

„Data visualization is the fastest way to make a whole bunch of numbers look a lot more interesting.“

Vizualizace dat

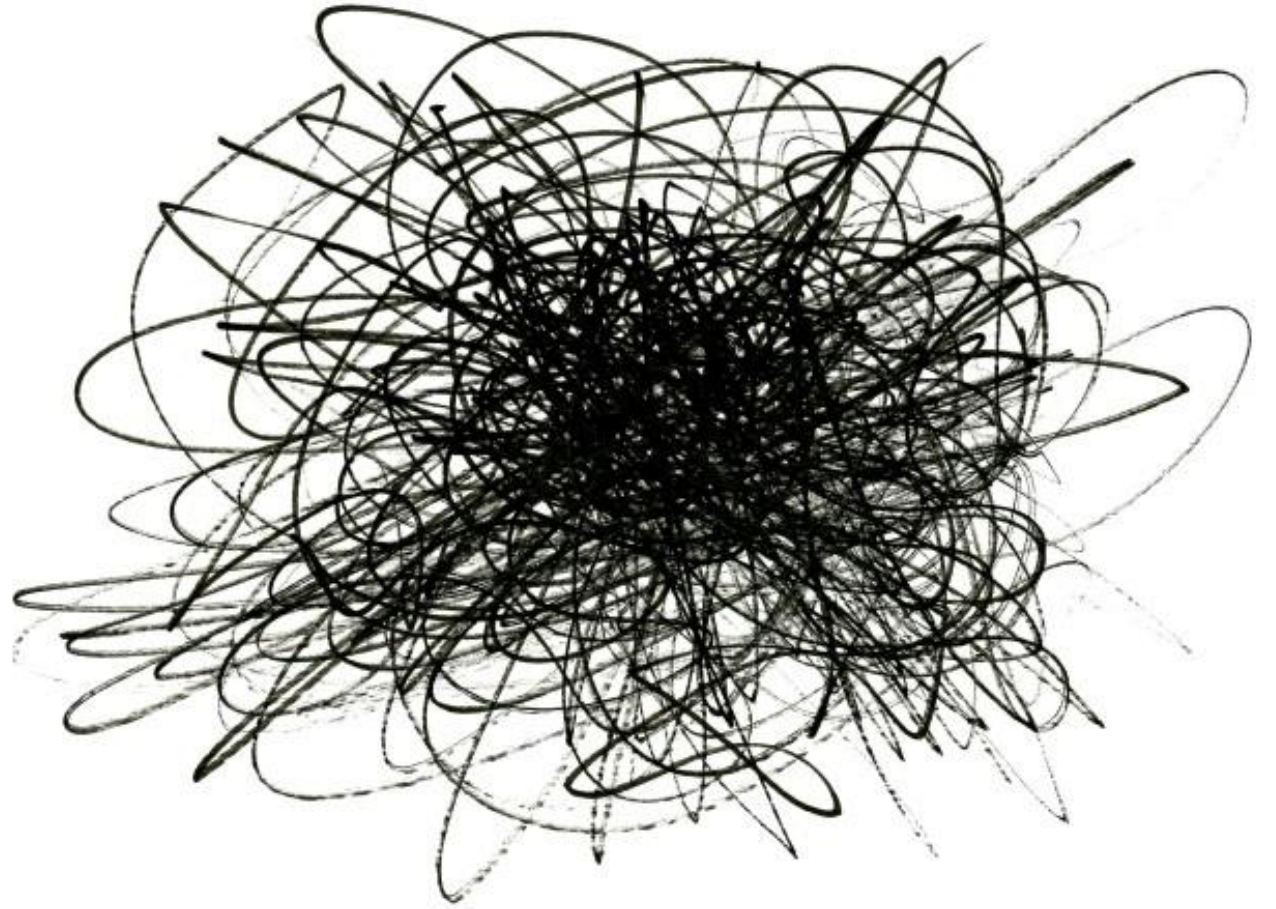
Úvodní a organizační hodina

15. 9. 2022

Kontakty

- *marek@kisk.cz*
- MS Teams
- Interaktivní osnova

Co čekáte?



muni.cz/go/dataviz

Co čekám já?

- Komplexní pohled (*informační design...*)
- Vizualizace jako nástroj
- Proč, kdy a jak ji používat v různých kontextech
- Základy, výzkumy, triky a tipy
- Dobrá a špatná praxe
- Historie – protože to dává smysl
- Hraní si s klikačkami
- Specificky zaměřené hodiny: kognice, barva, mapy...

Požadavky na ukončení

- Průběžné úkoly – *pár jich bude*
- Zkouška?
- Docházka?

Proč jsme tady?

Aktuálně máme hodně dat.

Data jsou všude.

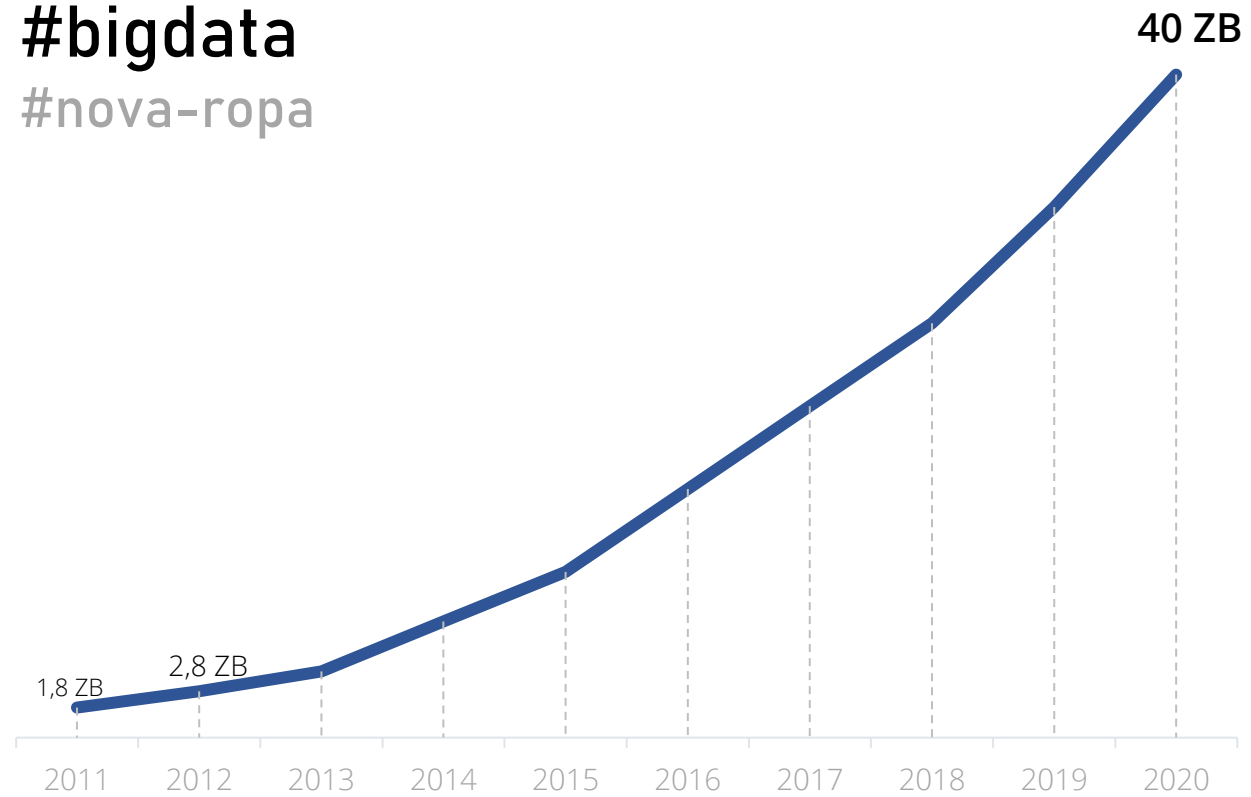
Data jsou o všem.



"According to all the big data we've gathered, our discussions about big data are up 72% this year alone."

#bigdata

#nova-ropa



X	Y	Z	AA	AB
JUNE 2017				
Sales	Tax			
4,840,579	\$ 1,064,302			
5,215,122	\$ 1,256,920			
2,952,720	\$ 987,355			
2,224,265	\$ 774,935			
3,890,290	\$ 838,947			
3,979,018	\$ 830,231			
4,617,850	\$ 833,773			
4,774,399	\$ 901,683			
5,381,983	\$ 1,219,918			
2,932,589	\$ 1,004,275			
2,141,298	\$ 763,059			
4,088,307	\$ 784,215			
3,990,602	\$ 816,751			
4,554,625	\$ 861,428			
4,922,840	\$ 951,585			
5,449,133	\$ 1,246,051			
2,988,242	\$ 994,368			
2,299,106	\$ 775,098			
3,879,202	\$ 810,374			
4,214,111	\$ 866,423			
4,651,739	\$ 904,261			
4,727,973	\$ 939,773			
5,346,354	\$ 1,192,097			
2,847,706	\$ 965,755			
2,165,789	\$ 754,109			
4,027,001	\$ 825,657			
4,352,374	\$ 832,652			
4,783,360	\$ 868,812			
5,402,665	\$ 959,733			
7,270,700	\$ 1,423,554			
124,911,942	\$ 28,248,093			

2017 Summary	
Sales	Tax
\$1,365,571,860	\$ 311,232,693

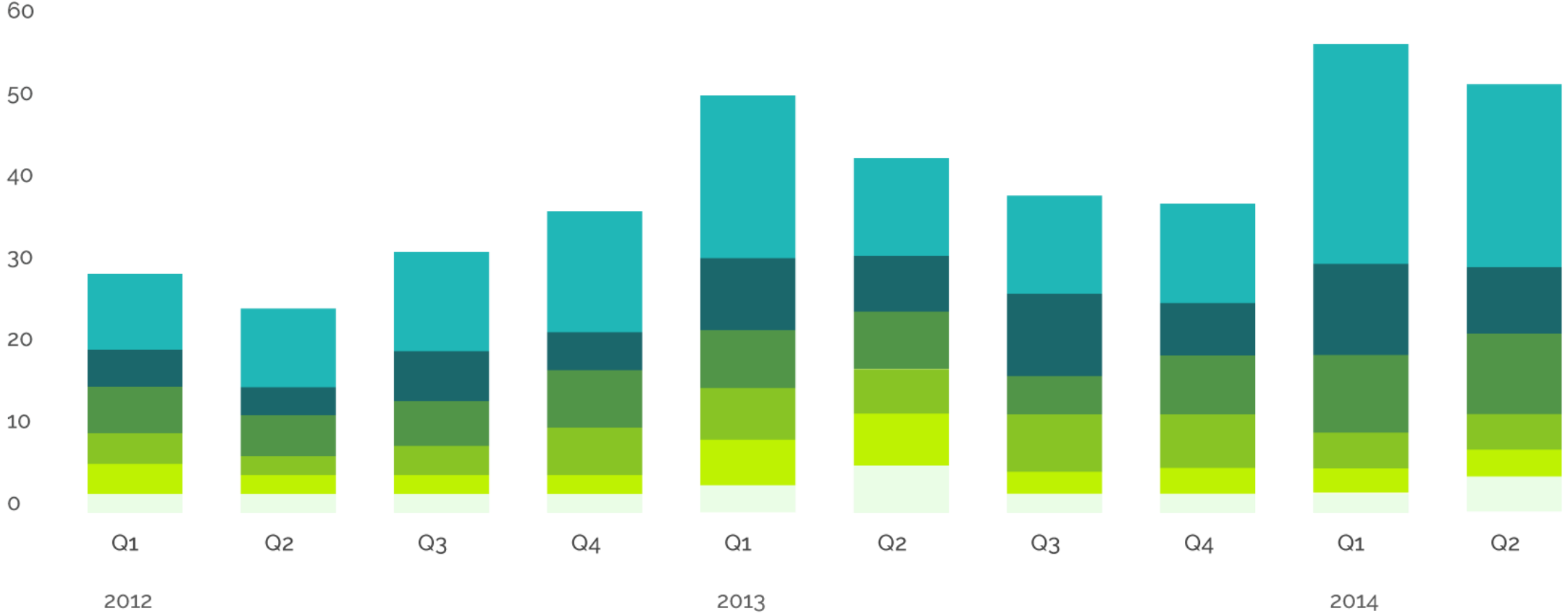
	A	S	T	U	V	W	X	Y	Z	AA
2	DATE	APRIL 2016			MAY 2016		JUNE 2016		2016 Summary	
3		Tax	Sales	Tax	Sales	Tax	Sales	Tax	Sales	Tax
4	1	\$ 563,580	\$ 3,323,081	\$ 881,812	\$ 1,436,863	\$ 487,540	\$ 3,087,816	\$ 686,992	\$786,387,430	\$ 1
5	2	\$ 516,337	\$ 1,971,737	\$ 652,143	\$ 2,266,284	\$ 534,466	\$ 3,282,005	\$ 643,917		
6	3	\$ 577,848	\$ 1,392,094	\$ 472,041	\$ 2,449,472	\$ 591,603	\$ 3,804,940	\$ 898,883		
7	4	\$ 725,025	\$ 2,104,560	\$ 519,457	\$ 2,833,248	\$ 541,924	\$ 2,188,886	\$ 702,189		
8	5	\$ 631,954	\$ 2,293,434	\$ 542,937	\$ 3,220,679	\$ 616,830	\$ 1,584,063	\$ 514,321		
9	6	\$ 463,323	\$ 2,658,728	\$ 527,966	\$ 3,450,675	\$ 788,272	\$ 2,636,948	\$ 600,291		
10	7	\$ 488,557	\$ 3,225,386	\$ 557,070	\$ 2,037,710	\$ 631,961	\$ 2,544,690	\$ 569,928		
11	8	\$ 506,731	\$ 3,283,071	\$ 748,172	\$ 1,477,601	\$ 514,467	\$ 2,879,905	\$ 591,792		
12	9	\$ 495,068	\$ 1,926,156							
13	10	\$ 553,055	\$ 1,480,518							
14	11	\$ 720,916	\$ 2,327,832							
15	12	\$ 621,340	\$ 2,376,567							
16	13	\$ 435,885	\$ 2,961,393							
17	14	\$ 501,008	\$ 3,129,414							
18	15	\$ 514,536	\$ 3,539,473							
19	16	\$ 517,905	\$ 2,008,189							
20	17	\$ 544,855	\$ 1,502,015							
21	18	\$ 726,728	\$ 2,795,613							
22	19	\$ 646,488	\$ 3,201,236							
23	20	\$ 478,636	\$ 3,753,646							
24	21	\$ 524,628	\$ 2,421,589							
25	22	\$ 496,148	\$ 2,878,873							
26	23	\$ 505,226	\$ 1,879,411							
27	24	\$ 550,418	\$ 1,315,719							
28	25	\$ 729,227	\$ 2,264,860							
29	26	\$ 618,574	\$ 2,247,245							
30	27	\$ 400,913	\$ 2,908,787							
31	28	\$ 510,471	\$ 3,036,704							
32	29	\$ 494,012	\$ 4,062,385							
33	30	\$ 489,217	\$ 2,520,970							
34	31	\$ 736,630								
35	Total	\$ 17,285,238	\$ 76,790,684	\$ 18,181,181	\$ 35,157,619	\$ 8,789,405	\$ 41,498,522	\$ 10,374,631	\$ 45,916,145	\$ 1

