farm, father, fast, fat, fault, fear, feed, feel, female, fever, few, fight, fill, film, find, fine, finger, finish, fire, first, fit, five, fix, flag, flat, float, floor, flour, flower, fly, fold, fool, foot, football, for, force, foreign, forest, forget, forgive, fork, form, fox, four, free, freedom, freeze, fresh, friend, friendly, from, front, fruit, full, fun, funny, furniture, further, future. game, garden, gate, general, gentleman, get, gift, give, glad, glass, go, goat, god, gold, good, goodbye, grandfather, grandmother, grass, grave, great, green, grey, ground, group, grow, gun. hair, half, hall, hammer, hand, happen, happy, hard, hat, hate, have, he, head, healthy, hear, heavy, hello, help, heart, heaven, height, help, hen, her, here, hers, hide, high, hill, him, his, hit, hobby, hold, hole, holiday, home, hope, horse, hospital, hot, hotel, house, how, hundred, hungry, hour, hurry, husband, hurt. I, ice, idea, if, important, increase, inside, into, introduce, invent, iron, invite, is, island, it, its, jelly, job, join, juice, jump, just. keep, key, kill, kind, king, knock, know, ladder, lady, lap, lead, large, last, late, lately, laugh, lazy, lead, leaf, learn, leave, leg, left, lend, length, less, letter, library, life, light, like, lion, lip, list, listen, little, live, lock, lonely, long, look, lose, lot, love, low, lower, luck. machine, main, make, male, man, many, map, mark, market, marry, matter, may, me, meal, mean, measure, meat, medicine, meet, mention, method, middle, milk, million, mind, minute, miss, mistake, mix, model, modern, moment, money, monkey, moon, more, morning, mouse, move, mountain, much, move, much, music, must, my. name, narrow, nation, nature, near, nearly, neck, need, needle, neighbor, net, new, news, newspaper, nice, night, nine, no, noble, noise, none, nor, north, nose, not, nothing, notice, now, number. obey, object, ocean, of, off, offer, office, often, oil, old, on, one, only, open, opposite, or, orange, order, other, our, out, outside, over, own. page, pain, paint, pair, pan, paper, parent, park, part, partner, party, pass, past, path, pay, peace, pen, pencil, people, pepper, per, perfect, period, person, petrol, photograph, piano, pick, picture, piece, pig, pin, pink, place, plane, plant, plastic, plate, play, please, pleased, plenty, pocket, point, poison, police, polite, pool, poor, popular, position, possible, potato, pour, power, present, press, pretty, prevent, price, prince, prison, private, prize, probably, problem, produce, promise, proper, protect, provide, public, pull, punish, pupil, push, put. queen, question, quick, quiet, quite. radio, rain, rainy, raise, read, read, ready, real, really, receive, record, red, remember, remind, remove, rent, repair, repeat, reply, report, rest, restaurant, result, return, rice, rich, ride, right, ring, rise, road, rob, rock, room, round, rubber, rude, rule, ruler, run, rush. sad, safe, sail, salt, same, sand, save, say, school, science, scissors, search, seat, second, see, seem, sell, send, sentence, serve, seven, several, sex, shade, shadow, shake, shape, share, sharp, she, sheep, sheet, shelf, shine, ship, shirt, shoe, shoot, shop, short, should, shoulder, shout, show, sick, side, signal, silence, silly, silver, similar, simple, single, since, sing, sink, sister, sit, six, size, skill, skin, skirt, sky, sleep, slip, slow, smoke, small, smell, smile, smoke, snow, so, soap, sock, soft, some, someone, something, sometimes, son, soon, sorry, sound, soup, south, space, speak, special, speed, spell, spend, spoon, sport, spread, spring, square, stamp, stand, star, start, station, stay, steal, team, step, still, stomach, stone, stop, store, storm, story, strange, street, strong, structure, student, study, stupid, subject, substance, successful, such, sudden, sugar, suitable, summer, sun, sunny, support, sure, surprise, sweet, swim, sword. table, take, talk, tall, taste, taxi, tea, teach, team, tear, telephone, television, tell, ten, tennis, terrible, test, than, that, the, their, then, there, therefore, these, thick, thin, thing, think, third, this, though, threat, three, tidy, tie, title, to, today, toe, together, tomorrow, tonight, too, tool, tooth, top, total, touch, town, train, tram, travel, tree, trouble, true, trust, twice, try, turn, type. uncle, under, understand, unit, until, up, use, useful, usually, usually. vegetable, very, village, voice, visit. wait, wake, walk, want, warm, wash, waste, watch, water, way, we, weak, wear, weather, wedding, week, weight, welcome, well, west, wet, what, wheel, when, where, which, while, white, who, why, wide, wife, wild, will, win, wind, window, wine, winter, wire, wise, wish, with, without, woman, wonder, word, work, world, worry, worst, write, wrong. year, yes, yesterday. yet you your yours yours

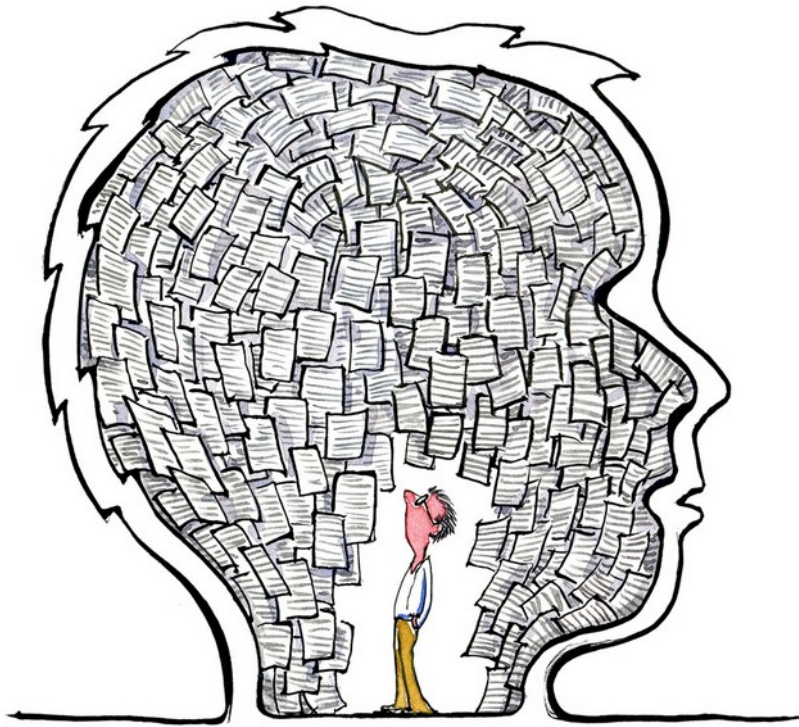
# A Picture Is Worth A Thousand Words

# Is it ?

1000 words =?

Two pages when the font type is Arial, the font size is 12pt, and it has single spacing.

Four pages when the font type is Times New Roman, the font size is 12pt, and it has double spacing. These are the common requirements for both high school and college writing.



Can a picture say more  
than a thousand words?