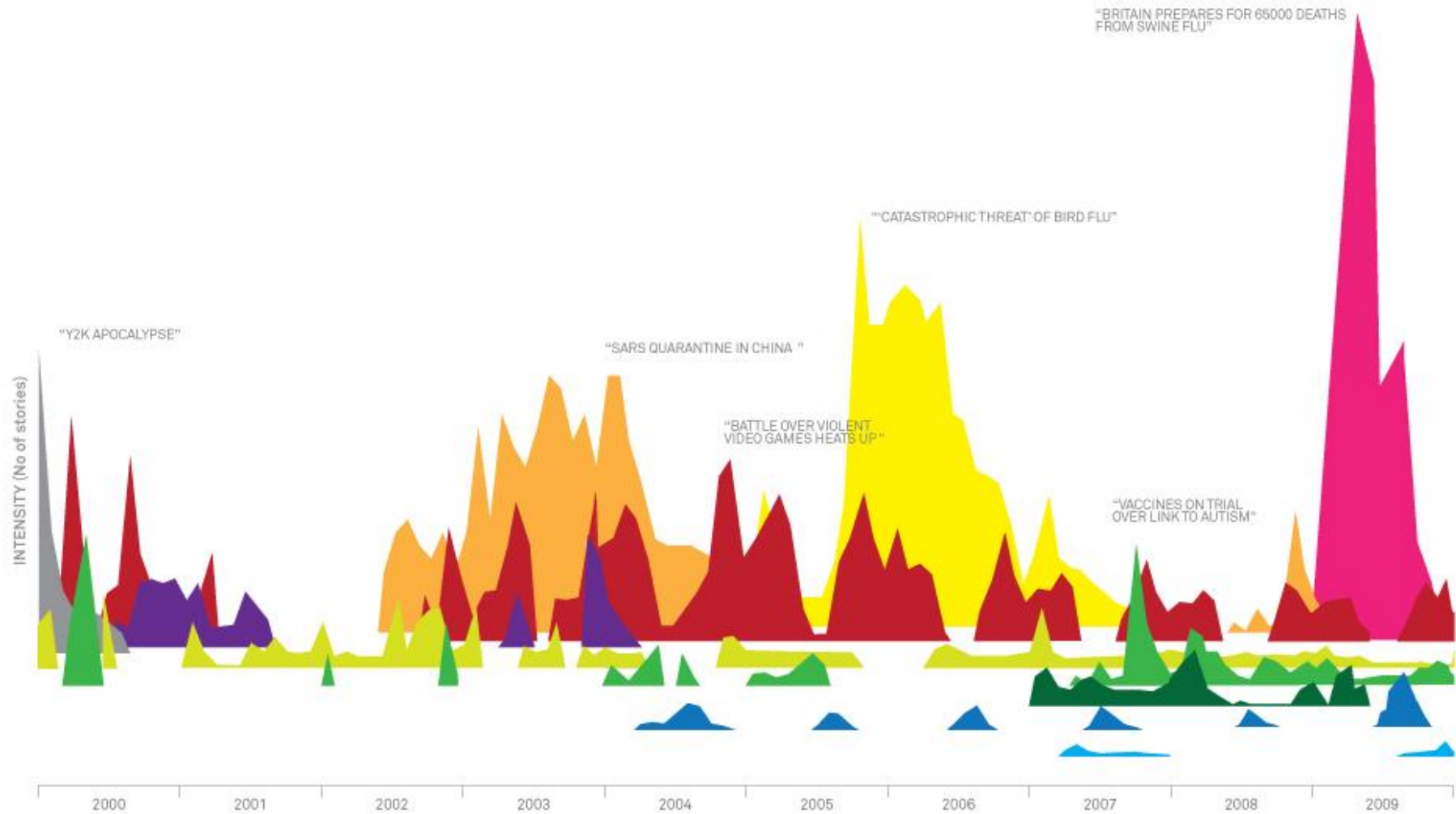
6 2017 2018 +

2015 2016 2017

2015 2016 2017 2018 +

HOW APPLE'S SALES STACK UP

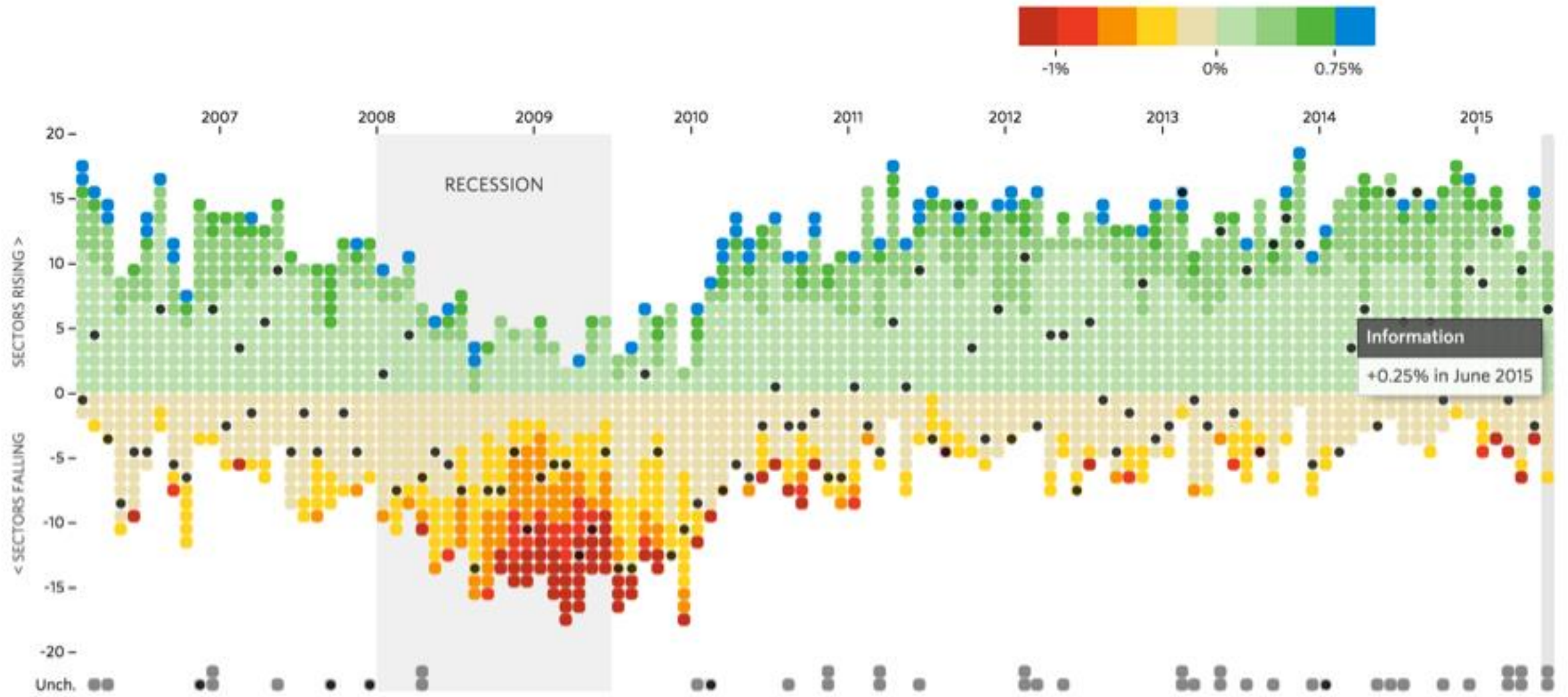


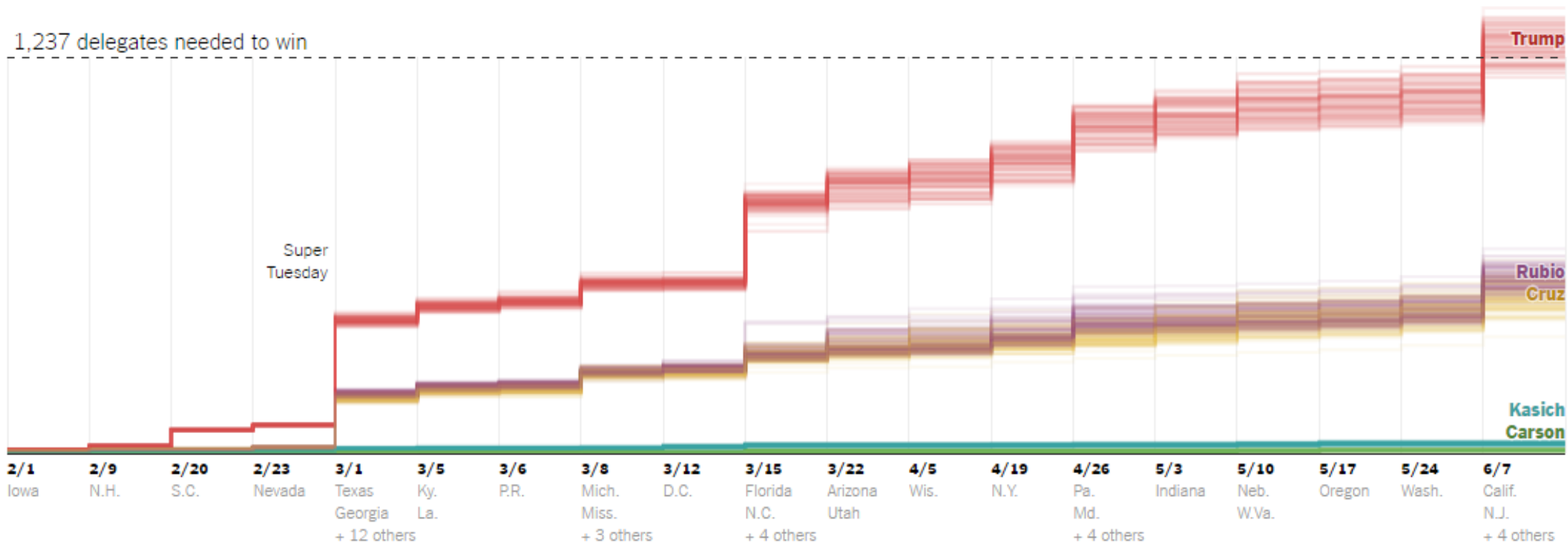


Story (worldwide deaths)

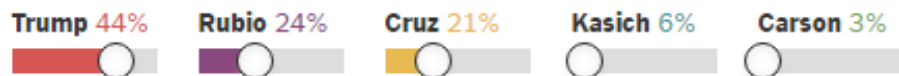
- | | | | |
|-------------------------------|---------------------------|---------------------------------|-------------------|
| ▲ Killer Wasps (1000) | ▲ Autism Vaccinations (0) | ▲ Mad Cow Disease (204) | ▲ Bird Flu (282) |
| ▲ Killer Wifi (0) | ▲ Asteroid Collision (0) | ▲ Violent Video Games (Unknown) | ▲ Swine Flu (702) |
| ▲ Mobile Phones & Tumours (0) | ▲ Millenium Bug (0) | ▲ SARS (774) | |

Mountains Out of Molehills
A timeline of global media scare stories.

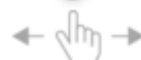
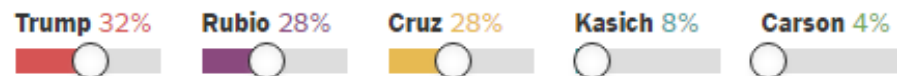


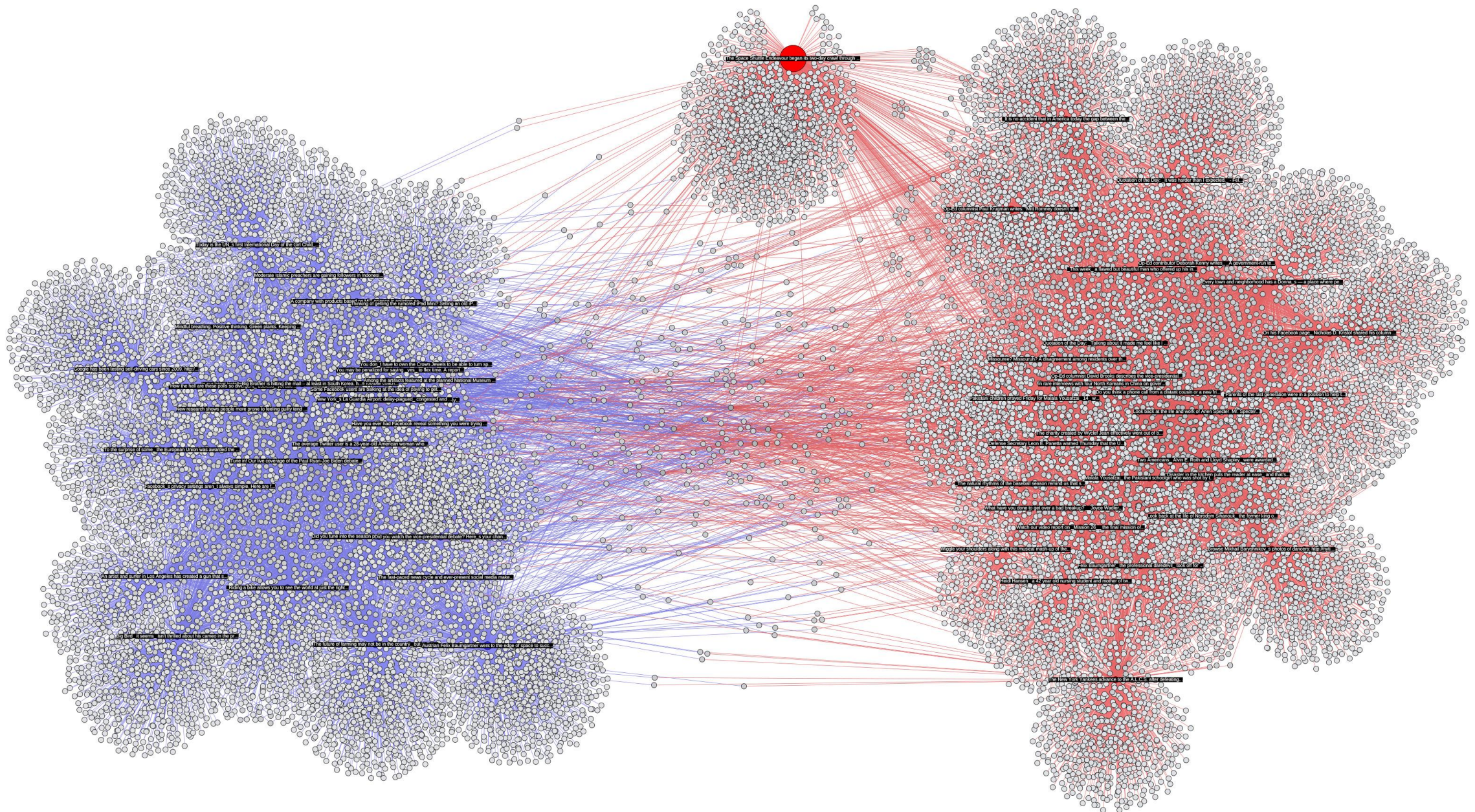


Average results through March 7



Average results after March 7





The Queen Elizabeth II memorial began its two-day crowd

It is the oldest ever in America's history

Location of the Bay - was under the

of a historical post on the street

of Ed Conner's DeCade's history

of the week - loved by local

in the electronic page

Location of the large young

Unusual? Misadventure

of Ed Conner's DeCade's history

of the week - loved by local

of the week - loved by local

look back at the life and work of

The charity created by

of the week - loved by local

of the week - loved by local

The return rhythm of the

of the week - loved by local

of the week - loved by local

look back at the life and work of

of the week - loved by local

of the week - loved by local

of the week - loved by local

of the week - loved by local

of the week - loved by local

The New York

Today is the UN's

Victoria's historic

A company with

Mindful breathing

You go to

Google has been

of the week - loved by local

of the week - loved by local

of the week - loved by local

of the week - loved by local

of the week - loved by local

of the week - loved by local

of the week - loved by local

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of the week - loved by local

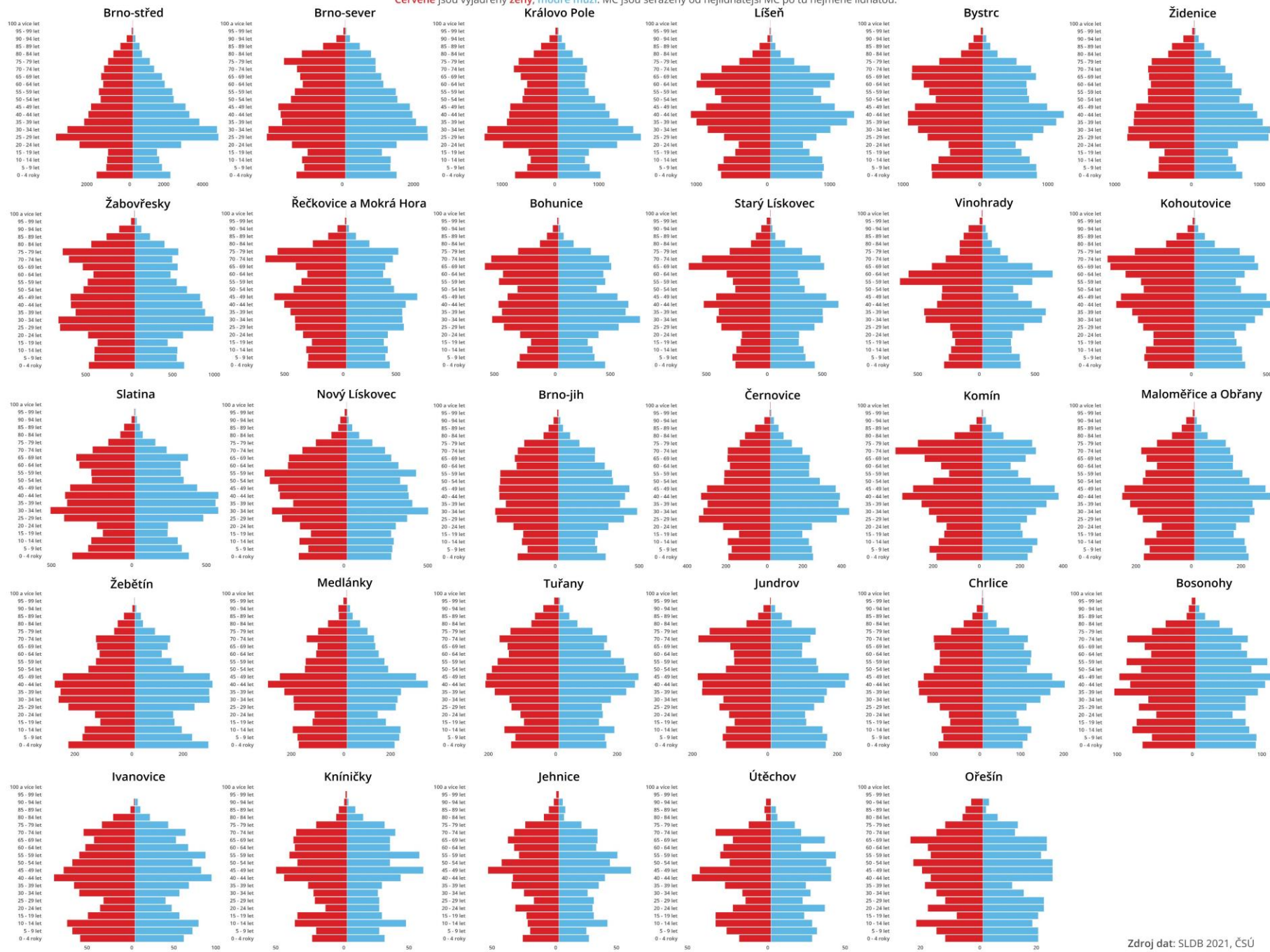
of the week - loved by local

co je dobrá vizualizace?

Věková struktura v městských částech Brna

Grafika představuje 29 městských částí (MČ) Brna rozdělených dle pohlaví a věkových kategorií = věková pyramida.

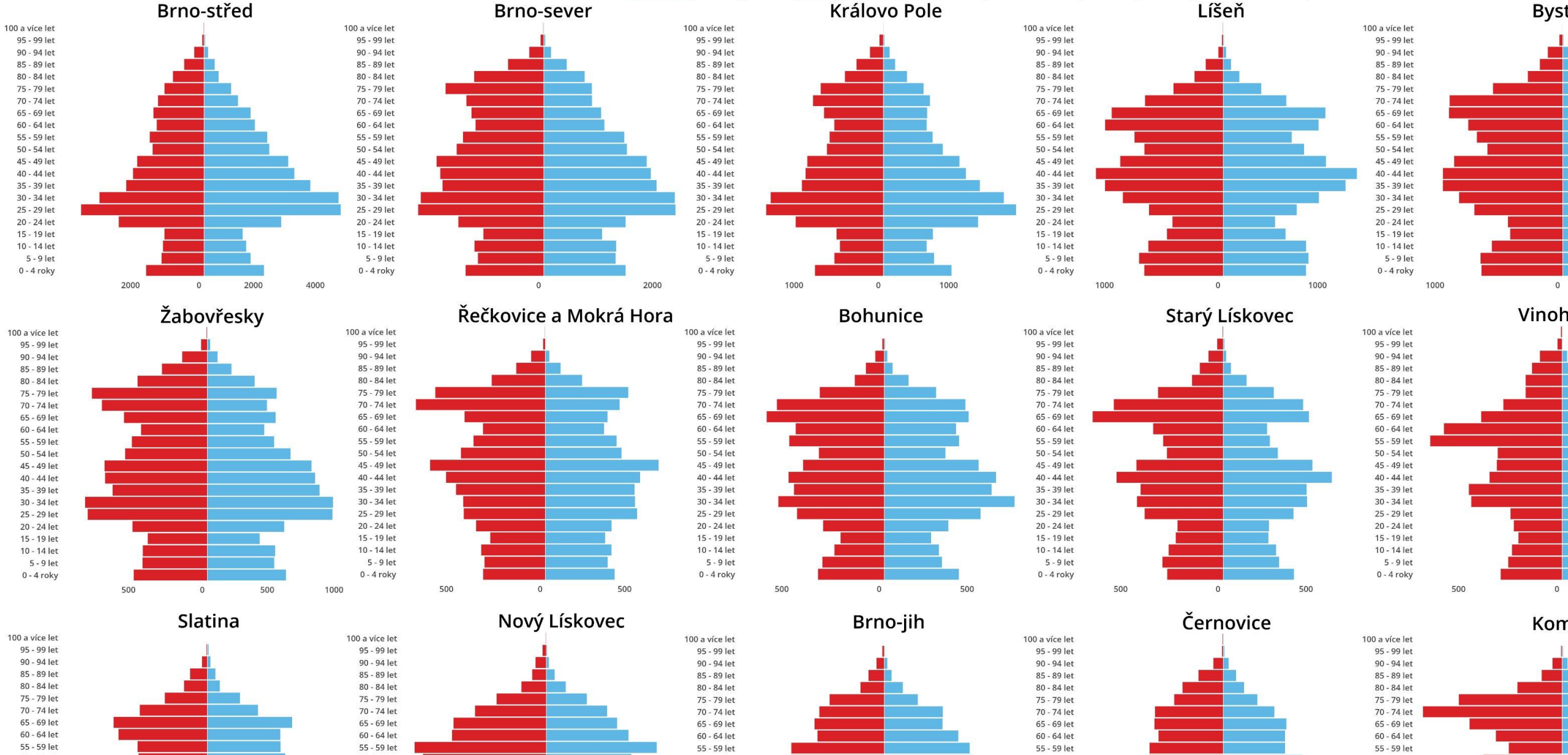
Červeně jsou vyjádřeny ženy, modře muži. MČ jsou seřazeny od nejlidnatější MČ po tu nejméně lidnatou.



Věková struktura v městských částech Brna

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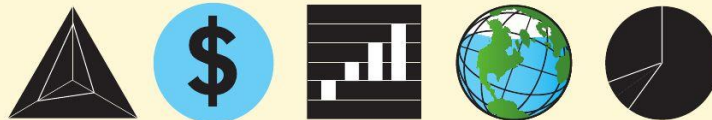
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THE WALL STREET JOURNAL.

GUIDE TO
INFORMATION
GRAPHICS

THE DOS AND DON'TS OF PRESENTING
DATA, FACTS, AND FIGURES



DONA M. WONG



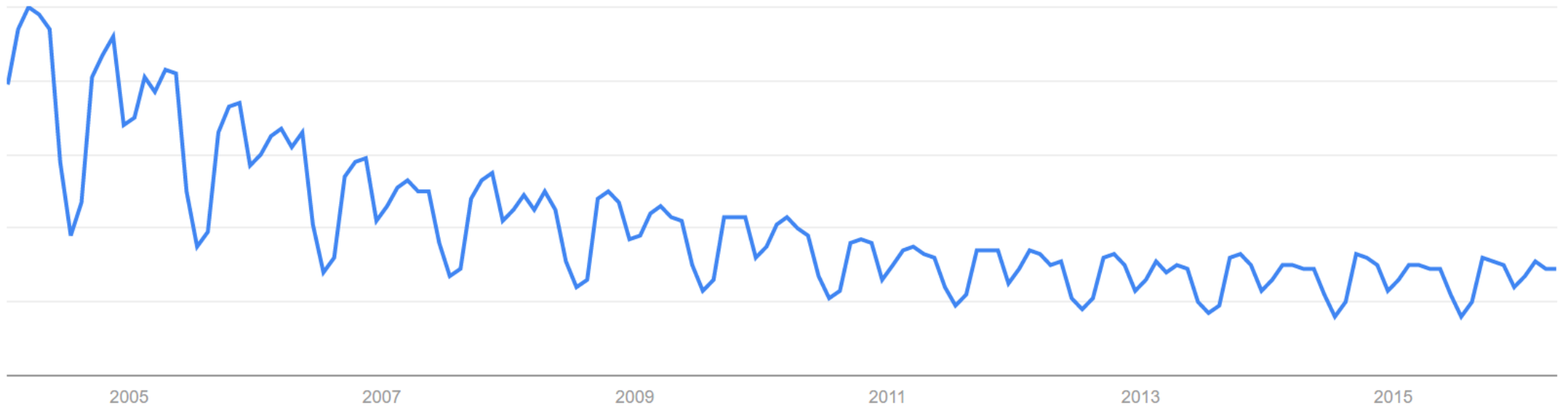
intencionalistická kritika

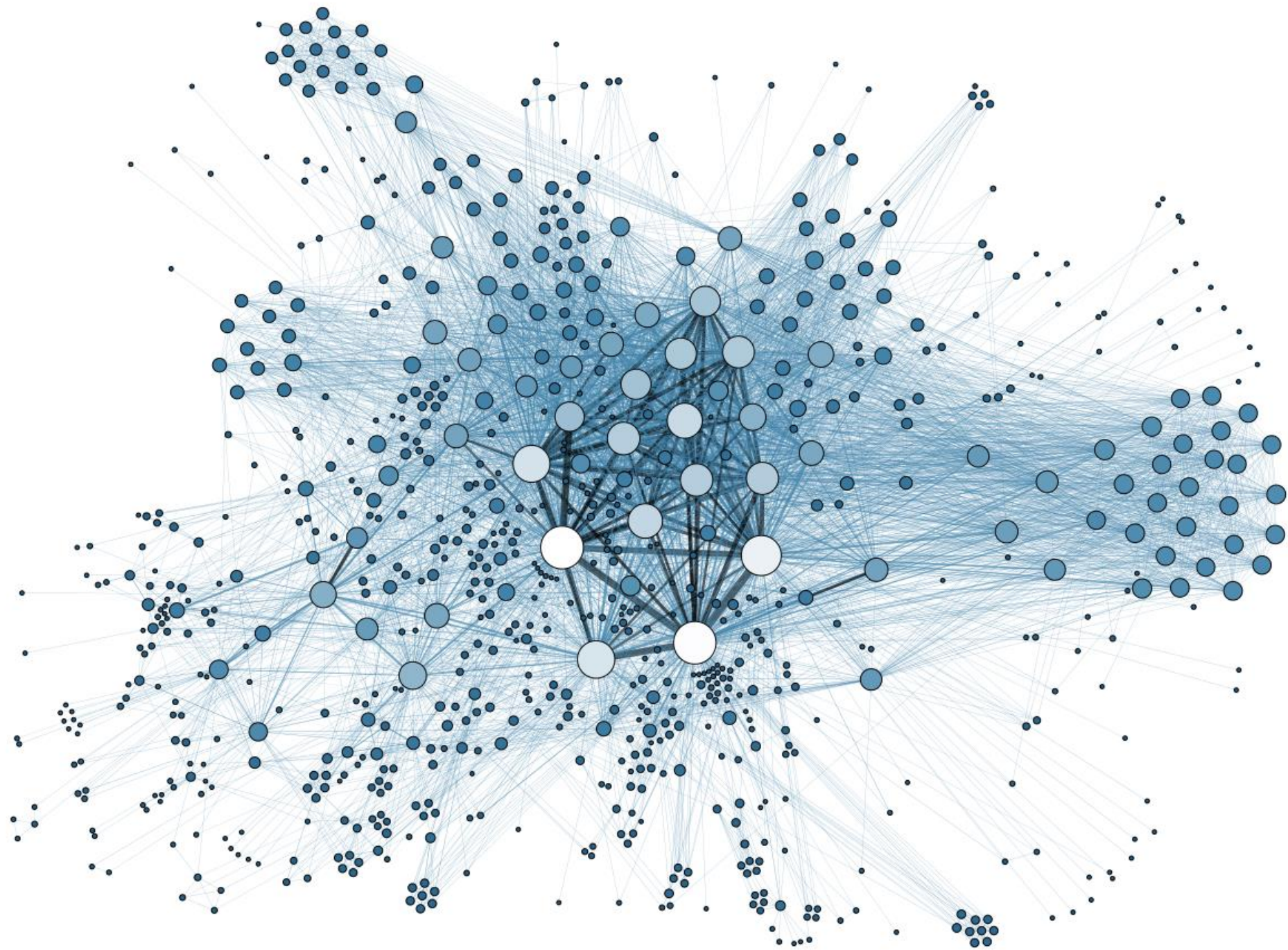


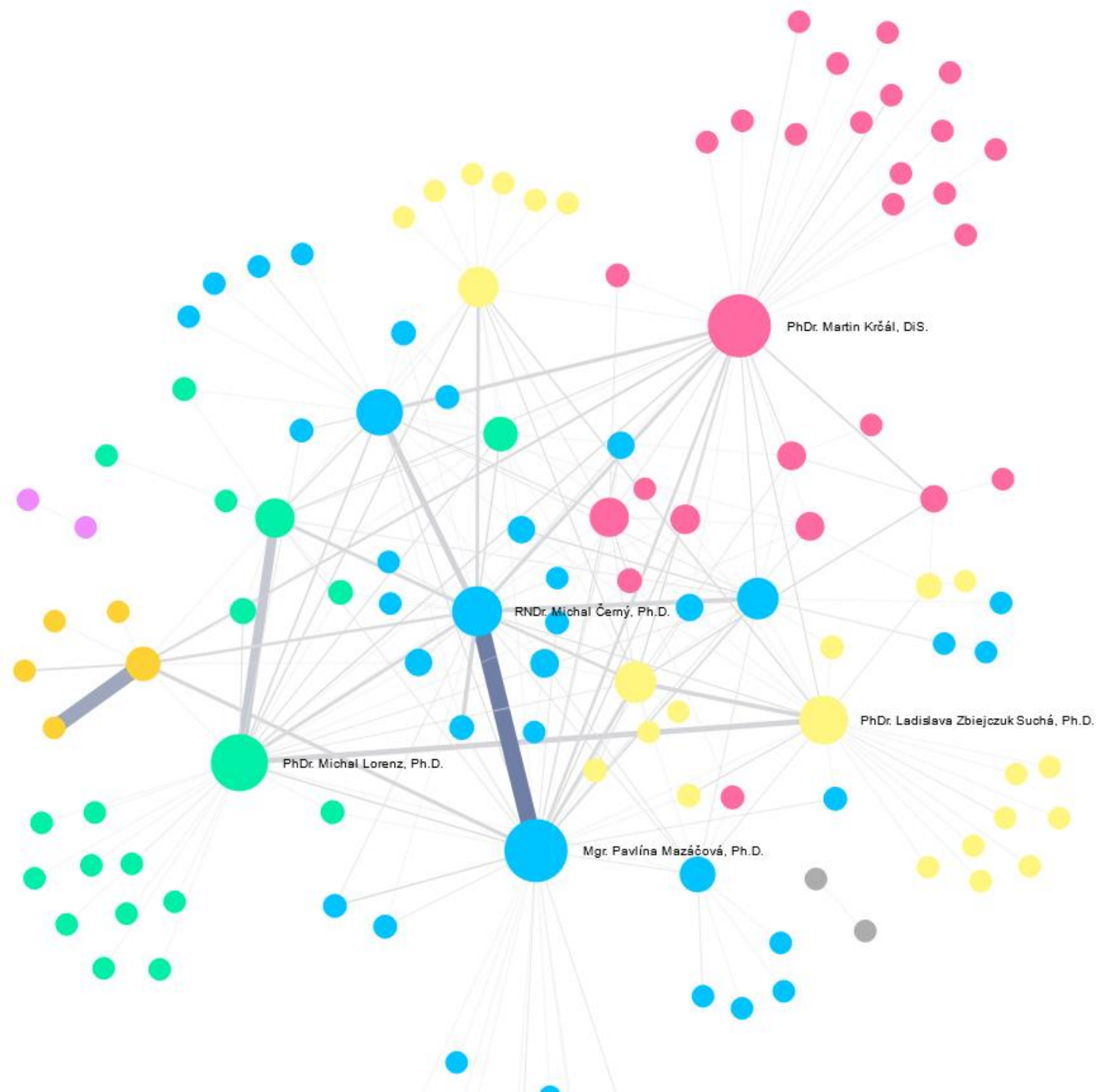
Vizualizujeme data, protože...

...v nich chceme najít vzory, trendy, změny a korelace. Chceme z nich dostat smysluplné informace.



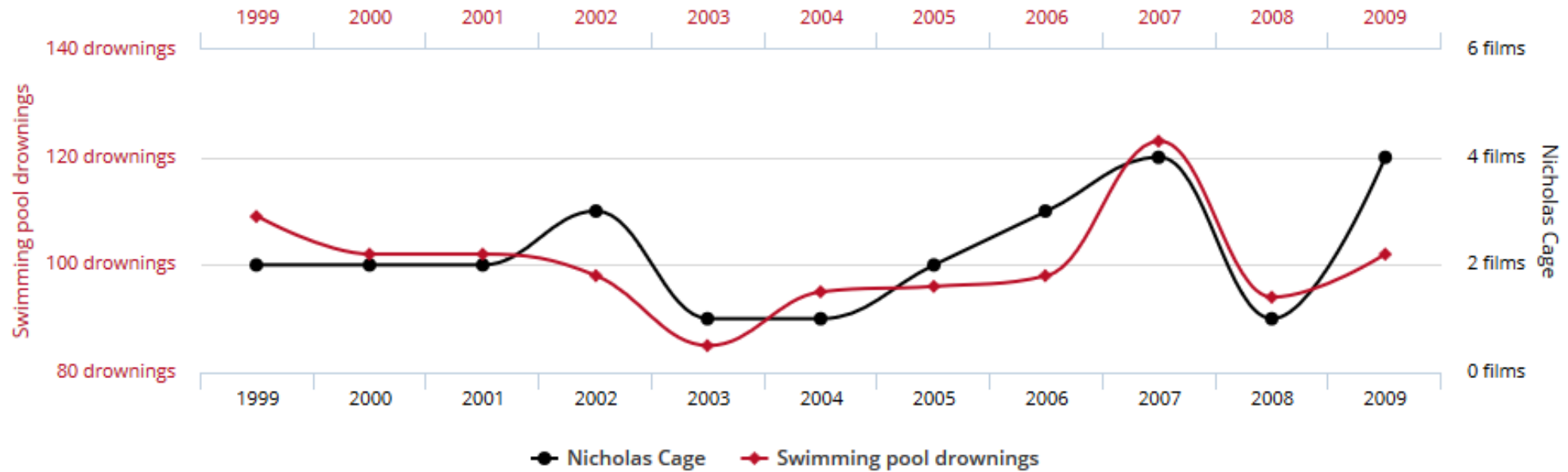






Number of people who drowned by falling into a pool correlates with Films Nicolas Cage appeared in

Correlation: 66.6% ($r=0.666004$, $p>0.05$)



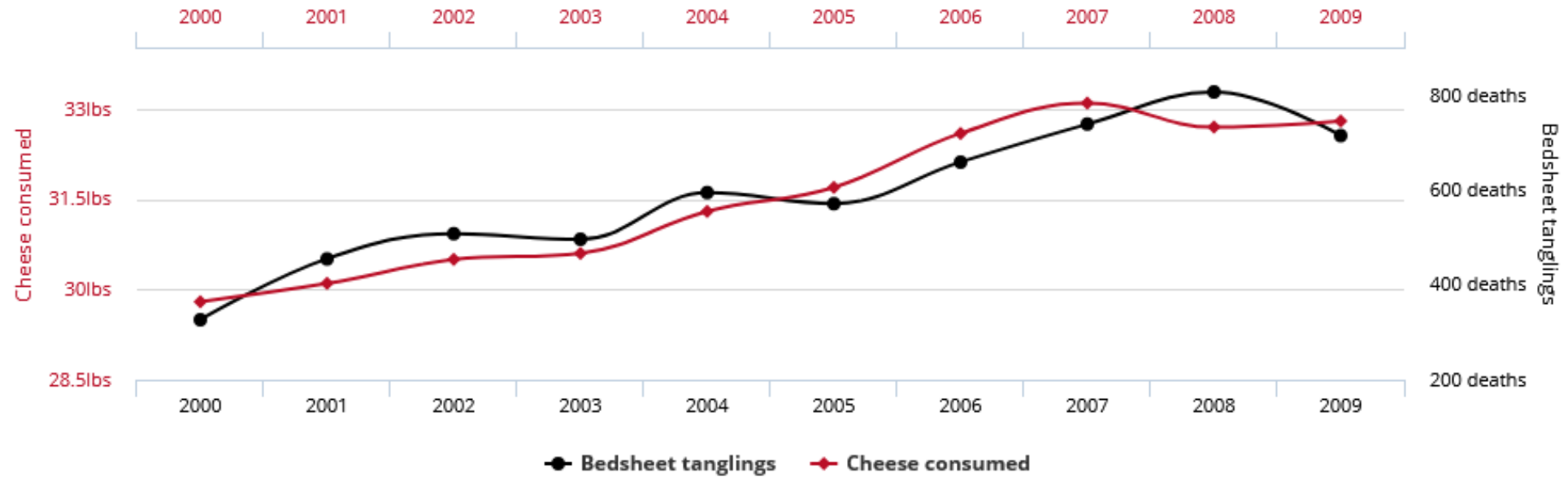
Data sources: Centers for Disease Control & Prevention and Internet Movie Database