HikingArtist.com



**A good chart is always accompanied by a paragraph explaining the main informations conveyed by the chart.**

**Today's DataViz is graphical**

**It has evolved with technical capacities  
and its audience**

# From this

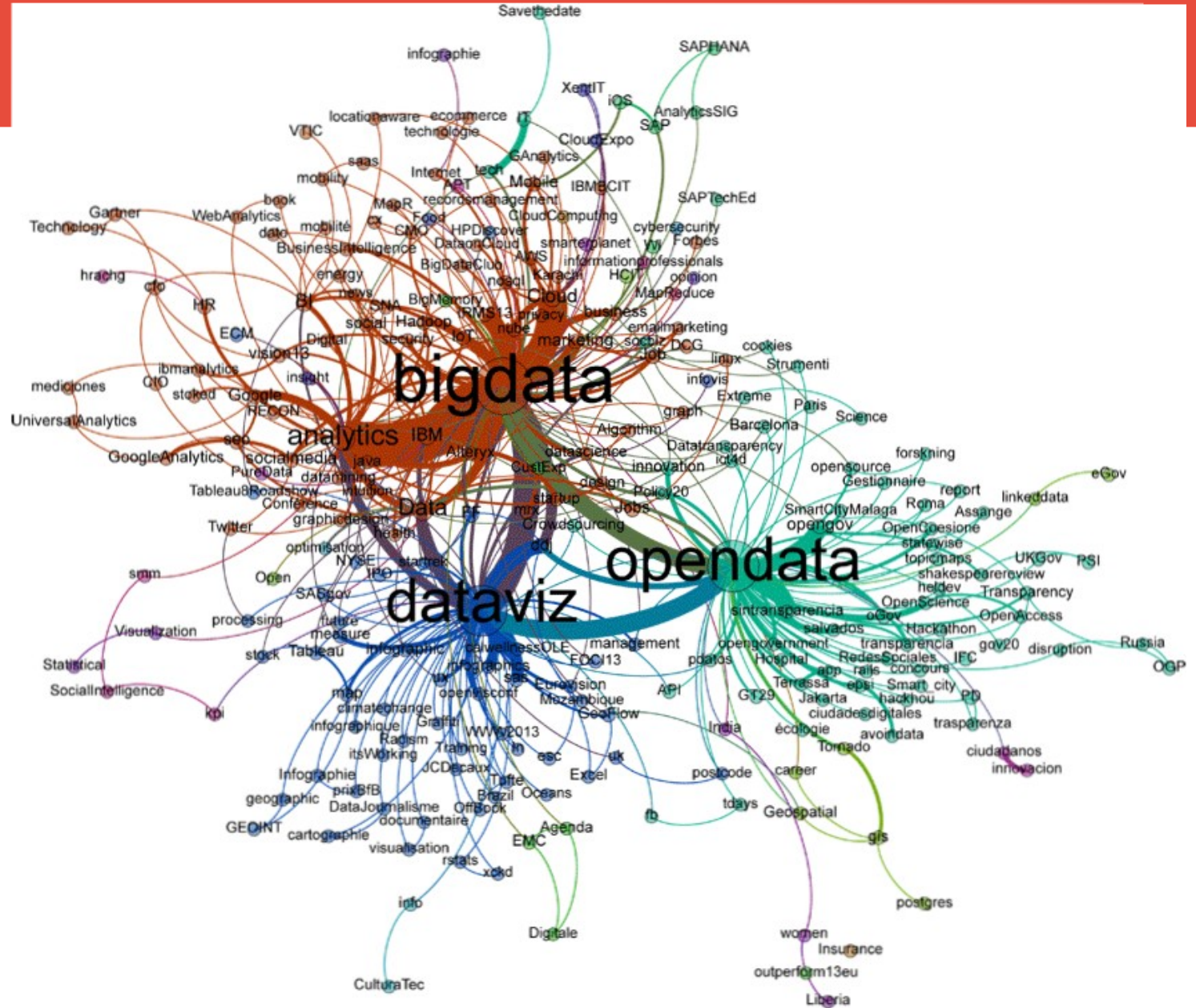
B1: "Principal" MENU

Worksheet Range Copy Move File Print Graph Data Quit  
Global, Insert, Delete, Column-Width, Erase, Titles, Window, Status

	A	B	C	D	E
1		Principal	\$50,000		
2		Rate	13.0%		
3		Years	5		
4		Payment	1,137.65		
5					
6	Year	Begin Bal.	End Bal.	Total Paid	Interest
7	1	50,000.00	42,406.26	13,651.84	6,058.10
8	2	42,406.26	33,764.33	13,651.84	5,009.92
9	3	33,764.33	23,929.53	13,651.84	3,817.05
10	4	23,929.53	12,737.22	13,651.84	2,459.53
11	5	12,737.22	0.00	13,651.84	914.63
12					
13					
14					
15					
16					
17					
18					
19					
20					