Per capita cheese consumption

correlates with

Number of people who died by becoming tangled in their bedsheets

Correlation: 94.71% (r=0.947091)



tylervigen.com

Data sources: U.S. Department of Agriculture and Centers for Disease Control & Prevention

Anscombův kvartet

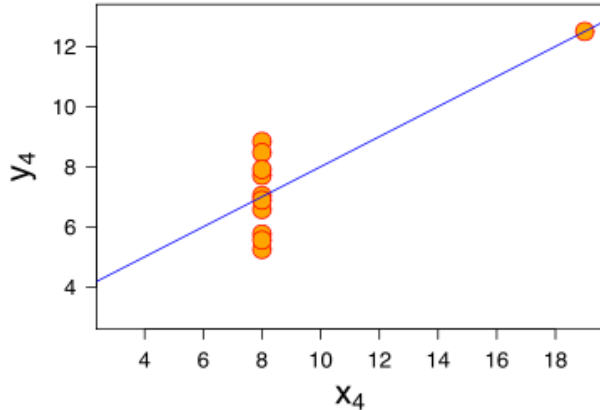
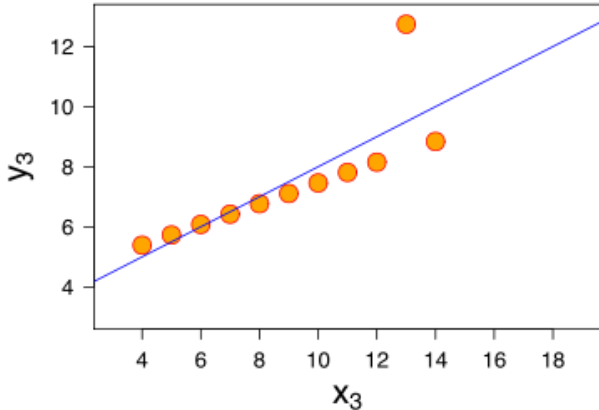
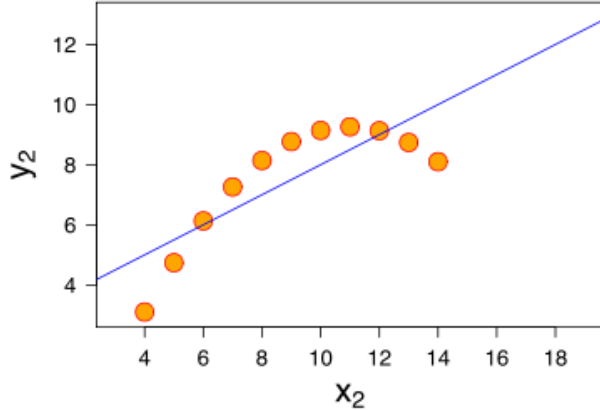
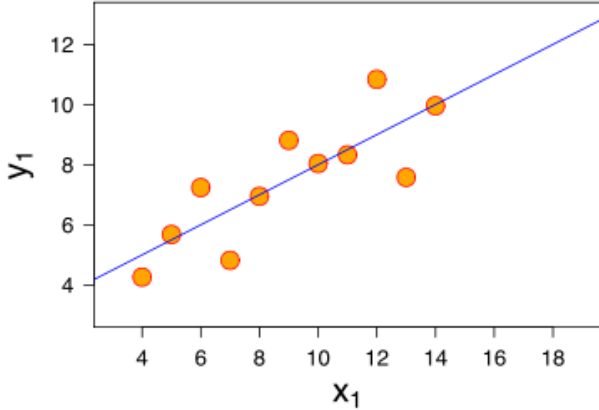
I		II		III		IV	
x	y	x	y	x	y	x	y
10.0	8.04	10.0	9.14	10.0	7.46	8.0	6.58
8.0	6.95	8.0	8.14	8.0	6.77	8.0	5.76
13.0	7.58	13.0	8.74	13.0	12.74	8.0	7.71
9.0	8.81	9.0	8.77	9.0	7.11	8.0	8.84
11.0	8.33	11.0	9.26	11.0	7.81	8.0	8.47
14.0	9.96	14.0	8.10	14.0	8.84	8.0	7.04
6.0	7.24	6.0	6.13	6.0	6.08	8.0	5.25
4.0	4.26	4.0	3.10	4.0	5.39	19.0	12.50
12.0	10.84	12.0	9.13	12.0	8.15	8.0	5.56
7.0	4.82	7.0	7.26	7.0	6.42	8.0	7.91
5.0	5.68	5.0	4.74	5.0	5.73	8.0	6.89

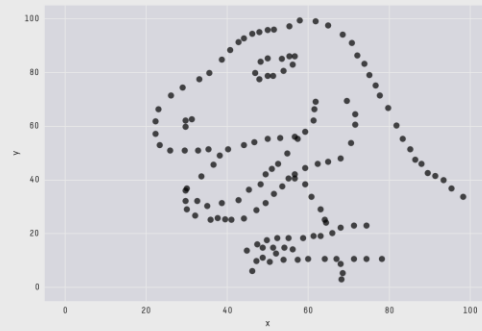
Dataset v popisné statistice

Property	Value	Accuracy
Mean of x	9	exact
Sample variance of x	11	exact
Mean of y	7.50	to 2 decimal places
Sample variance of y	4.125	plus/minus 0.003
Correlation between x and y	0.816	to 3 decimal places
Linear regression line	$y = 3.00 + 0.500x$	to 2 and 3 decimal places, respectively

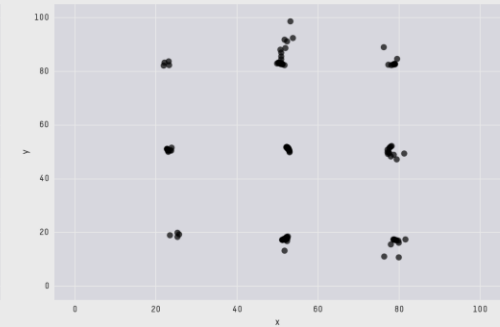
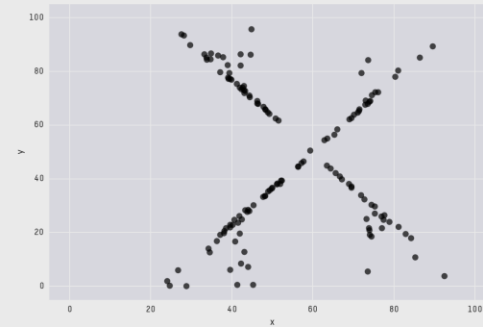
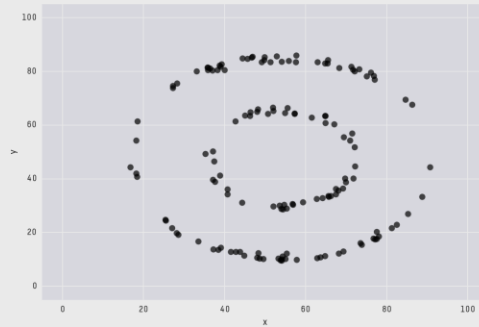
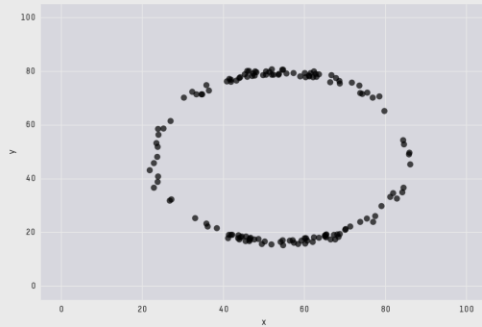
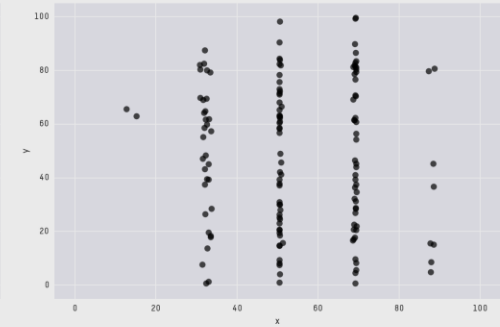
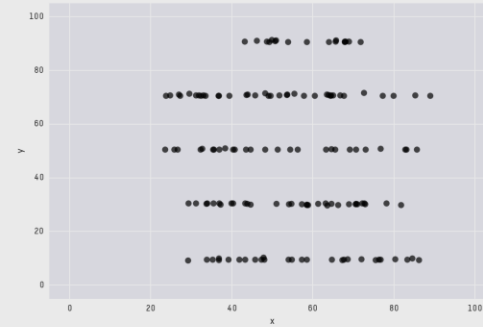
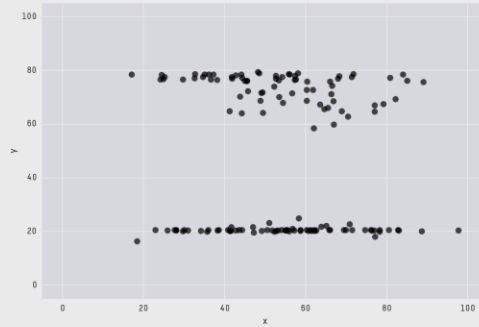
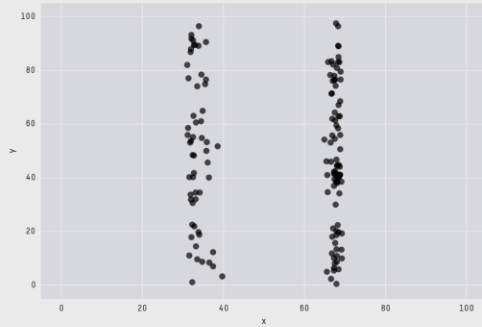
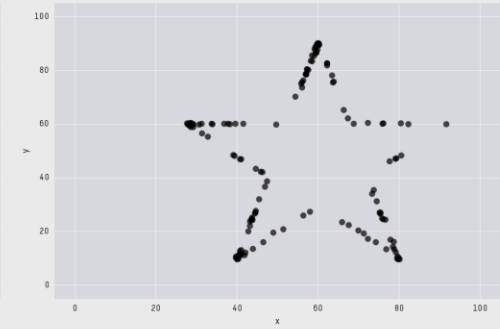
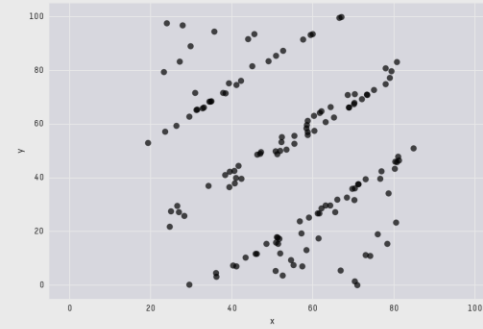
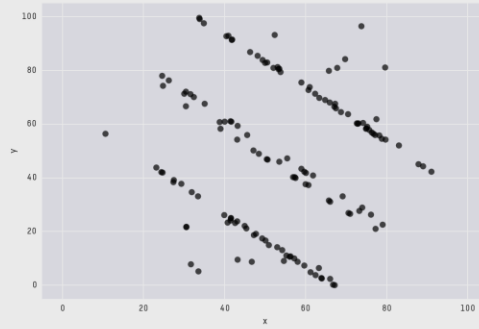
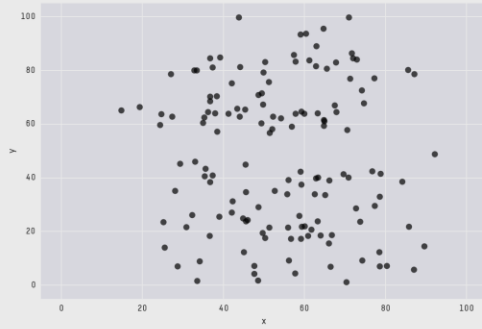
Anscombův kvartet

I		II		III		IV	
x	y	x	y	x	y	x	y
10.0	8.04	10.0	9.14	10.0	7.46	8.0	6.58
8.0	6.95	8.0	8.14	8.0	6.77	8.0	5.76
13.0	7.58	13.0	8.74	13.0	12.74	8.0	7.71
9.0	8.81	9.0	8.77	9.0	7.11	8.0	8.84
11.0	8.33	11.0	9.26	11.0	7.81	8.0	8.47
14.0	9.96	14.0	8.10	14.0	8.84	8.0	7.04
6.0	7.24	6.0	6.13	6.0	6.08	8.0	5.25
4.0	4.26	4.0	3.10	4.0	5.39	19.0	12.50
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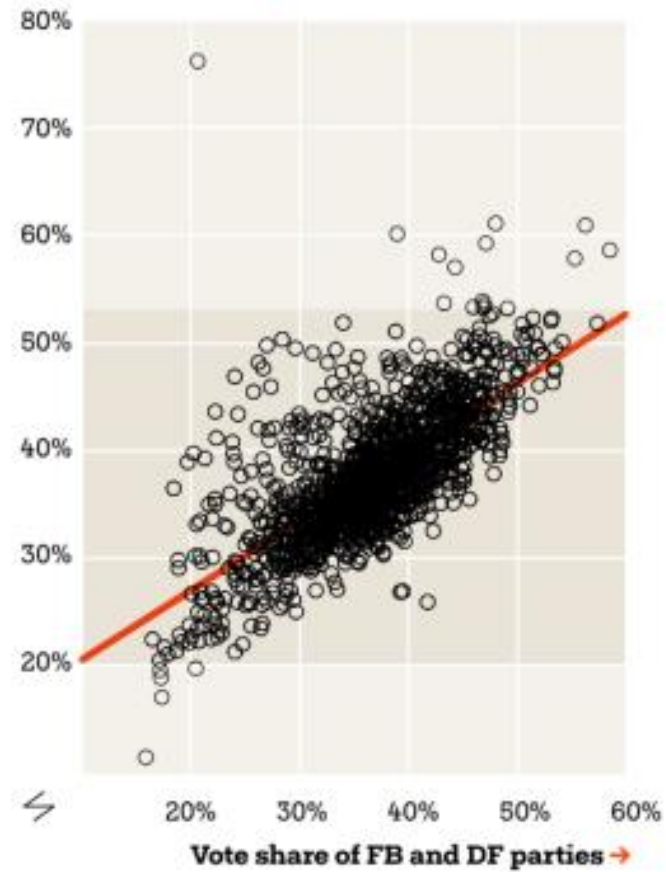


X Mean: 54.26
Y Mean: 47.83
X SD : 16.76
Y SD : 26.93
Corr. : -0.06



Vote shares in European Parliament election 2014 and referendum results by precinct in Denmark

**"No" votes
in the referendum ↑**



Source: Open Knowledge Danmark 2014.
Valgdata workshop

Vizualizujeme data, protože...

...můžeme efektivněji komunikovat
komplexní informace vizuální cestou.



Carte Figurative des pertes successives en hommes de l'Armée Française dans la campagne de Russie 1812-1813.

Dressée par M. Mimarzd, Inspecteur Général des Ponts et Chaussées en retraite. Paris, le 20 Novembre 1869.

Les nombres d'hommes présents sont représentés par les largeurs des zones colorées à raison d'un millimètre pour dix mille hommes; ils sont de plus écrits en travers des zones. Le rouge désigne les hommes qui ont été en Russie, le noir ceux qui en sont sortis. — Les renseignements qui ont servi à dresser la carte ont été puisés dans les ouvrages de M. M. Chiers, de Légué, de Fezensac, de Chambray et le journal inédit de Jacob, pharmacien de l'Armée depuis le 28 Octobre.

Pour mieux faire juger à l'œil la diminution de l'armée, j'ai supposé que les corps du Prince Jérôme et du Maréchal Davoust qui avaient été détachés sur Minsk et Mohilow et ont rejoint vers Orscha et Witebsk, avaient toujours marché avec l'armée.

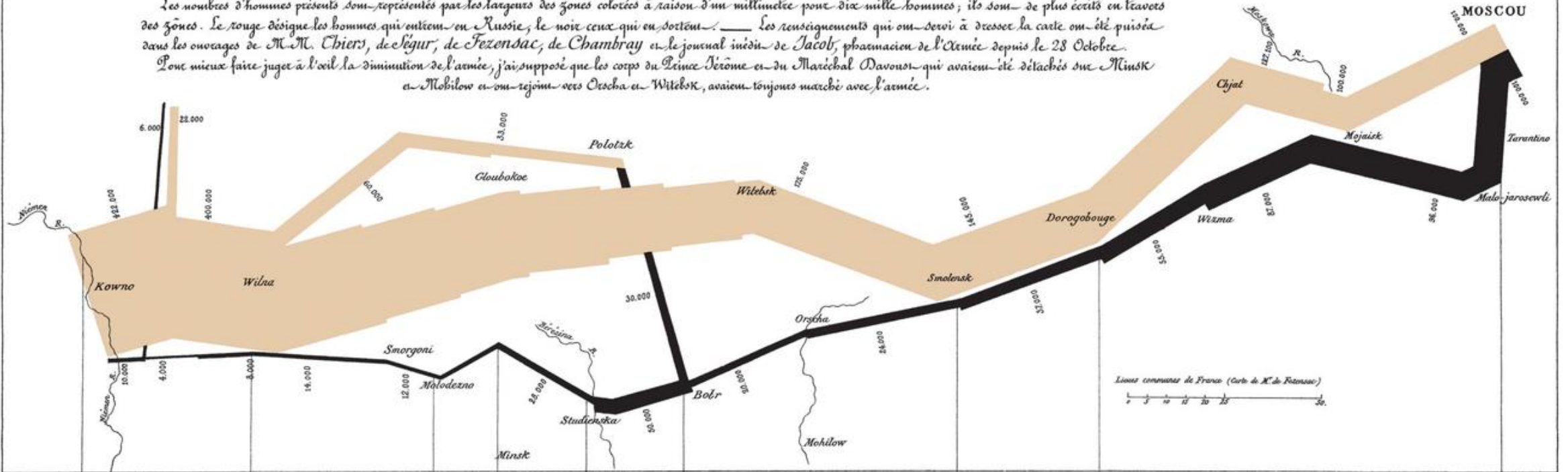
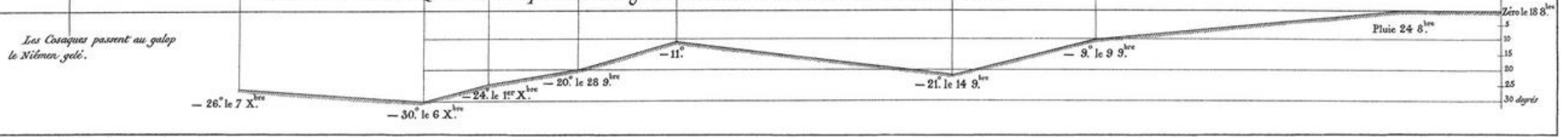


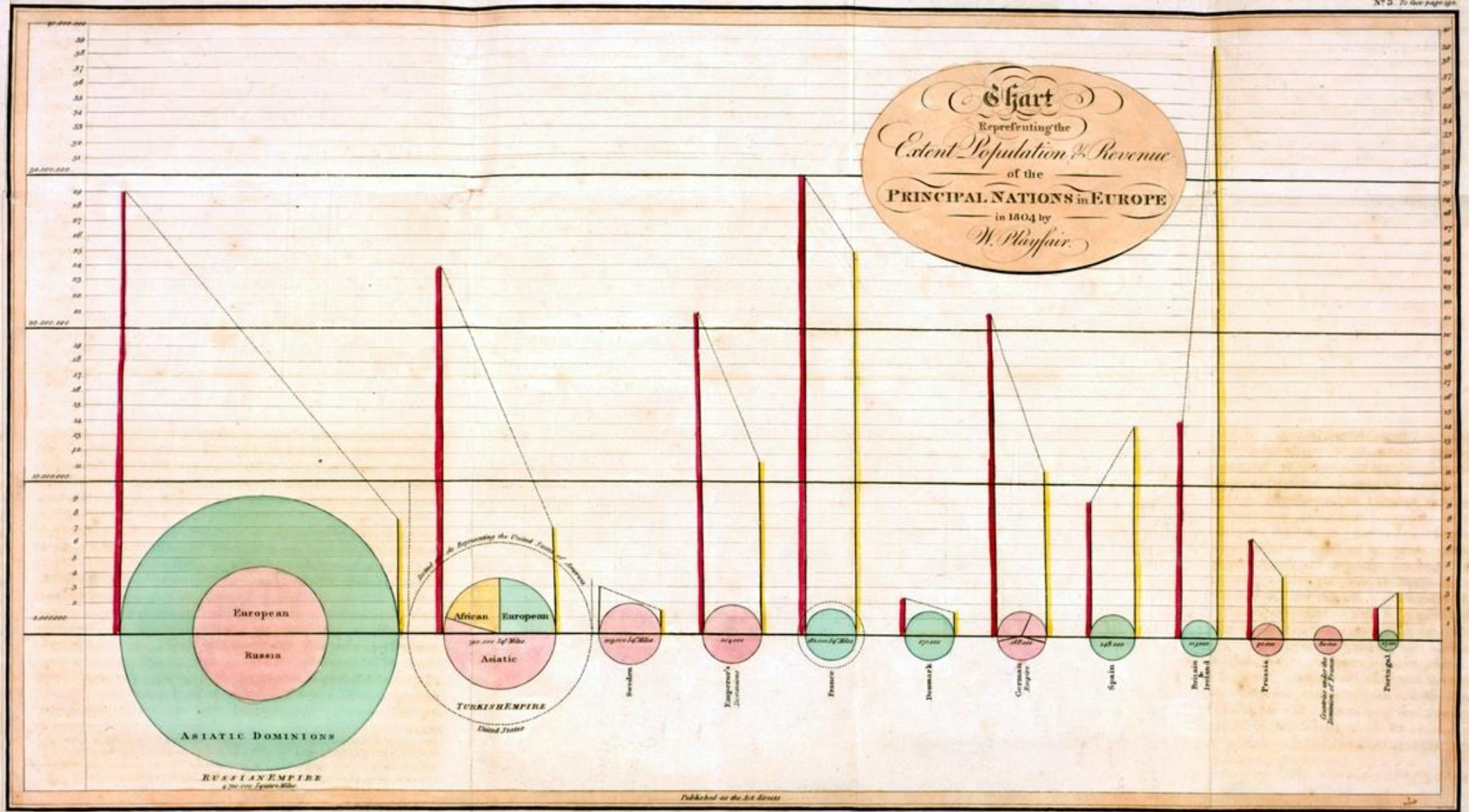
TABLEAU GRAPHIQUE de la température en degrés du thermomètre de Réaumur au dessous de zéro.



Autog. par Rognier, 8. Par. 5^{me} Marie St 6^{me} à Paris.

Imp. Lit. Rognier et Desroses.

„Probably the best statistical graphic ever drawn.“ Edward Tufte



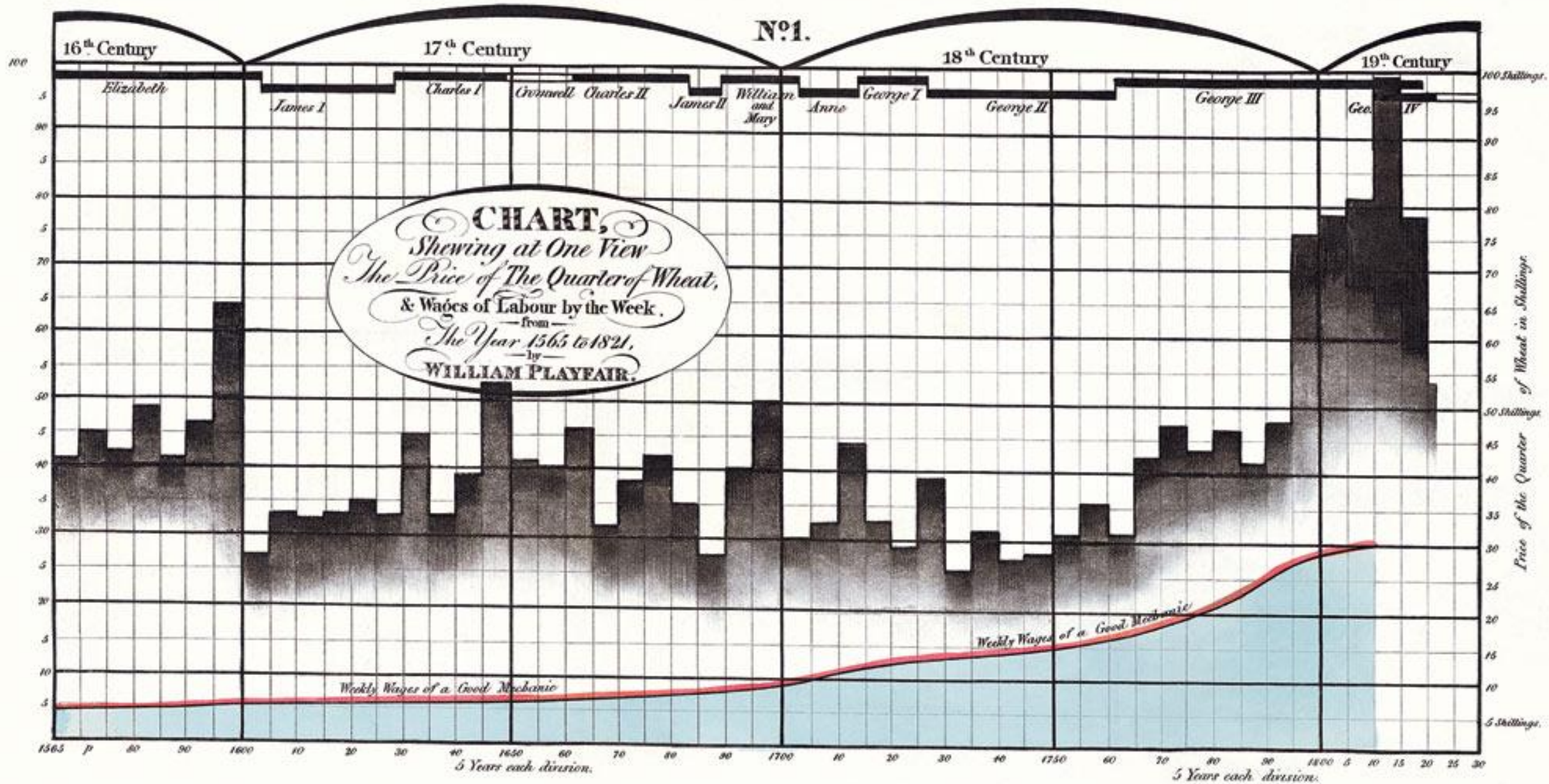
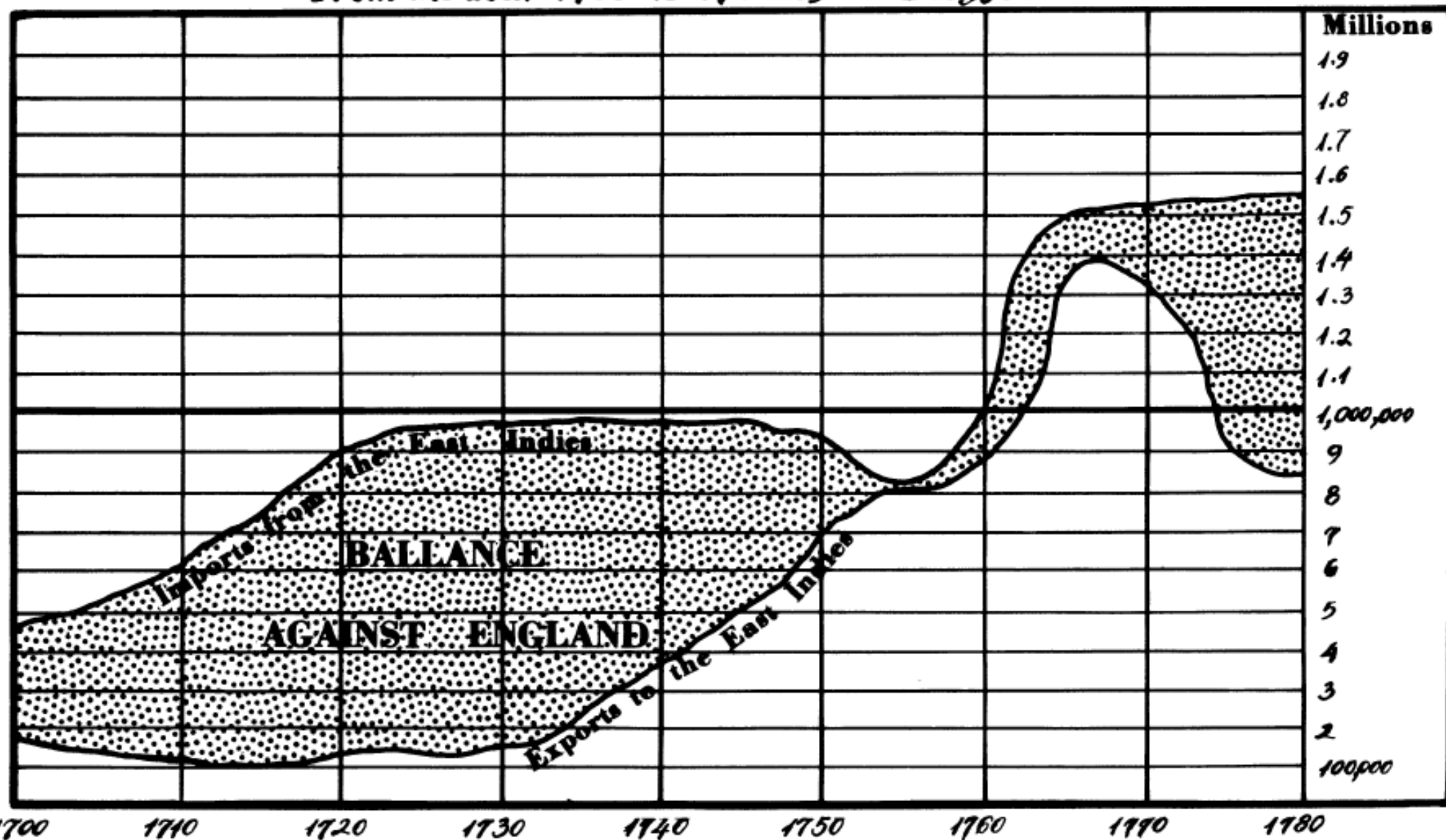
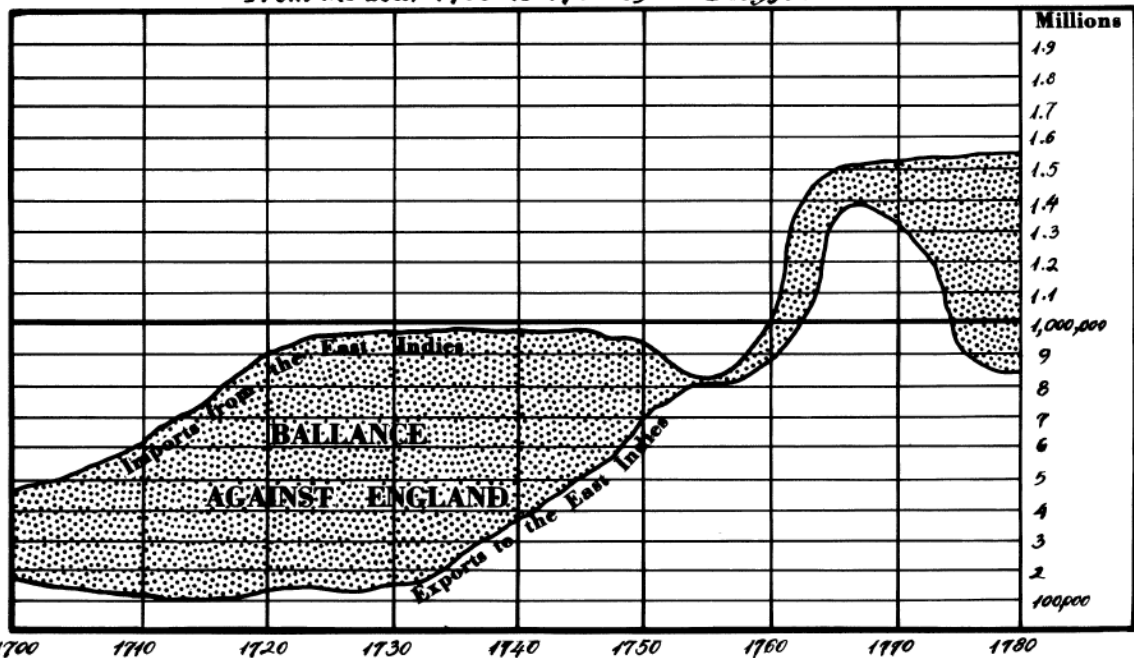


CHART of EXPORTS and IMPORTS to and from the EAST INDIES
From the Year 1700 to 1780 by W. Playfair



The Bottom Line is Divided into Years the Right hand Line into HUNDRED THOUSAND POUNDS
is force Page 31st
Published in the Act Divine 16th Aug. 1785

CHART of EXPORTS and IMPORTS to and from the EAST INDIES
From the Year 1700 to 1780 by W. Playfair



The Bottom Line is Divided into Years the Right hand Line into HUNDRED THOUSAND POUNDS
Strength & Height *is from Page 31st* *Published in the Art. Scine 16th Aug. 1785*

CHART OF BALANCE AGAINST ENGLAND

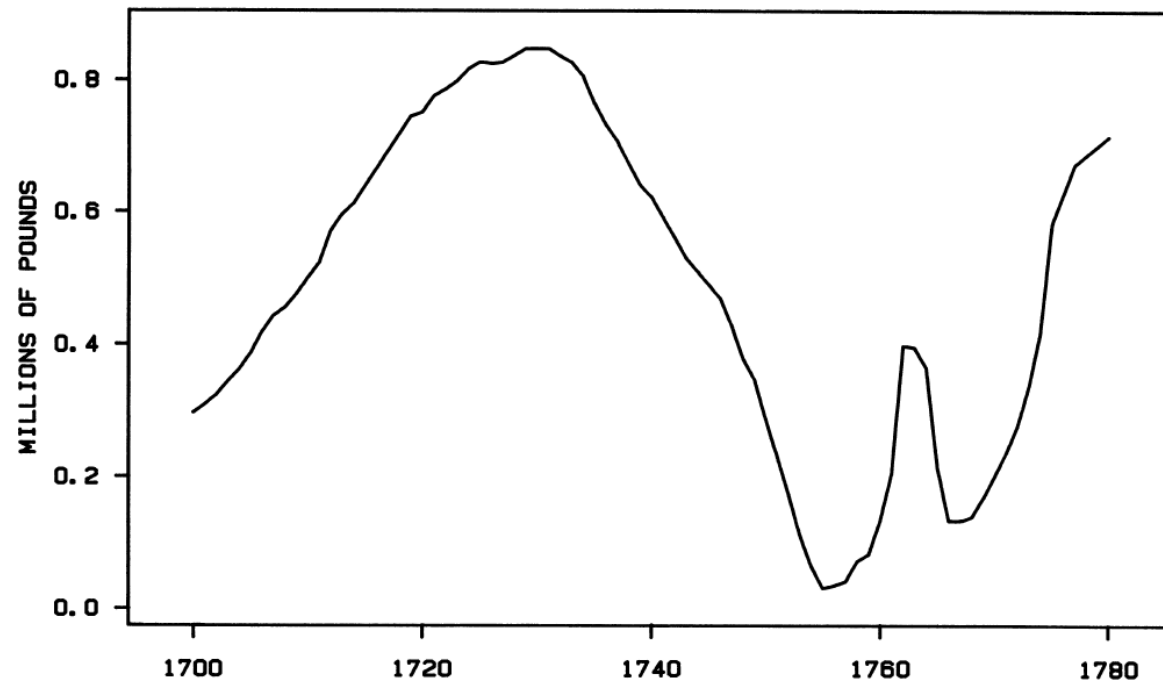


Figure 28. Playfair data.