This is high-end software in the 80's

# To this





# Still available, but nobody likes this

API\_FRA\_DS2\_en\_csv\_v2\_728836.csv - LibreOffice Calc

File Edit View Insert Format Sheet Data Tools Window Help

Liberation Sans 10

A1 f(x) Σ =

	AA	AB	AC	AD	AE	AF	AG	AH	AI	AJ	
70	23702964367.7014	20129959549.0145	17825564812.7299	18461819243.6852	24954067620.0398	28848630361.2354	29030943728.6642	32037836726.3006	39812070834.8392	33183350773.1659	36337
71											
72	45.2523852836828	45.1398283198465	47.5418299082076	47.0163879903232	40.8879984679522	40.2927394586107	41.3922169441697	44.0017811278671	42.7360551888574	42.983681489047	27978
73	-2.45499488898256	-0.267174164350542	0.129131720011881	-0.36796099719014	-0.121041596079529	-1.09803582547784	-0.658765800381533	-0.685473478143575	-0.784588428032568	-0.313912641235499	0.6695
74	-704297400	11056476600	17001343800	13166609700	291494100	-8389058000	-9064001500	-6394670900	-8675002100	-1375782500	
75	-14386000000	-1738000000	913000000	-2788000000	-986000000	-9399000000	-6095000000	-6835000000	-8266000000	-3427000000	
76	-14358718434.9736	-1495825802.56476	685281092.846956	-2035333625.34677	-933800549.294441	-10257557568.4819	-6711815879.30845	-7027555007.1972	-9957836405.25238	-3984420416.23067	93828
77	23.8536900863327	22.7035012420985	23.7063490940978	23.6921744937567	20.5045200320159	20.6953876420443	21.0254913722756	22.3436273030054	21.760321808445	21.6487970651412	20.661
78	158500883000	154223568100	159469626400	167035005000	178167742400	191836595400	208034728200	224819771100	236155632100	243136053700	
79	3.56233614532782	-2.69860635413622	3.40159313173093	4.74408749226241	6.66491278280262	7.6719011061567	8.44371365443864	8.06838504572333	5.04219933350871	2.95585649934623	1.7668
80	207157402587.056	201567039757.778	20842353038.012	218311324971.71	232861584376.055	250726494843.616	271897122124.021	293834828865.228	308650566647.887	317773834482.417	32338
81	139780000000	147689000000	167611000000	179513000000	167029000000	177149000000	194531000000	222793000000	229255000000	236341000000	
82	139514921648.867	127109906188.14	125805749455.828	131050518323.843	158186381286.107	193330786860.199	214217597180.927	229069504421.139	276177568967.594	274783164748.285	28955
83	23.7978869910527	21.7504058341737	21.2292264826104	21.1685797207033	21.7569199946968	22.2629421378696	23.3426825116324	24.2683686332953	24.409660328073	23.6021635881488	21.960
84	262468952700	246327452700	245456047900	251731963900	269250103400	282924457000	310571302800	336902537200	351290222300	340807351600	
85	3.42466294481272	-6.14987023568064	-0.353758702267456	2.55683901606565	6.95904454428324	5.07868090943136	9.7718119151502	8.47832177751357	4.2705778411692	-2.98410545883276	-2.600
86	336448517241.189	315757370020.985	314640350846.484	322685198097.213	345141004770.607	362669615090.511	398109007750.555	431861970452.914	450304972067.512	436867396814.651	42550
87	139453000000	141489000000	150097000000	160392000000	177231000000	190567000000	215970000000	241985000000	257167000000	257666000000	
88	139188541770.636	121773818745.159	112660061547.699	117091546211.126	167848281087.224	207974462512.278	237826230591.345	248802179724.45	309802433441.754	299576793396.117	30776
89											
90	3239000000	-1239000000	-460000000	-94000000	4323000000	3489000000	6693000000	11003000000	10820000000	4626000000	
91	3232857570.61583	-1066356829.33127	-345267582.376342	-68623156.6652066	4094137702.43394	3807704900.14187	7370333663.69343	11312975529.5085	13034574147.6931	5378444366.93408	-16939
92	23.2451462399465	21.9407174656271	21.2944288078299	21.1809858662327	21.2262274796341	21.855340585035	22.6192830855531	23.1648917232713	23.3826524897821	23.1784227424075	22.080
93	262518830200	254569517200	252439061400	258263903100	269069782200	282945672100	307526703300	330176759600	345394158300	343548960200	
94	-0.890920597994963	-3.02809249681016	-0.836885666215181	2.30742487620421	4.18404545516992	5.15698559182169	8.68754450900823	7.36523237070061	4.60886426968254	-0.534229678081971	-1.487
95	332732568162.494	322657118231.522	319956847058.019	327339610940.155	341035649054.667	358622808339.392	389778324433.332	418486403758.47	437773874094.774	435435156136.47	42896
96	136214000000	142727000000	150580000000	160486000000	172908000000	187078000000	209277000000	230982000000	246347000000	253040000000	
97	135955684200.02	122839314915.225	113006079711.777	117160169367.791	163754143384.79	204166757612.136	230455896927.651	237489204194.941	296767859294.061	294198349029.183	30945
98											
99											
100	21.3986951973501	22.436327077748	23.8354808141097	23.3242134965665	20.3834784359363	19.5973518165664	20.3667255718941	21.6581538248618	20.9757333804124	21.3348844239057	21.330
101	157796585600	165280044700	176470970300	180201614700	178459236500	183447537400	198970726700	218425100300	227480630000	241760271200	
102	-1.12585871794072	4.74247213369361	6.77088732660538	2.1140272497272	-0.966904876463346	2.7952046628867	8.46192296719268	9.77750542637989	4.1458283354626	6.27729982988001	5.9498
103	200547310668.741	210058210992.078	224281015778.635	229022377568.16	226807949031.261	233147695398.381	252876473782.777	277601484728.926	289110365742.482	307258690239.401	32554
104	125394000000	145951000000	168524000000	176725000000	166043000000	167750000000	184336000000	215958000000	220989000000	232914000000	

API\_FRA\_DS2\_en\_csv\_v2\_728836

Sheet 1 of 1

Default

Sum=0

85%

Menu

95% 876

lun. 17 févr., 12:17

**(back in the days) Dataviz was for company boards**

**It used to be reports**

Litterally piles of paper

**Then reports with charts**

Still paper piles

**Or just charts in a presentation**

(also invention of 'death by powerpoint')

**Dashboards**

On demand

**Now : all this plus animated charts, 3D**

Tomorrow charts in VR ?

## **We are viewers, not readers anymore**

Lets not compare time spent reading books now and before  
Mainstream TV happened.

## **We want information quick**

The Hurry Generations

Because of living with remote controls.

Attention span : size matters

## **From**

From an ocean of data (Internet)

Or data lakes :) (company zone)

**(back in the days) Dataviz was for company boards**

**It used to be reports**

Litterally piles of paper

**Then reports with charts**

Still paper piles

**Or just charts in a presentation**

(also invention of 'death by powerpoint')

**Dashboards**

On demand

**Now : all this plus animated charts, 3D**

Tomorrow charts in VR ?



From [https://en.wikipedia.org/wiki/Data\\_lake](https://en.wikipedia.org/wiki/Data_lake)

**A data lake is a system or repository of data stored in its natural/raw format, [1] usually object blobs or files. A data lake is usually a single store of all enterprise data including raw copies of source system data and transformed data used for tasks such as reporting, visualization, advanced analytics and machine learning. A data lake can include structured data from relational databases (rows and columns), semi-structured data (CSV, logs, XML, JSON), unstructured data (emails, documents, PDFs) and binary data (images, audio, video). [2]**

**A data swamp is a deteriorated and unmanaged data lake that is either inaccessible to its intended users or is providing little value.[3]**

-----

**To which I'll append 'data dump'**

# Dataviz conveys a message

## **If you produce a chart**

You want it to illustrate a point

## **However .... its difficult to get understood**

You need to make it crystal clear

Many traps on the way

## **DataViz must be adapted to the audience**

The how

Is audience reading LTR or RTL ?

Some colors convey a different meaning in different cultures !

The what

Dont show board's salaries to a company salarymen

## **Dataviz must be adapted to the era**

Dont represent booming business numbers with explosions.

Avoid anything that can be stamped as not politically correct

# However ...

## Some rules stay valid

Show ordered data

Use a legend

Create a title

Keep user's attention

**And to maintain attention, you must choose the colors wisely**

# The RED color

Red – Fire: Red is an auspicious as well as a popular color in Chinese culture. It symbolizes luck, happiness and joy. It also represents summer season and the Southern Direction. It is the color worn by brides, since it is believed to be an auspicious color for warding off evil. Red also represents vitality, celebration and fertility in traditional Chinese color symbolism.

Today, westerners take red to be a representation of China's Revolution or political system.

However, this is definitely not the case since ancient Chinese roots certainly did not factor in the revolution for it. If you are doing business in China, make use of bit of red in marketing, but not too much.

I like red too – Jérôme, France (hence the slides)

Red is the enemy : CCCP / USSR – says every world map representation in the 80s

# Colors meanings (west world only ?)

RED	PINK	PURPLE	NAVY	GREEN	BLUE	ORANGE
<p><b>MEANS:</b></p> <p>passionate <b>active</b> EXCITING bold energy youthful <b>physical</b> PIONEERING leader willpower confidence ambition <b>POWER</b></p> <p><b>BRANDS:</b></p> <p>Kellogg's Virgin LEGO Coca-Cola Nintendo Red Bull Pinterest</p>	<p><b>MEANS:</b></p> <p>love <b>calm</b> respect <b>WARMTH</b> longterm feminine intuitive <b>care</b> assertive <b>sensitive</b> NURTURE <b>possibilities</b> UNCONDITIONAL</p> <p><b>BRANDS:</b></p> <p>BBC three Barbie COSMOPOLITAN VICTORIA'S SECRET</p>	<p><b>MEANS:</b></p> <p><b>DEEP</b> creativity unconventional original <b>stimulation</b> individual WEALTHmodesty <b>compassion</b> DISTINGUISHED respectable <b>fantasy</b></p> <p><b>BRANDS:</b></p> <p>Cadbury YAHOO! Hallmark Milka Zoopla.co.uk Your advantage in property</p>	<p><b>MEANS:</b></p> <p>trust order <b>LOYALTY</b> <b>sincere</b> authority communication confidence <b>PEACE</b> integrity control responsible <b>success</b> CALM masculine</p> <p><b>BRANDS:</b></p> <p>Facebook LG Reebok British Gas t GAP</p>	<p><b>MEANS:</b></p> <p>BALANCE <b>growth</b> <b>restore</b> sanctuary EQUILIBRIUM positivityNATURE <b>generous</b> clarity prosperity good judgement safetystable</p> <p><b>BRANDS:</b></p> <p>bp Holiday Inn tic tac LACOSTE Intel Blu-ray Disc skype Twitter WordPress</p>	<p><b>MEANS:</b></p> <p><b>spirit</b> perspective <b>CONTENT</b> control <b>rescue</b> determination self-sufficient modern goals aware PURPOSE <b>OPEN</b> ambition</p> <p><b>BRANDS:</b></p> <p>Fanta orange MasterCard bitly B</p>	

# Colors

**So, choose wisely !**

## **A beautiful palette**

is not friendly to the color blind

4 % of World population

/!\ there is several kinds of color blindness /!\

See colourblindness simulators



# BIG ISSUE

**Not easy to satisfy everybody when you have a global audience (web site).**

**Because people tend to see things  
But not mandatorily what you want to show.**

Things they love

Things they hate

**Not mandatorily what you show, but what they interpret**

# **Communication.**

## **Example : this course**

**(any lecture)**

**What I know**

**What I thought of**

**What I wrote**

**What you read**

**What you take away**

**How you will explain it to someone else**

**What that person will remember**

**...**

**All these can be different from one another**

**Hopefully not**

# Communication is difficult

**Charts are a way to communicate,  
to give an information disguised  
as a scientific proof**

**[https://en.wikipedia.org/wiki/  
Milgram\\_experiment](https://en.wikipedia.org/wiki/Milgram_experiment)**



# **ANTIPATTERN : ONE DATAVIZ TO RULE THEM ALL !**



**Predicate :**

**ONE DATAVIZ CAN EXPRESS ANY DATA !**

**It is Camembert viz (Eng : pie chart)**

**Or so seem to think many, many journalists.**

**FYI : Camembert is from Normandy**

**Real camembert is made from unpasteurized milk**

# ONE DATAVIZ TO RULE THEM ALL !

**Predicate :**

**ONE DATAVIZ CAN EXPRESS ANY DATA !  
It is Camembert viz (Eng : pie chart) !!**

**Experience replies :  
No, not at all**

**NO !!!**

# Same data

Can be represented in many ways

So many chart types to choose from

# Same data

Can be represented in many ways

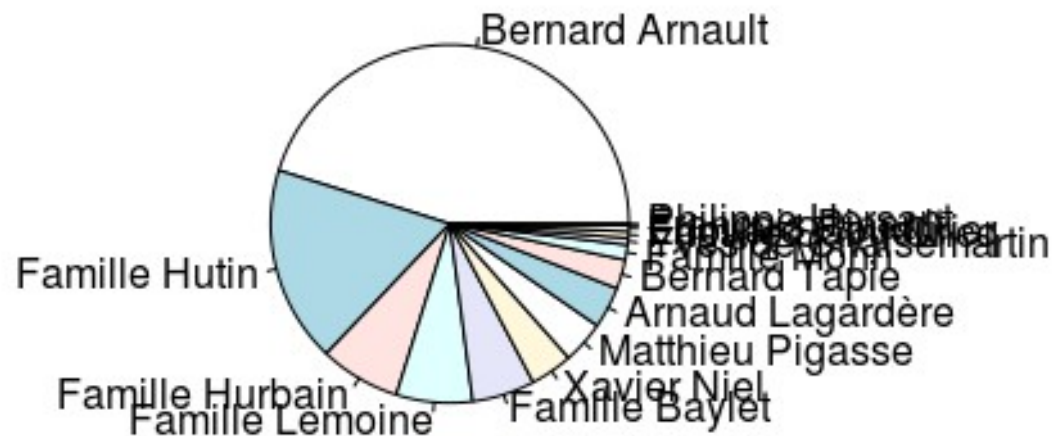
So many chart types to choose from

The role of charts is to make data show a meaning within a glance



# Pie - Most known & badly used

**We will see later what this data is**



**Your comments ?**

Source : [https://github.com/wadael/presse\\_fr](https://github.com/wadael/presse_fr)