Vizualizujeme data, protože...

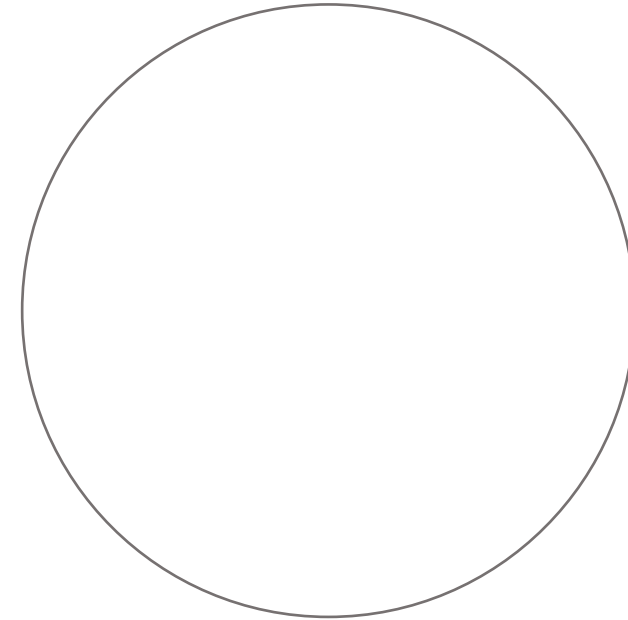
...máme oči a náš mozek
pracuje s vizuální informací efektivně.



Množina všech bodů
v rovině, které leží ve stejné
vzdálenosti, označované jako
poloměr, od pevně daného
bodu, zvaného střed.

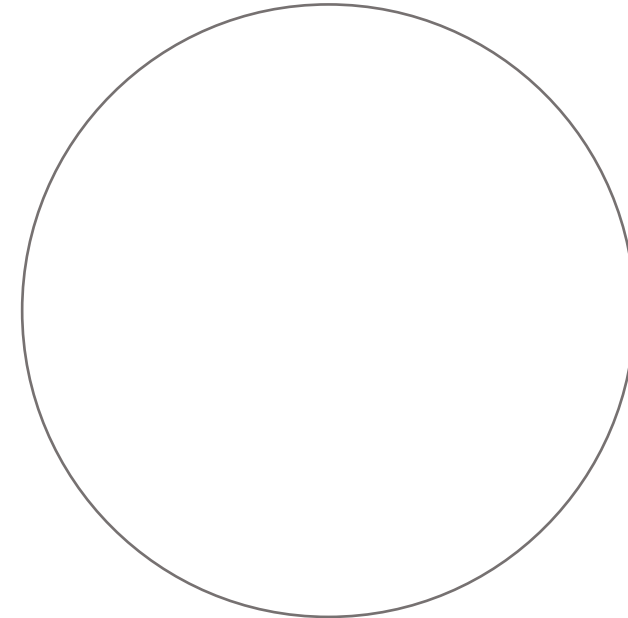
00.000x

Množina všech bodů
v rovině, které leží ve stejné
vzdálenosti, označované jako
poloměr, od pevně daného
bodu, zvaného střed.



60.000x

Množina všech bodů
v rovině, které leží ve stejné
vzdálenosti, označované jako
poloměr, od pevně daného
bodu, zvaného střed.



~~60.000x~~

<http://sedesatkrat.jdem.cz/>

Vizualizujeme data, protože...

...můžeme vizuálně (tj. lépe)
podpořit svůj argument.



A large pharmaceutical company has recently developed a new drug to boost peoples' immune function. It reports that trials it conducted demonstrated a drop of twenty percent (from eighty three to sixty three percent) in occurrence of the common cold. It intends to market the new drug as soon as next winter, following FDA approval.

Incidence of illness drops from 83% to 63% with the medication.

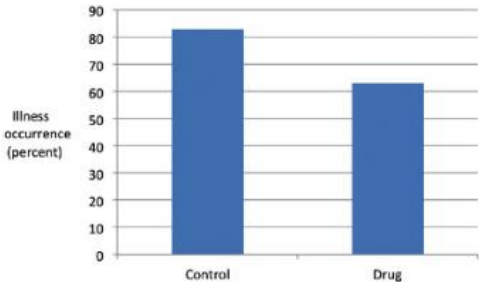
Please rate your agreement with the following statement:

I believe the new drug is effective.

1 2 3 4 5 6 7 8 9
 Strongly disagree ○ ○ ○ ○ ○ ○ ○ ○ ○ Strongly agree

a

A large pharmaceutical company has recently developed a new drug to boost peoples' immune function. It reports that trials it conducted demonstrated a drop of twenty percent (from eighty three to sixty three percent) in occurrence of the common cold. It intends to market the new drug as soon as next winter, following FDA approval.



Illness occurrence (percent)

Group	Illness occurrence (percent)
Control	83
Drug	63

Please rate your agreement with the following statement:

I believe the new drug is effective.

1 2 3 4 5 6 7 8 9
 Strongly disagree ○ ○ ○ ○ ○ ○ ○ ○ ○ Strongly agree

b

Fig. 1. First page of our second experiment, replicating experiment 2 from Tal and Wansink [49]. (a) no-chart condition, with an extra sentence repeating the two quantities with numerals; (b) chart condition: the extra sentence is replaced with a bar chart.

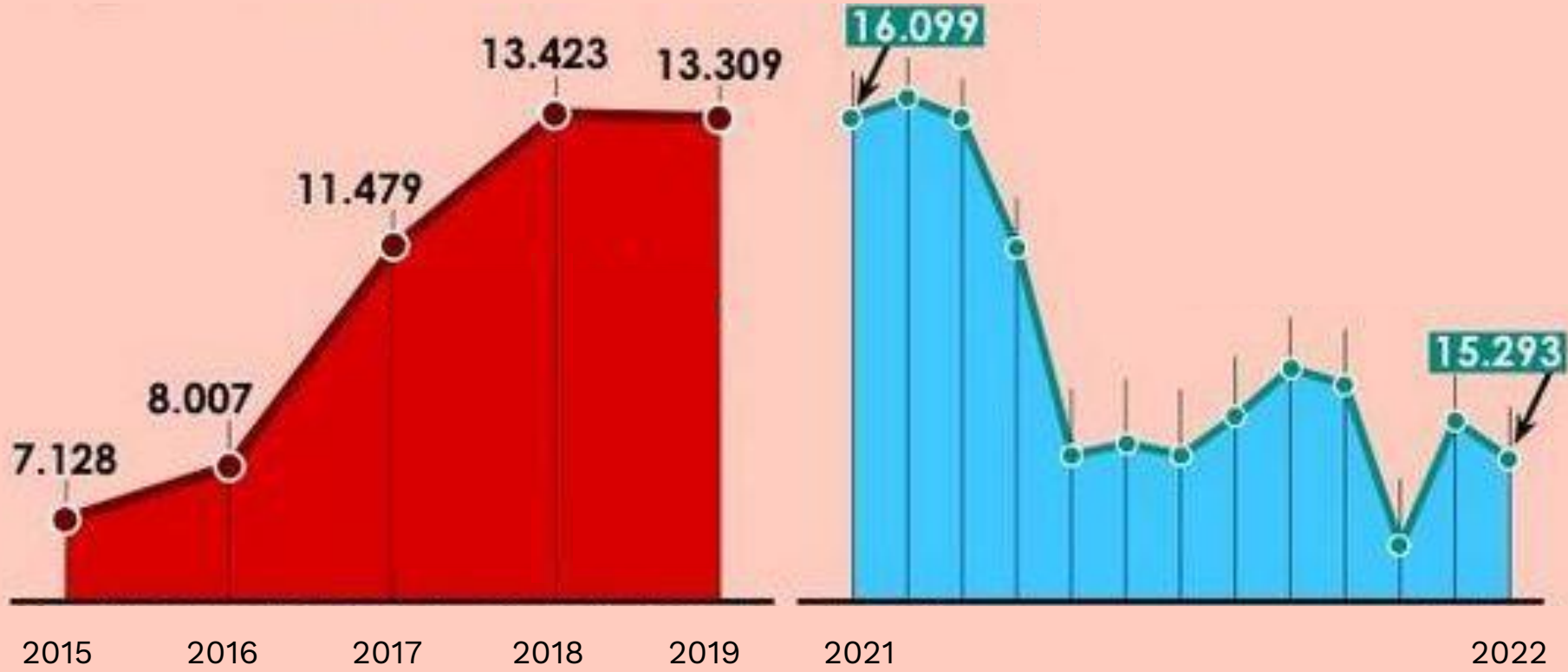
(23 %)

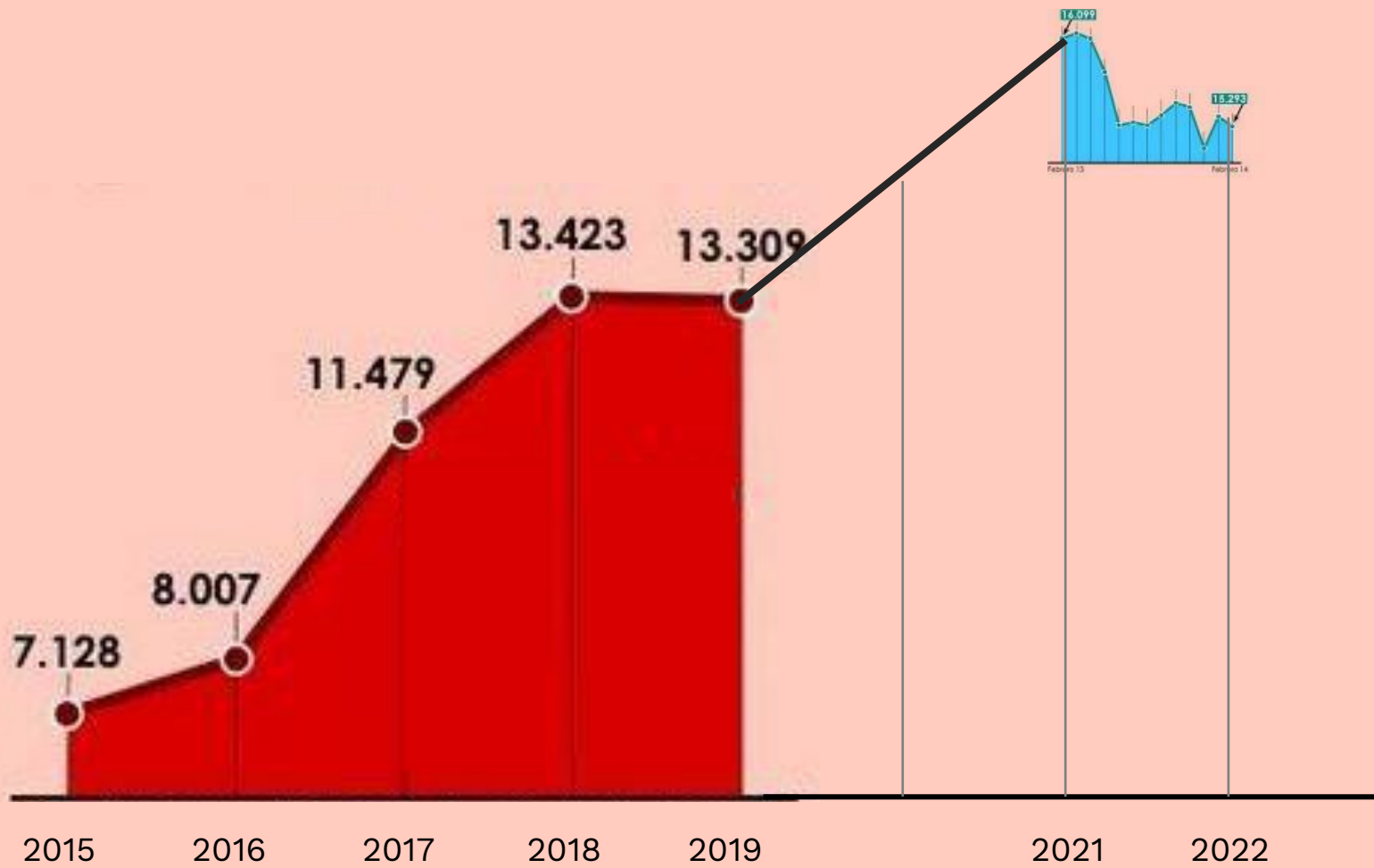
43 %

Vizualizujeme data, protože...

...vizualizace nám umožňují
lépe ~~argumentovat~~ manipulovat.







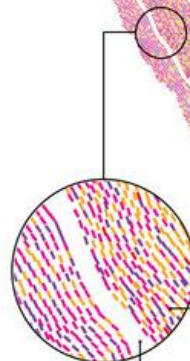
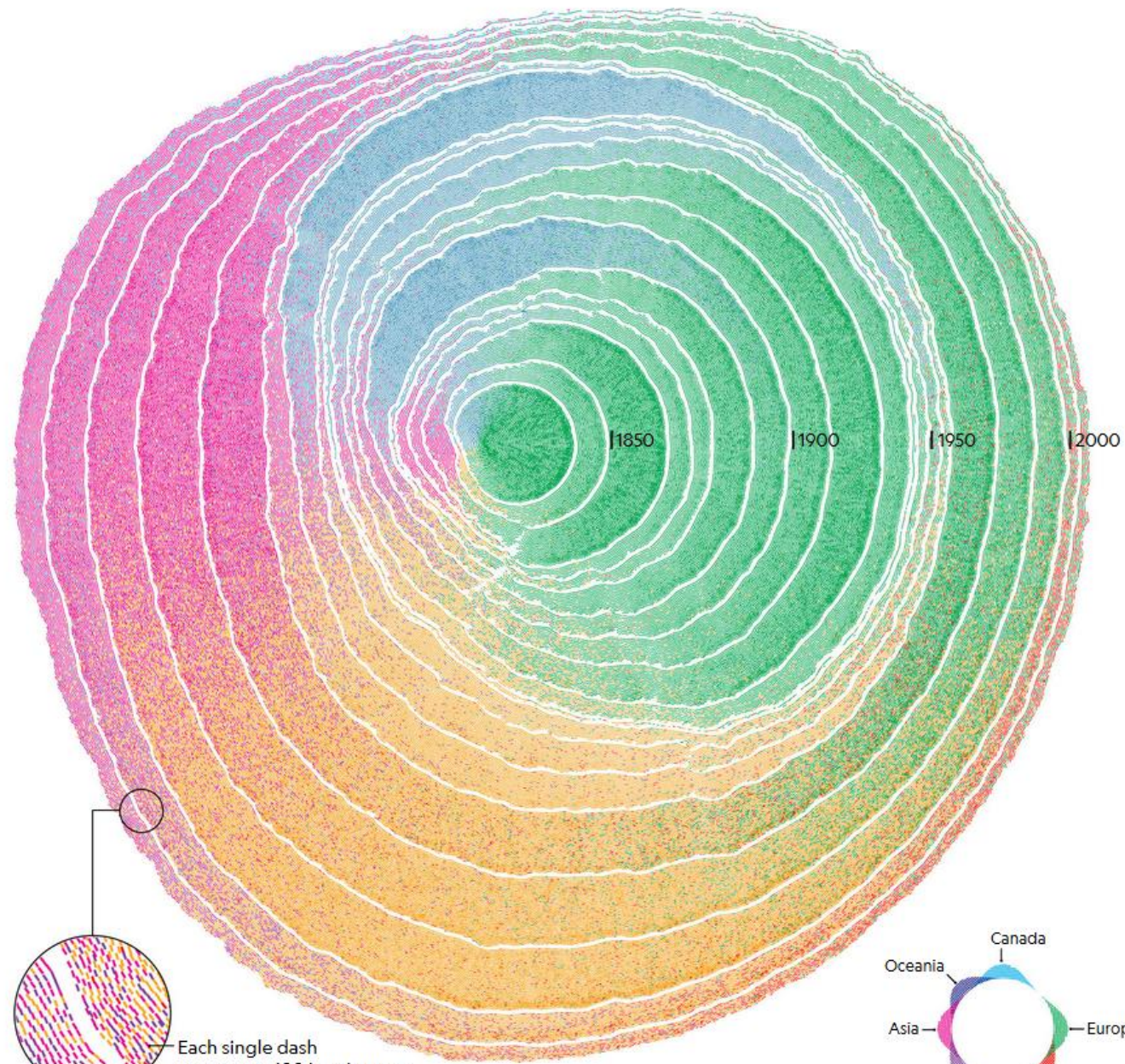
Vizualizujeme data, protože...

...skrže vizualizovaná data dokážeme lépe působit na emoce.

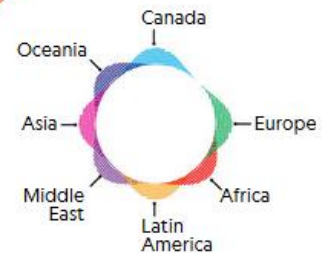




U.S. IMMIGRATION BY ORIGIN AT BIRTH, 1830-2015



Each single dash represents 100 immigrants.
Each ring represents one decade.



Vizualizujeme data, protože...

...k tomu máme boží technologie,
které nám umožňují vytvářet
boží vizualizace.