# **Did I hear 'unreadable' ?**

**Indeed, unreadable**

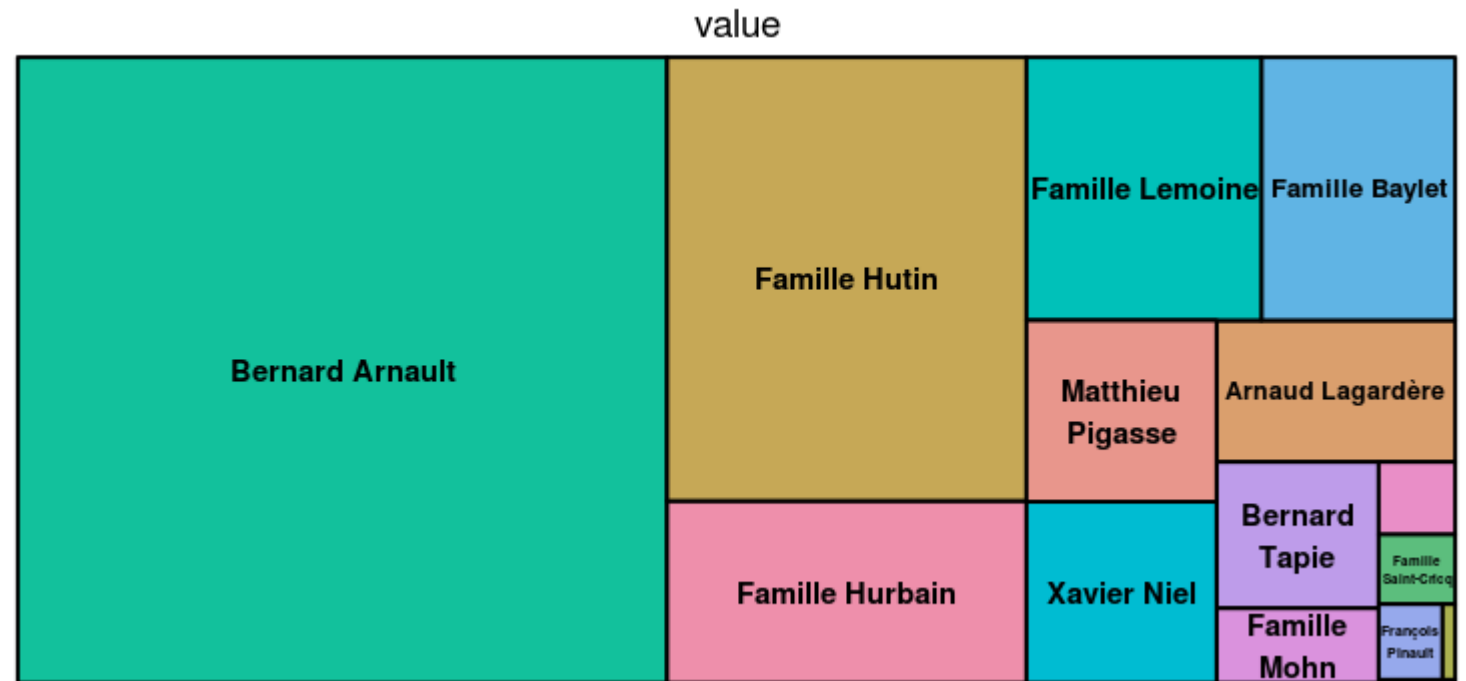
**5 points for Gryffindor**

# 'Too much data' issue



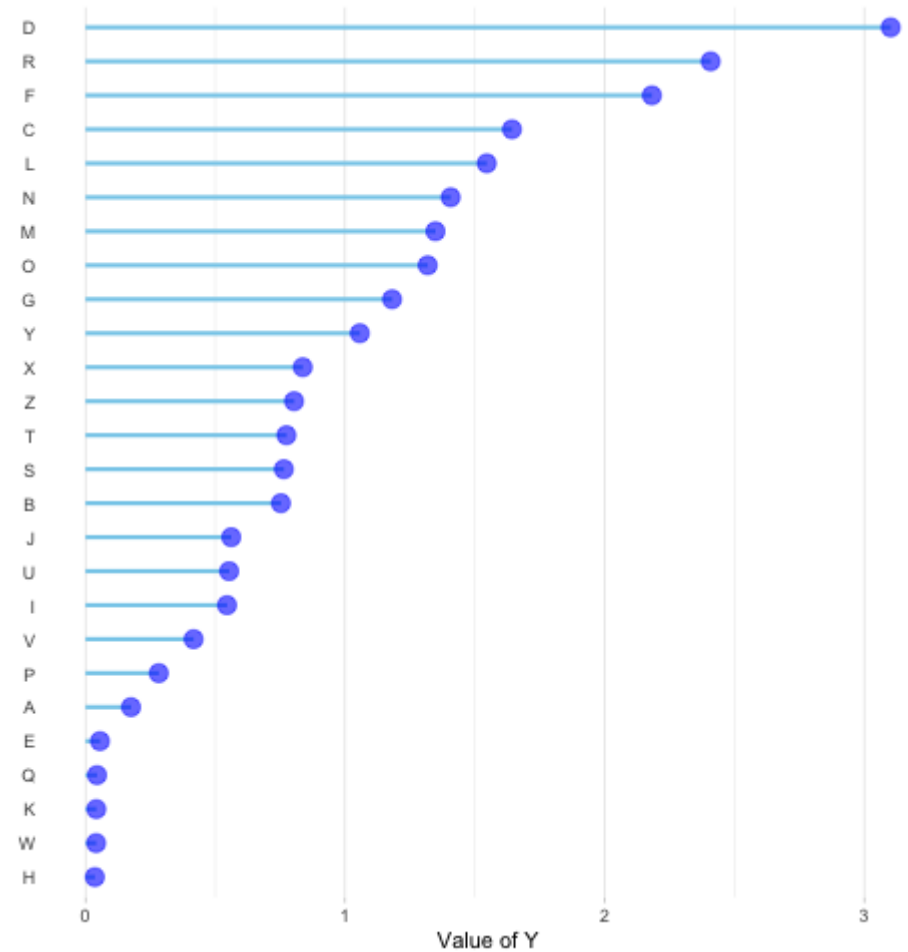
**This chart is better**

**(treemap)**



# Lollipop

**Gives a better insight  
Than pie**



! Do not forget to sort !

# Plenty of fish in the ocean

**To find the good dataviz, you need to select a few factors**

- \* nature of information (numeric, map ...)**

- \* how many parameters is there ?**

  - 1 : business per year

  - 2 : business per year per business line

  - 3 : business per year per business line per continent

- \* how many dimensions ?**

**/!\ Color scheme**

**Is all data shown ?**



**Charts are used to fool people**

**They are displayed as proofs of anything**

**And just like numbers can say anything and its contrary, charts are the same**

# How to fool people

## Scales

Sometimes scale is given and not respected

Linear and logarithmic produce different results

No origin in the chart

**A scale must start at zero and be linear !**

Because this is implied for most readers

## Units

Different units on the same axis



# Examples of this

**On every election day in France, I see lying charts**

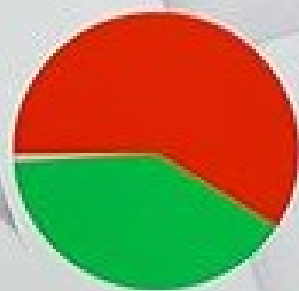
**Like 40 % being more than the half of a half-disc representing the new chamber of Parliament repartition.**

**With the % written on it .....**

BFM TV 17.01

ÊTES-VOUS FAVORABLE À LA DÉFINITION D'OBJECTIFS CHIFFRÉS ("QUOTAS")  
SUR UN CERTAIN NOMBRE DE MÉTIERS EN TENSION ?

L'OPINION  
EN DIRECT  
BFM TV ELAB



**35%**  
OPPOSÉ

**64%**  
FAVORABLE

SONDAGE ELABE POUR BFM TV

**ALERTE INFO** - Pour 59% des Français, l'immigration et l'asile sont  
"des sujets majeurs" qui "doivent être évoqués" (Elabe/BFM TV)

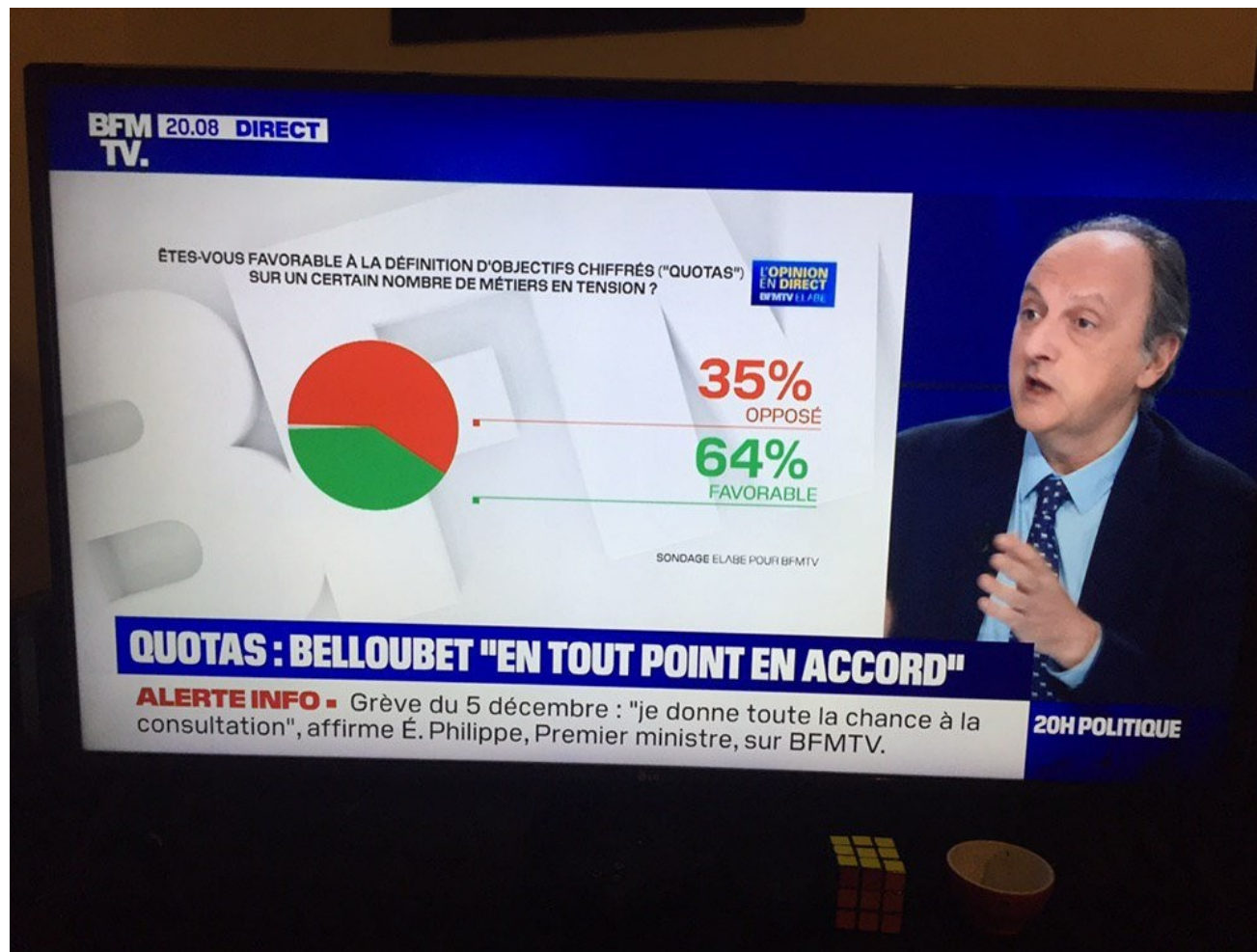
BFM STORY

# Local FoxNews at it again !



**Clearly 48 % is more than a half :)**

**Also, color choice is never innocent  
(green is support government)**



# Same old song

The year was 2005

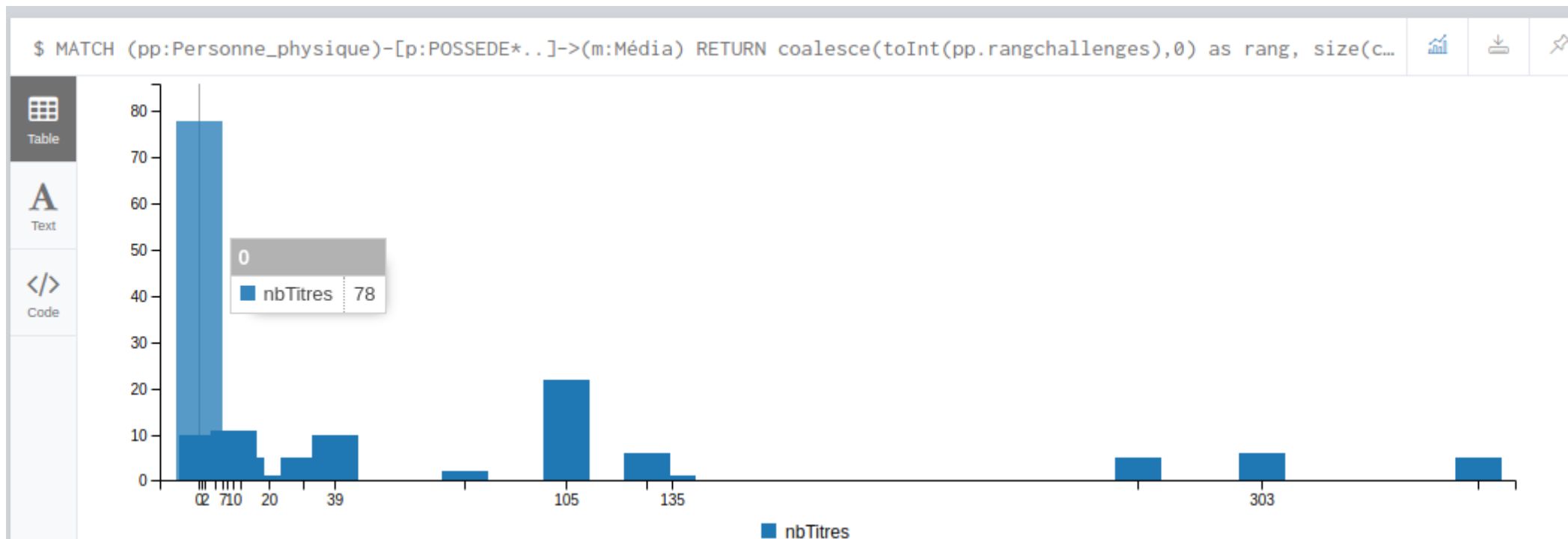
Final result :  
No 54,68 %

The chart is mainly red, this is  
an issue

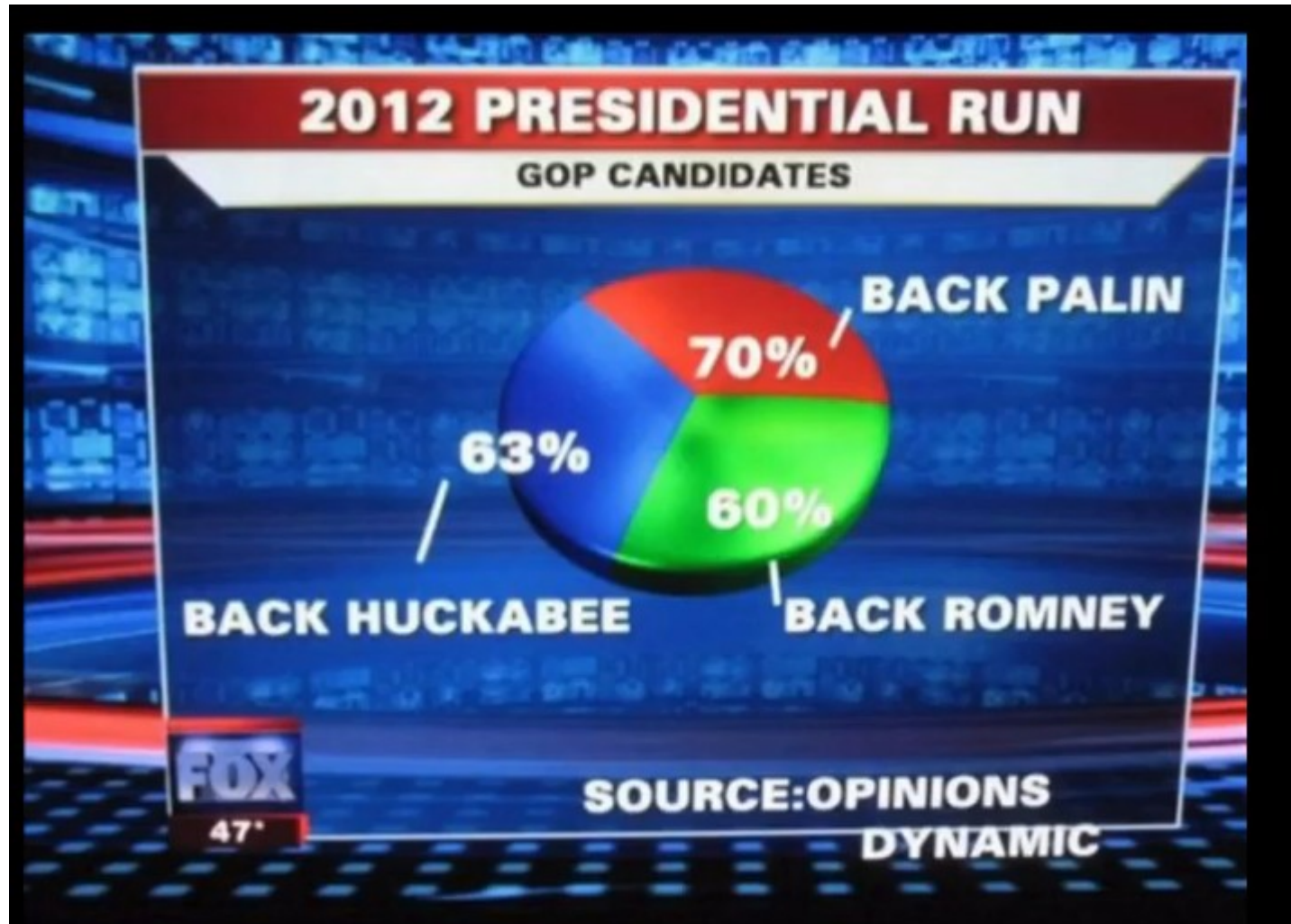


# One for which I can only blame myself

This is an ugly, useless bar chart





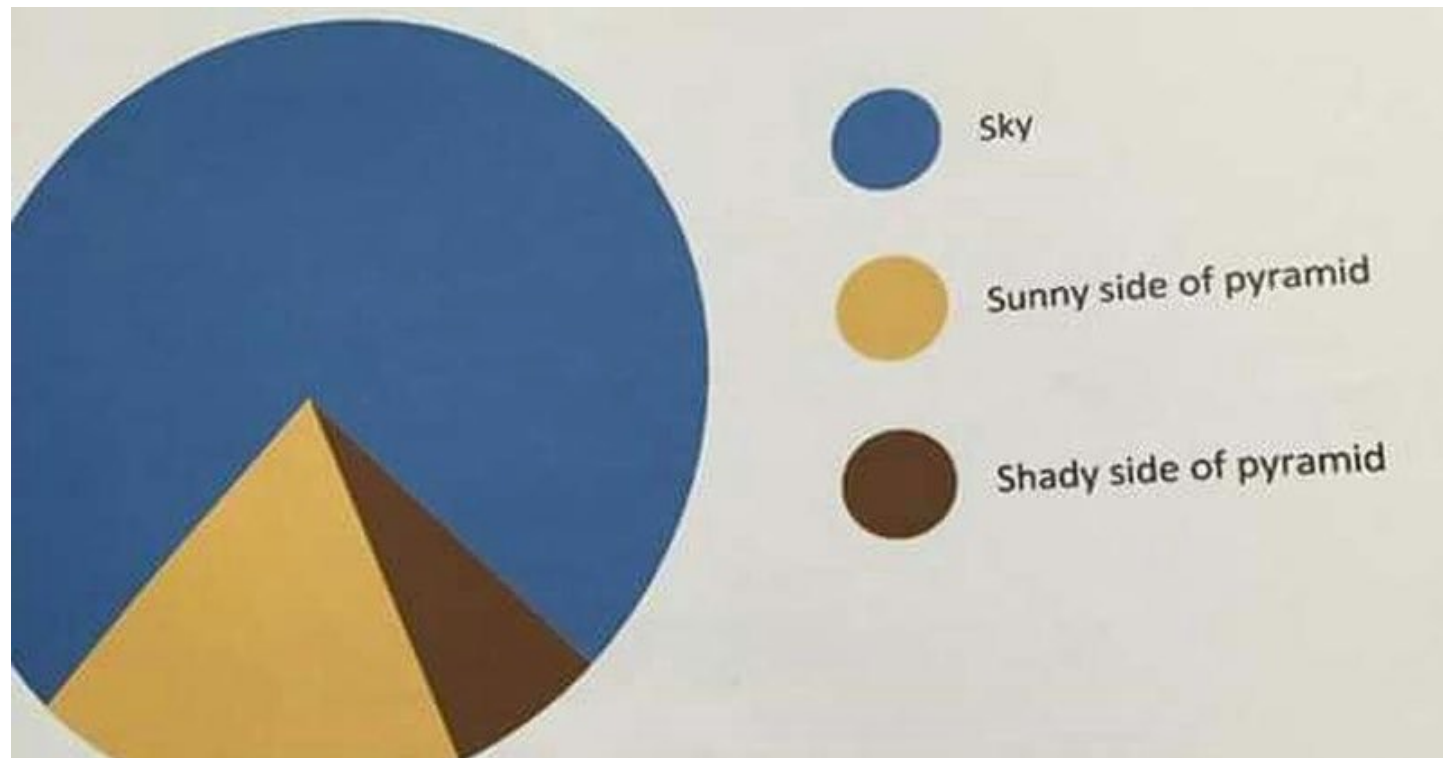


# U.S humor (American pie)





# More Pie humor

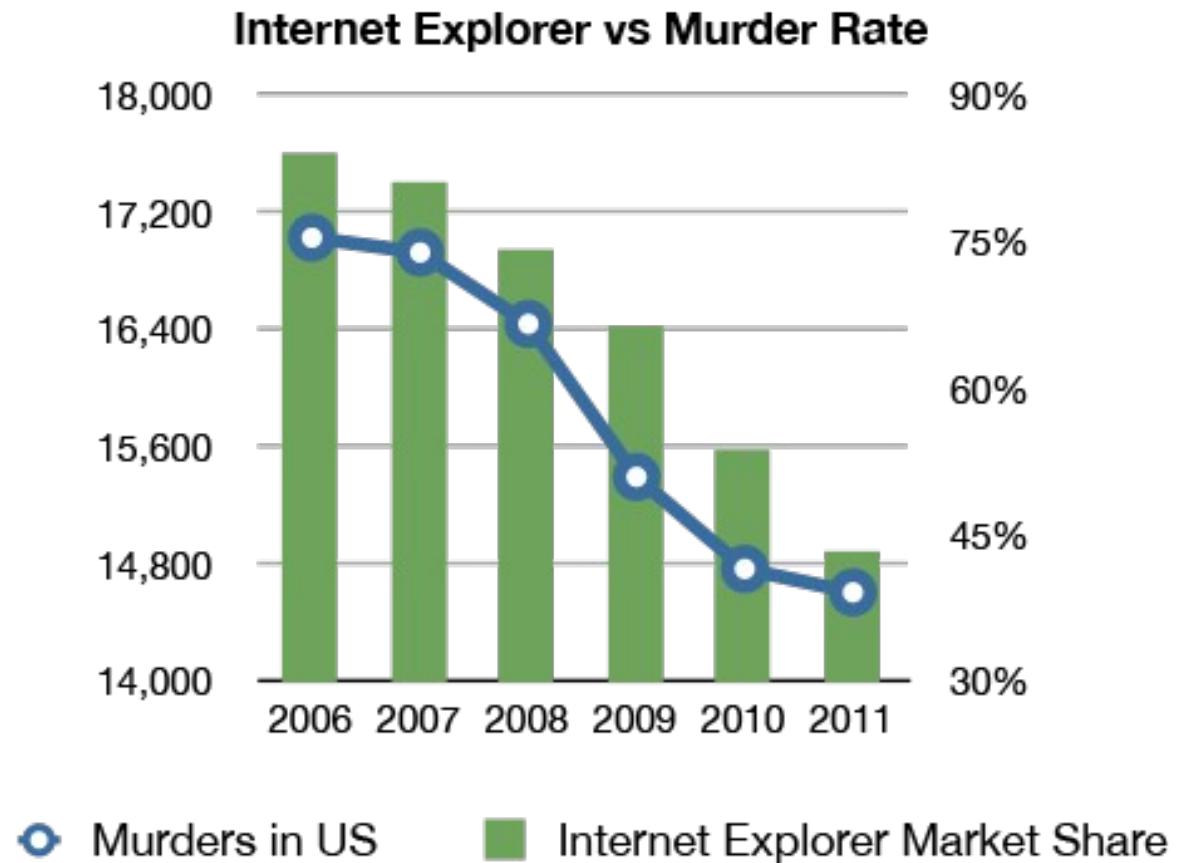


# Perfect pie usage

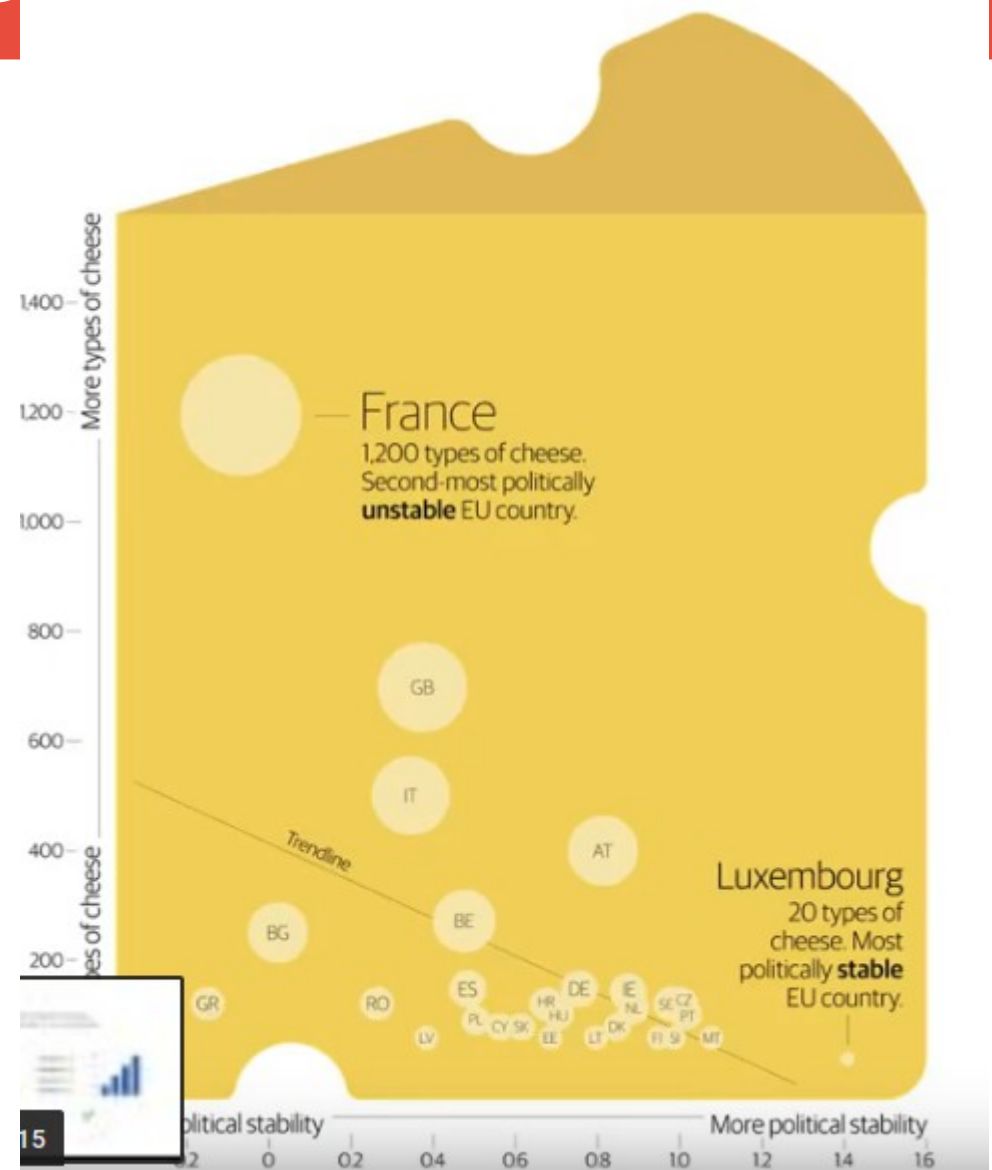


# One more faulty chart

**Numbers  
can be used to  
prove anything**



# Not bad, just too rich





**Lets have a new look to the first slide.**

**It was BAAAD**

**find why**

The major goals of this course are to understand how visual representations can help in the analysis and understanding of complex data, how to design effective visualizations, and how to create an interactive visualization using modern web-based frameworks.

It explores the underlying theory and practical concepts in creating visual representations of large amounts of data. It covers the core topics in data visualization: data representation, visualization toolkits, scientific visualization, medical visualization, information visualization, flow visualization, and volume rendering techniques



- **Title repetition**
- **Unreadable block of text**