2001

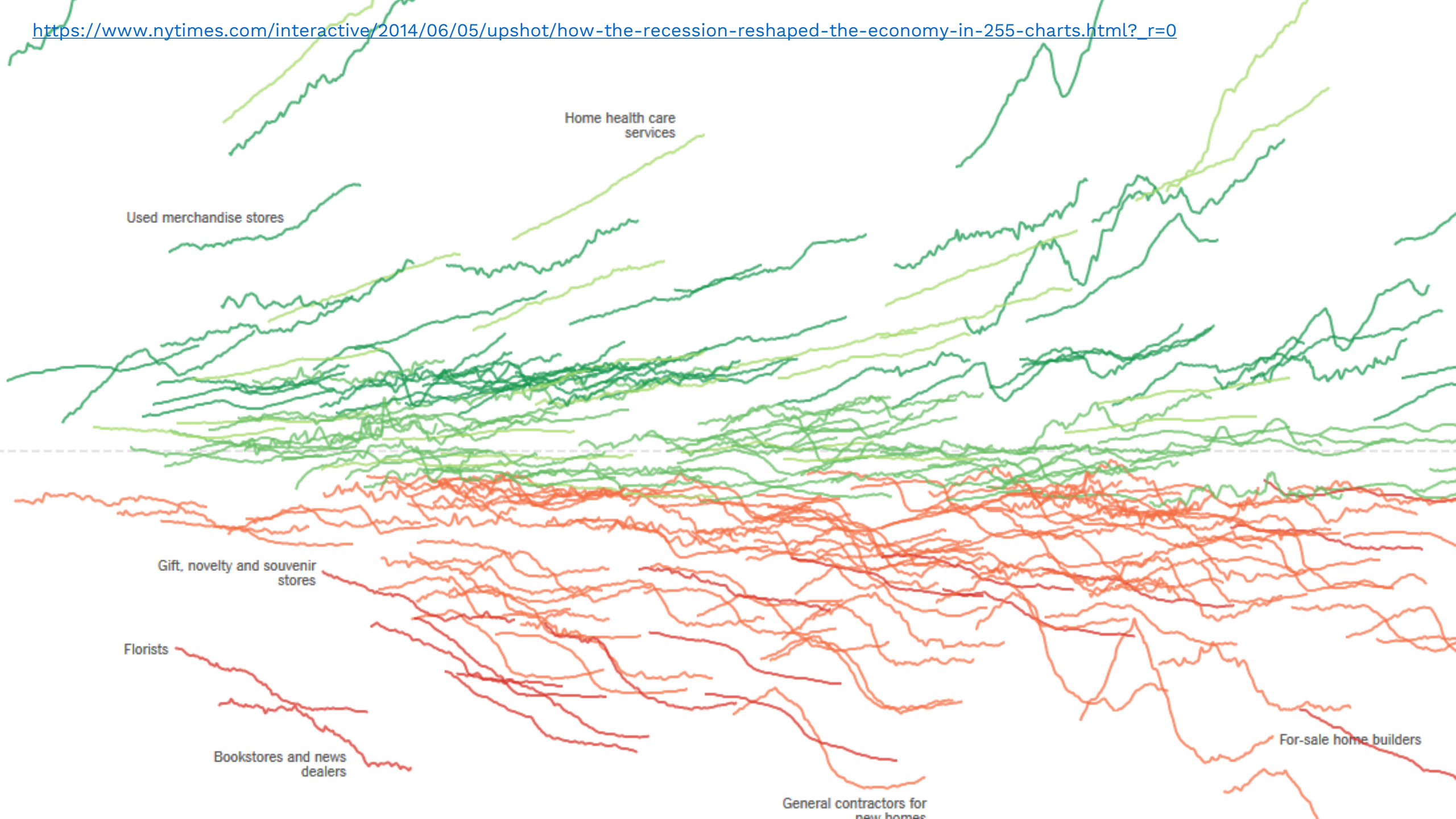
EXTREME POVERTY

\$1

\$10

\$100







Vizualizace je **nástroj**
s širokým spektrem použití.



Přesvědčování

Argumentace

Motivace

Ilustrace

Vhled

Emoce

Terminologie?

Přesahy vizualizace

- Grafický design
- Žurnalistika
- Kartografie
- Počítačová věda
- Management
- Statistika
- ...

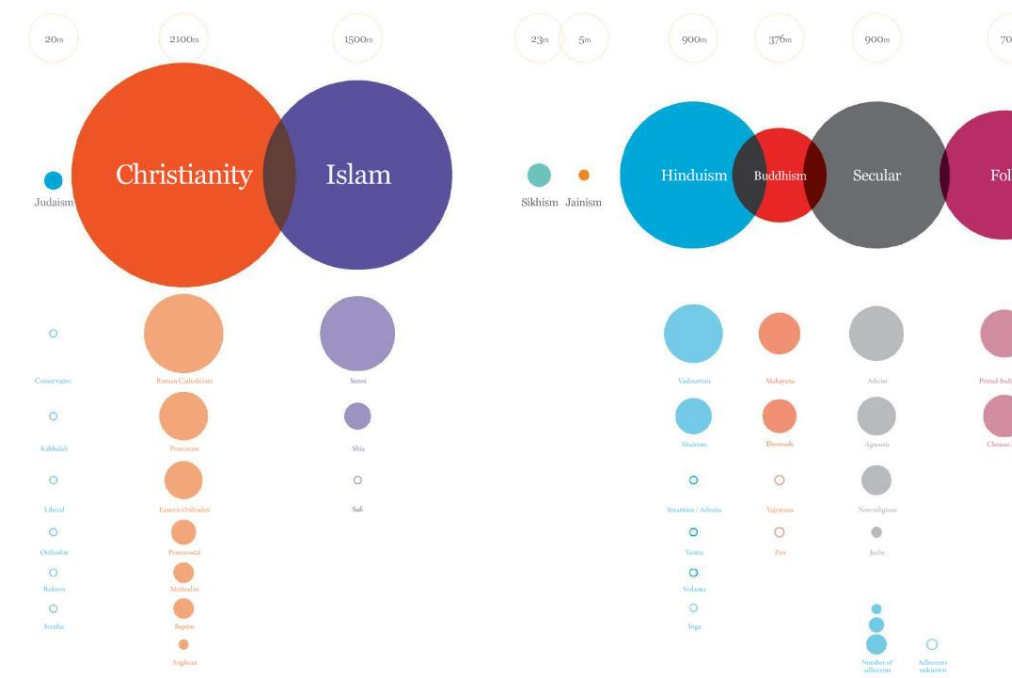
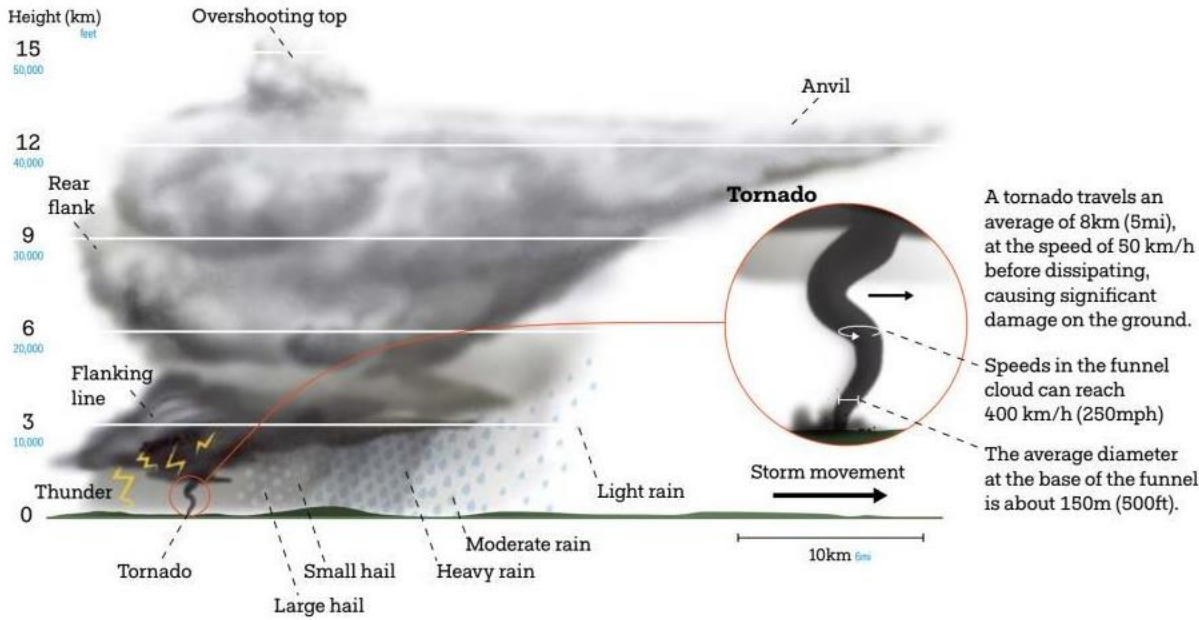
**Odlišné slovníky
v jednom poli...**

Informační design

“The art and science of preparing information so that it can be used by human beings with efficiency and effectiveness.” – [Robert Horn](#)

- informační design X grafický design
- [Information Design Journal](#) (1979)
- finský výzkum obalů léčiv – léky vypadají podobně

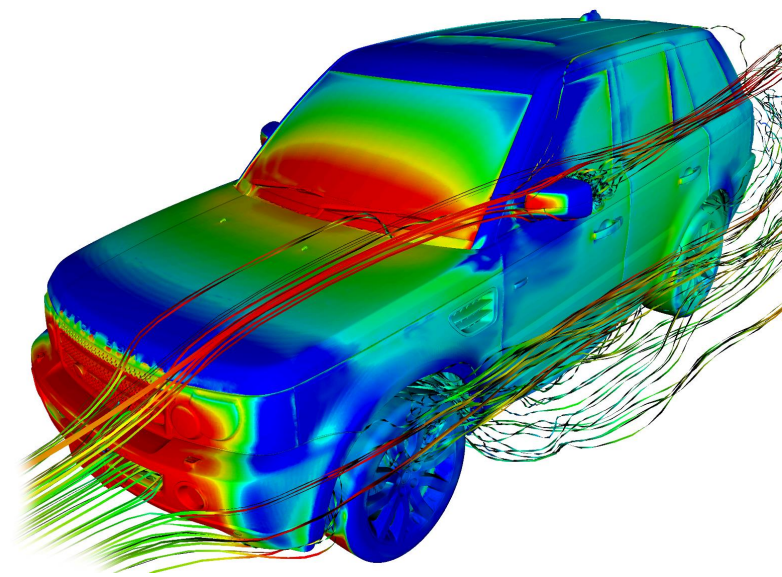
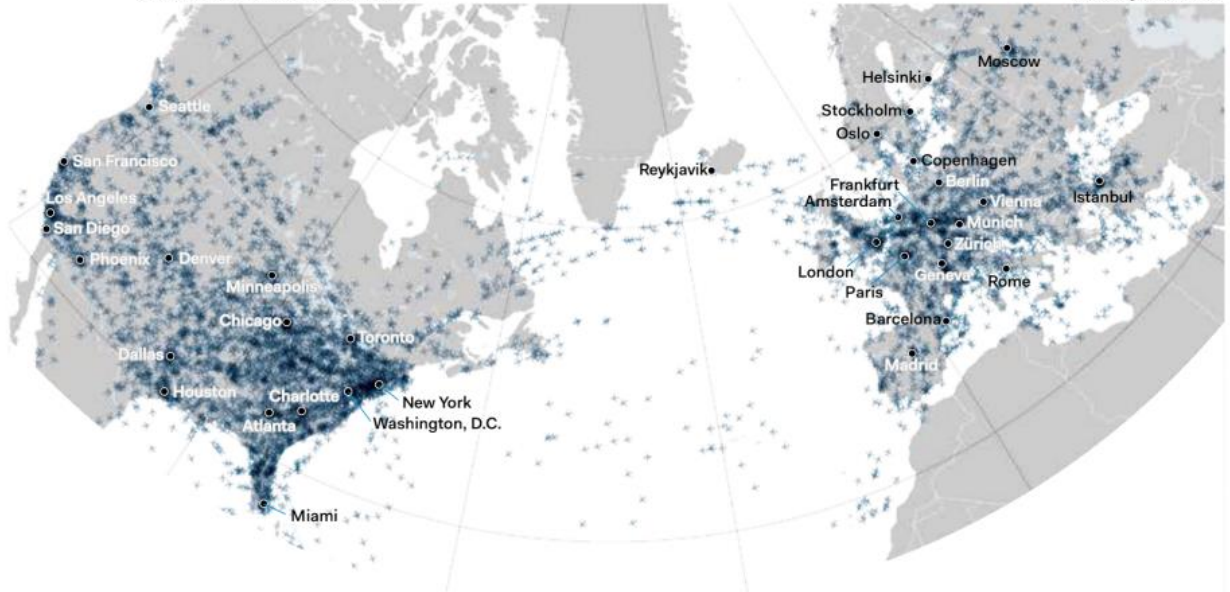
The structure of a supercell cloud



Aircraft in European and North American airspaces

Tuesday, 18 June 2013 at 14:00 UTC

Each + is a single aircraft. Source: Flightradar24.com

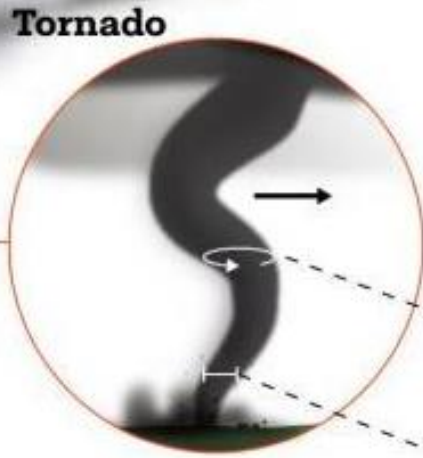
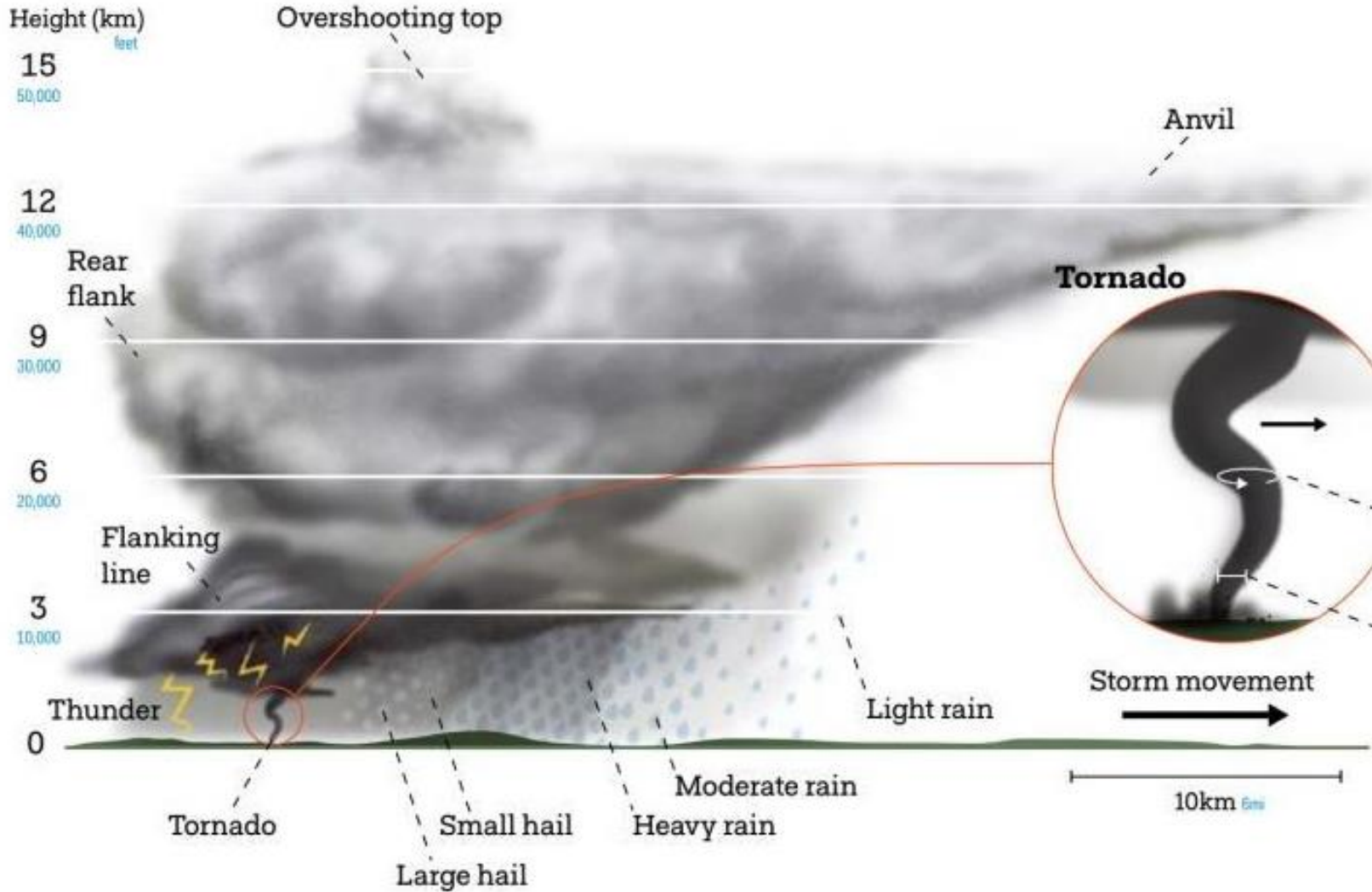


Typologie datové grafiky

- Scott Berinato – [Good Charts](#)
- Je informace konceptuální nebo založená na datech?
- Je cílem vysvětlovat (*explain*) nebo explorovat (*explore*)?

- Dvě škály:
- **conceptual – measurable**
- **explanatory – exploratory**
- vypráví příběh **X** poskytuje nástroj k hledání příběhů

The structure of a supercell cloud



A tornado travels an average of 8km (5mi), at the speed of 50 km/h before dissipating, causing significant damage on the ground.