  - Not easy to read on screen
  - No spacing
  - Same term repeated ad nauseam
  - leads to → no idea what was on the slide as soon as slide changes
- **Logo in an unexpected place**
  - Top Left is more common



# **That was just a warning**

**Presenting efficiently is another skill**

**However some items are shared between charting and powerpointing.**

**(this is outside of course' scope)**

# Rules of thumb

**A few**

**(we'll add more along the way)**

# Overloading

**DO NOT OVERLOAD the chart**

**Ask yourself**

**« Do you really think this needs 5 lines ? »**

**« Where is my area ? » (hidden)**

**« how to read a bubble-filled bubble chart ? »**

**« should I compare life expectancy in the last 50 years for all the known countries in the same chart ? »**

# Organize logically

**Choose how you sort data.**

**Do not go with defaults**

(in python, defaults set by the chart library)

# Help comparisons

**Why having two line charts looking alike side by side**

**if you can draw two lines in one chart ?**

# No overplotting

**Keep it readable**

**Remember the ballerinas**

**Also, think of a bubble chart with all circles grouped**

# Find a good title



# Use another pair of eyes

**Ask someone who did not work on your viz  
how (s)he understands your viz.**

**Ask this person the basic questions you wanted  
to answer with your chart.**

**That must match**



# Plenty of fish in the ocean

**Some people on the Internet have made a terrific work in classifying the existing data visualizations.**

**They made the flowchart to decide which chart to use.**

**Lets have a look at a**

**<https://datavizcatalogue.com/>**

**<https://www.data-to-viz.com/>**

**<https://www.r-graph-gallery.com/all-graphs/>**

# Bookmark and explore

<https://datavizcatalogue.com/>

**And**

<https://www.data-to-viz.com/>

**Are very useful sites to decide what chart to use.**

**Bookmark them**

**Explore them**

# Credits

[http://pre15.deviantart.net/f493/th/pre/i/2012/142/1/9/a\\_picture\\_is\\_worth\\_a\\_thousand\\_words\\_by\\_shadowxomega5-d50oo8p.png](http://pre15.deviantart.net/f493/th/pre/i/2012/142/1/9/a_picture_is_worth_a_thousand_words_by_shadowxomega5-d50oo8p.png)

<https://hikingartist.files.wordpress.com/2012/07/a-picture-is-worth-a-thousand-words-3.jpg>

<https://www.outsidethebeltway.com/farewell-to-lotus-1-2-3/>

<https://mathix.org/linux/archives/12851>

[https://assets.ils.fr/pages/7363852/HIS.2de.AP.graphique\\_greve\\_.jpg](https://assets.ils.fr/pages/7363852/HIS.2de.AP.graphique_greve_.jpg)

## Recommended book

**Data Visualization with Python**

**Mario Döbler and Tim Großmann - Packt Publishing**

# Exercises

**List the steps to create the best chart possible**

**Get DASH**

**Install**

**Get sample project**

**Adapt it (or get Sakila DB)**

**Lets pick a few dataviz and for each one, lets find**

**A case when it is perfect (explain why)**

**A case when it is a bad choice (explain differently)**

**2 dataviz per student, please synch yourselves**

**Will be shared with group later**