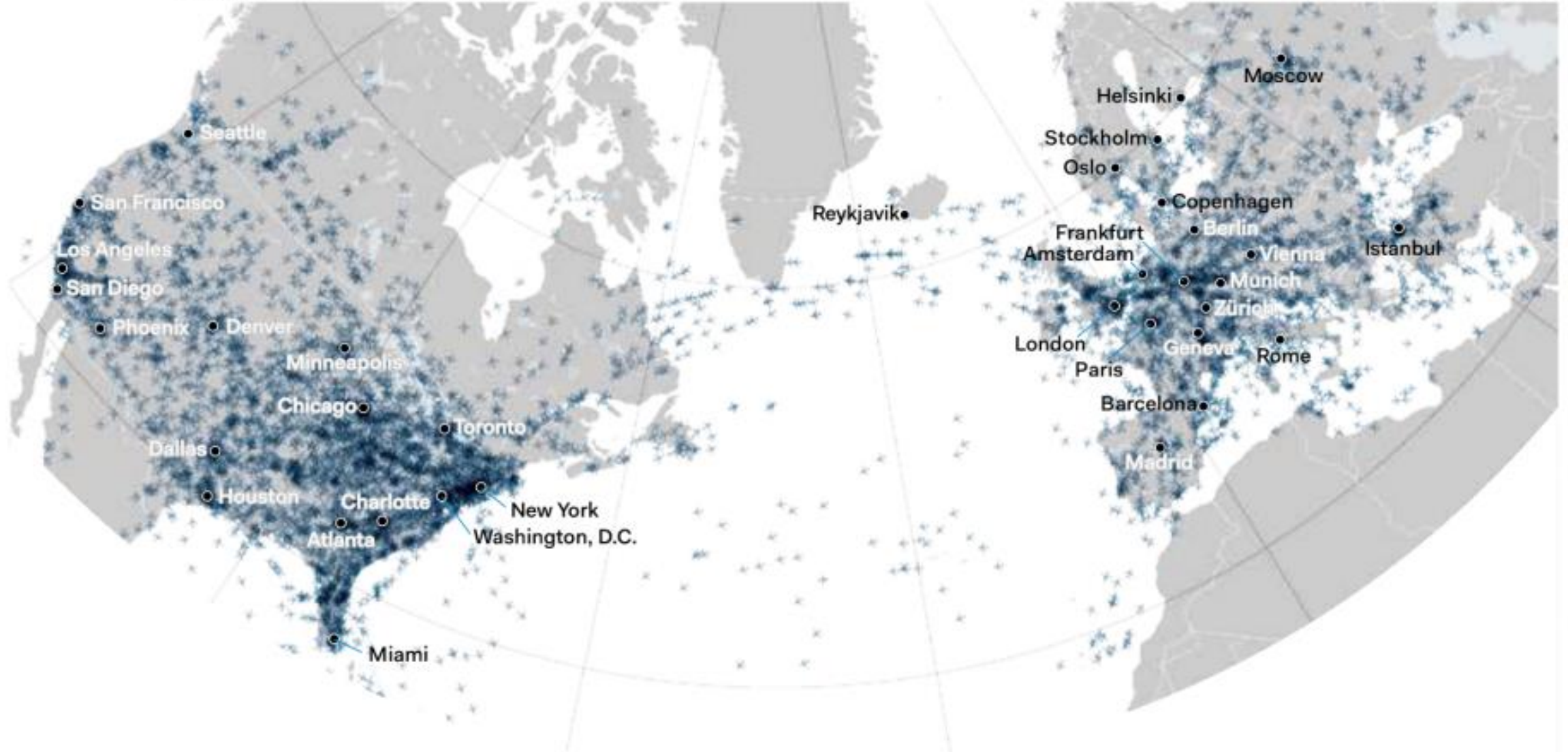
Speeds in the funnel cloud can reach 400 km/h (250mph)

The average diameter at the base of the funnel is about 150m (500ft).

Aircraft in European and North American airspaces

Tuesday, 18 June 2013 at 14:00 UTC

Each + is a single aircraft.
Source: Flightradar24.com



Ještě několik termínů

- *zásadní problematický termín*
- infografika = explanatory / conceptual - measurable
- vizualizace = expl[an/or]atory / measurable

- informační grafika X infografika

- chart X diagram X plot



AMO.CZ

FRIEDRICH
EBERT
STIFTUNG

ŽENY V ČESKÉ EVROPSKÉ POLITICE 2019

PODÍL ŽEN VE VÝBORECH POSLANECKÉ SNĚMOVNY

VÝBOR PRO
EVROPSKOU
INTEGRACI
1998-2004

11%

VÝBOR PRO
EVROPSKÉ
ZÁLEŽITOSTI
2004-2019

22%

39%

25%

7%

11%

10%



JEDINÁ
PŘEDSEDKYNĚ
VÝBORU PRO
EVROPSKÉ
ZÁLEŽITOSTI



KATEŘINA
JACQUES
SZ

2009-2019

KOMISAŘKA
PRO SPRÁVEDLNOST,
OCHRANU SPOTŘEBITELŮ
& OTÁZKY ROVNOSTI
POHLAVÍ



VĚRA JOUROVÁ

OD ROKU 2014

V SOUČASNOSTI
SLUŽEBNĚ NEJSTARŠÍ
ČESKÁ POSLANKYNĚ
EVROPSKÉHO
PARLAMENTU



OLGA SEHNALOVÁ
ČSSD

OD ROKU 2009
KANDIDUJE I VE VOVBÁCH
DO EP 2019

NEJVÝŠE POSTAVENÁ
ZÁSTUPKYNĚ ČR
V EVROPSKÉ SLUŽBĚ
PRO VNĚJŠÍ
ČINNOST (EEAS)



EDITA HRDÁ

OD ROKU 2018
VYCHNĚ ĀLOTELKA
SEAS PRO AMERIKU

STÁTNÍ
TAJEMNICE
PRO EVROPSKÉ
ZÁLEŽITOSTI

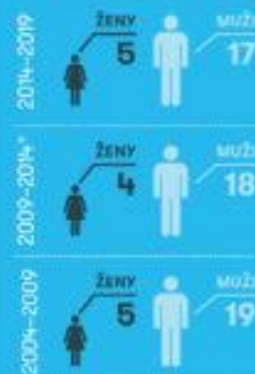


MILENA
HRDINKOVÁ

OD ROKU 2019

EVROPSKÝ PARLAMENT

POČET ČESKÝCH
EUROPOSLANKYNĚ 2004-2019



* Zájem tržebního úřadu v roce 2014 zastupovala ČR v EP celkem 2 europoslanky - po zastupitelce Vladimíře Remkové (KSCM) se jednalo o stávající kolegyni Věru Fialovou.

VELVYSLANKYNĚ ČESKÉ REPUBLIKY

PŘI ČLENSKÝCH STÁTECH EU



ČLENKY SENÁTNÍHO VÝBORU PRO ZÁLEŽITOSTI EU





Explanatorní
Cíl grafiky



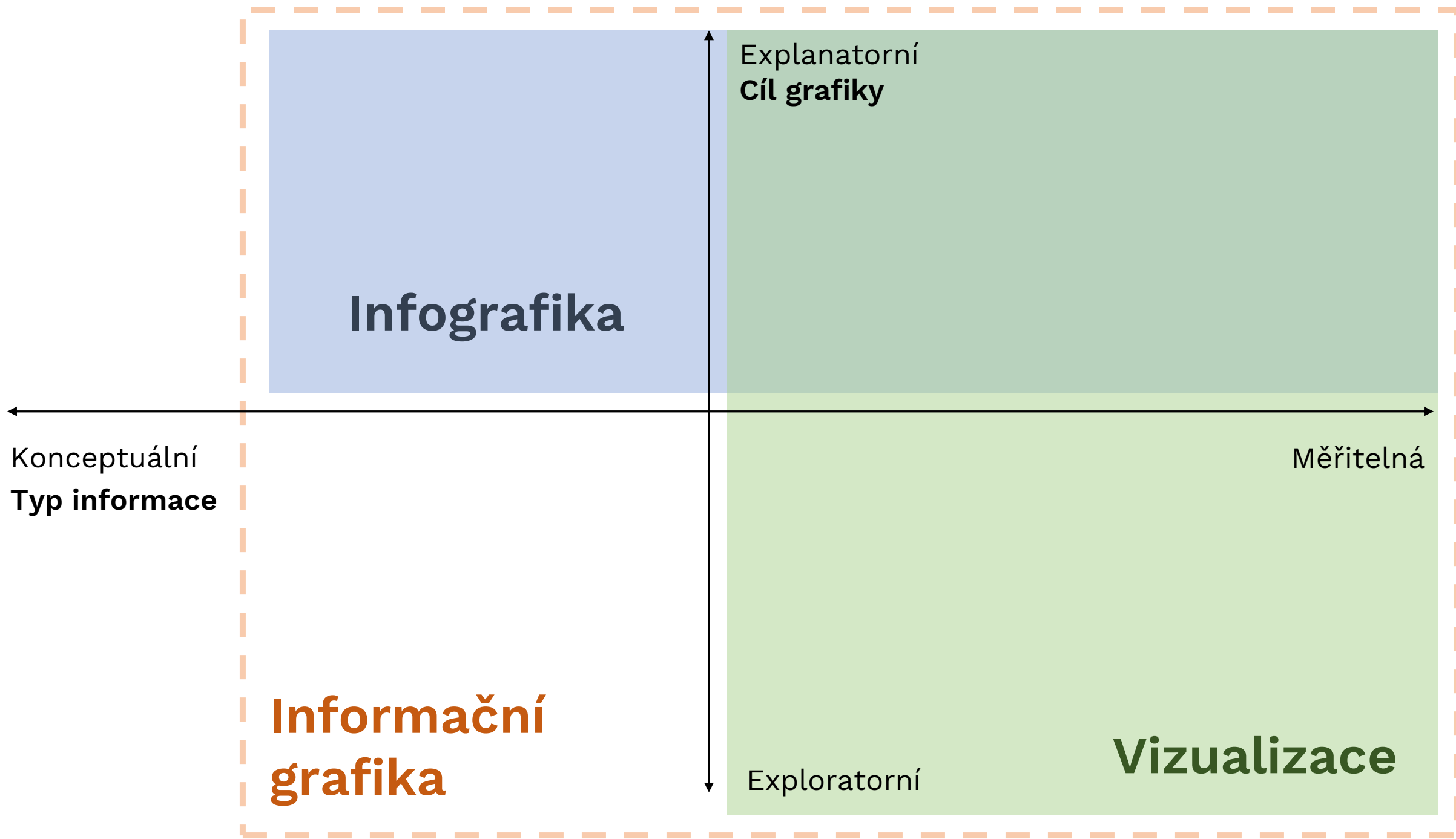
Konceptuální
Typ informace

Měřitelná

Exploratorní







Ilustrace

Infografika

Explanatorní
Cíl grafiky

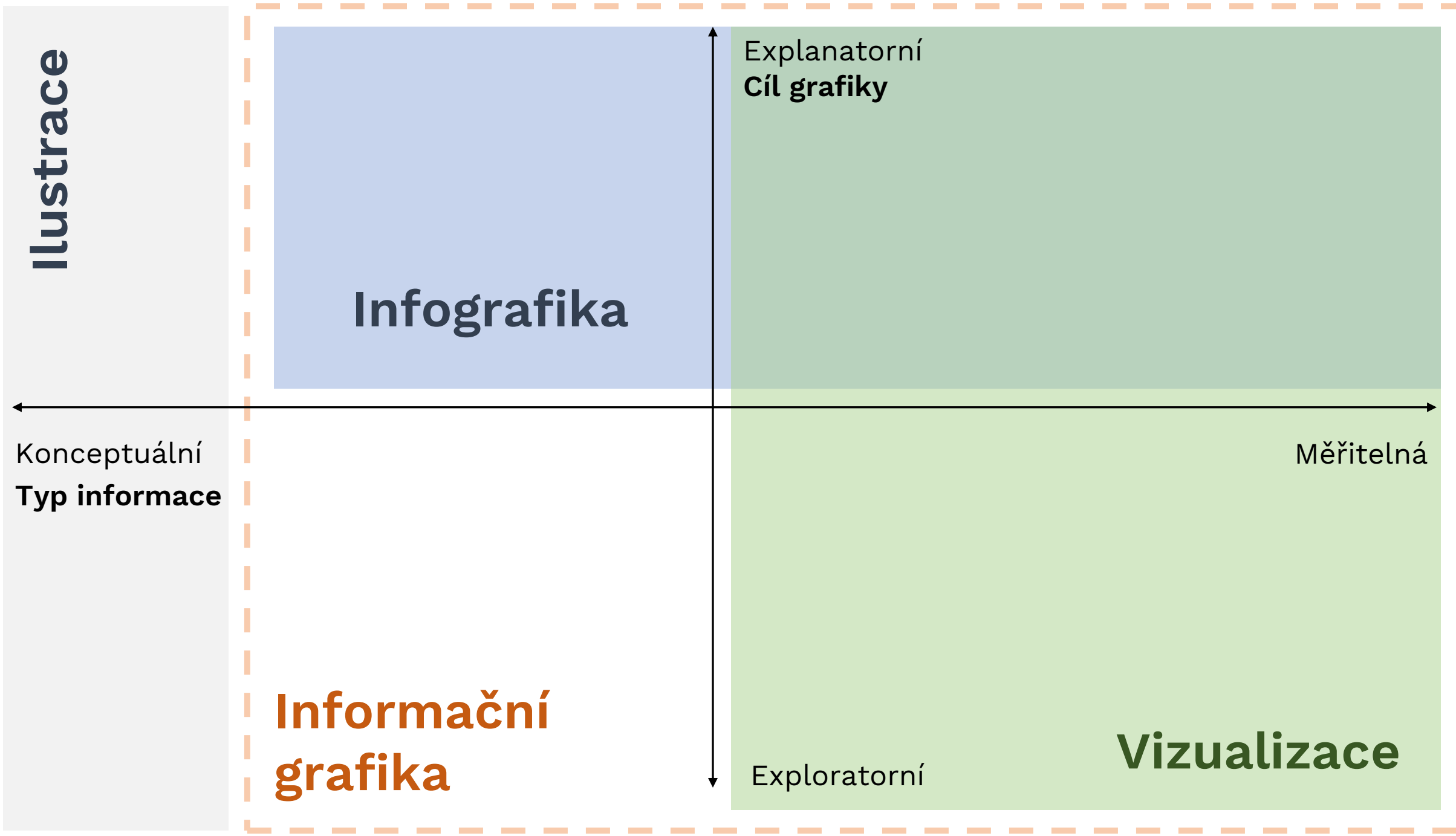
Konceptuální
Typ informace

Měřitelná

**Informační
grafika**

Exploratorní

Vizualizace



Definice Roberta Kosary

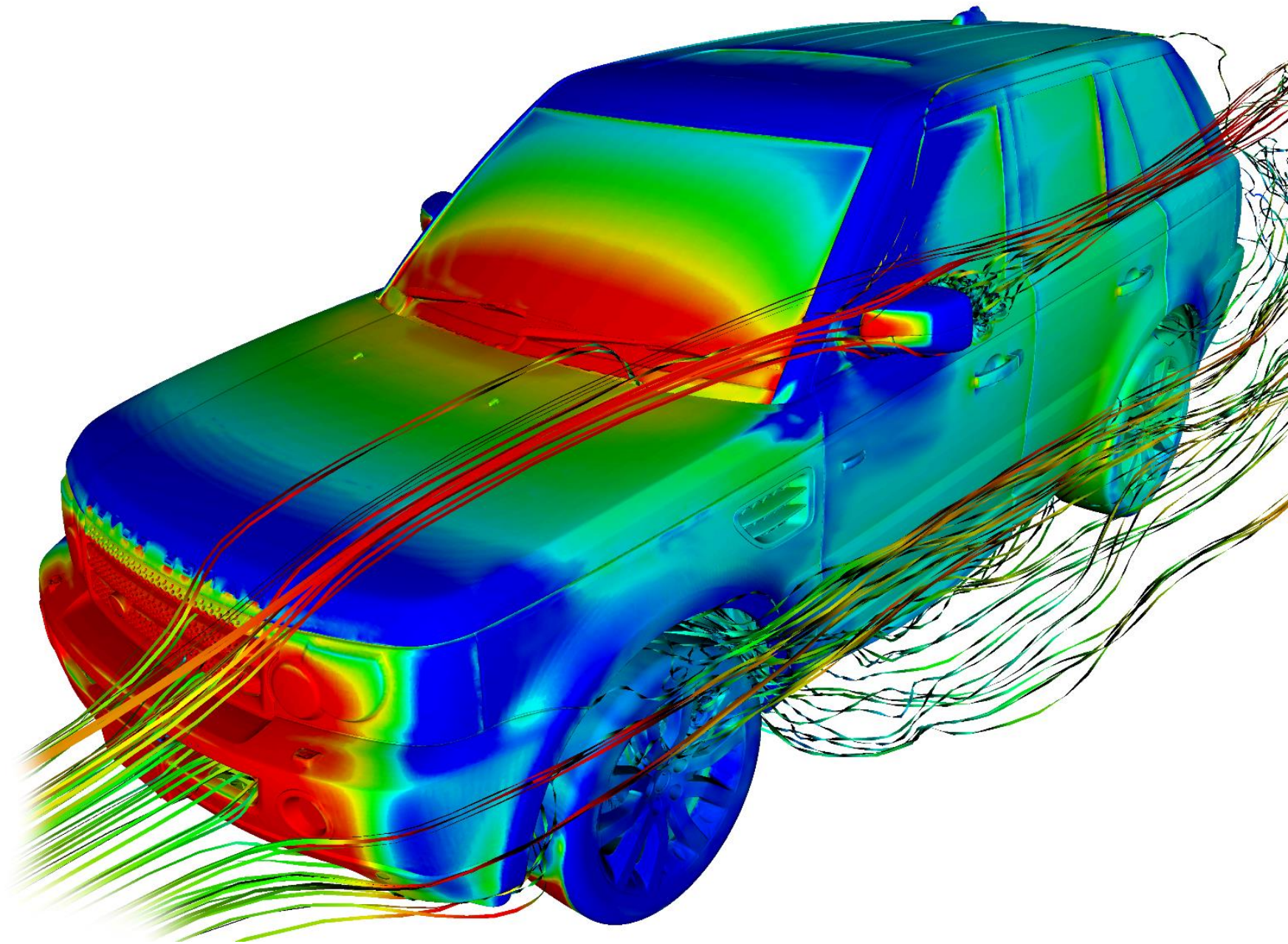
- *it is based on (non-visual) data – krajinka to není*
- *it produces an image*
- *the result is readable and recognizable*

KOSARA, Robert. [Visualization criticism](#) (2007)

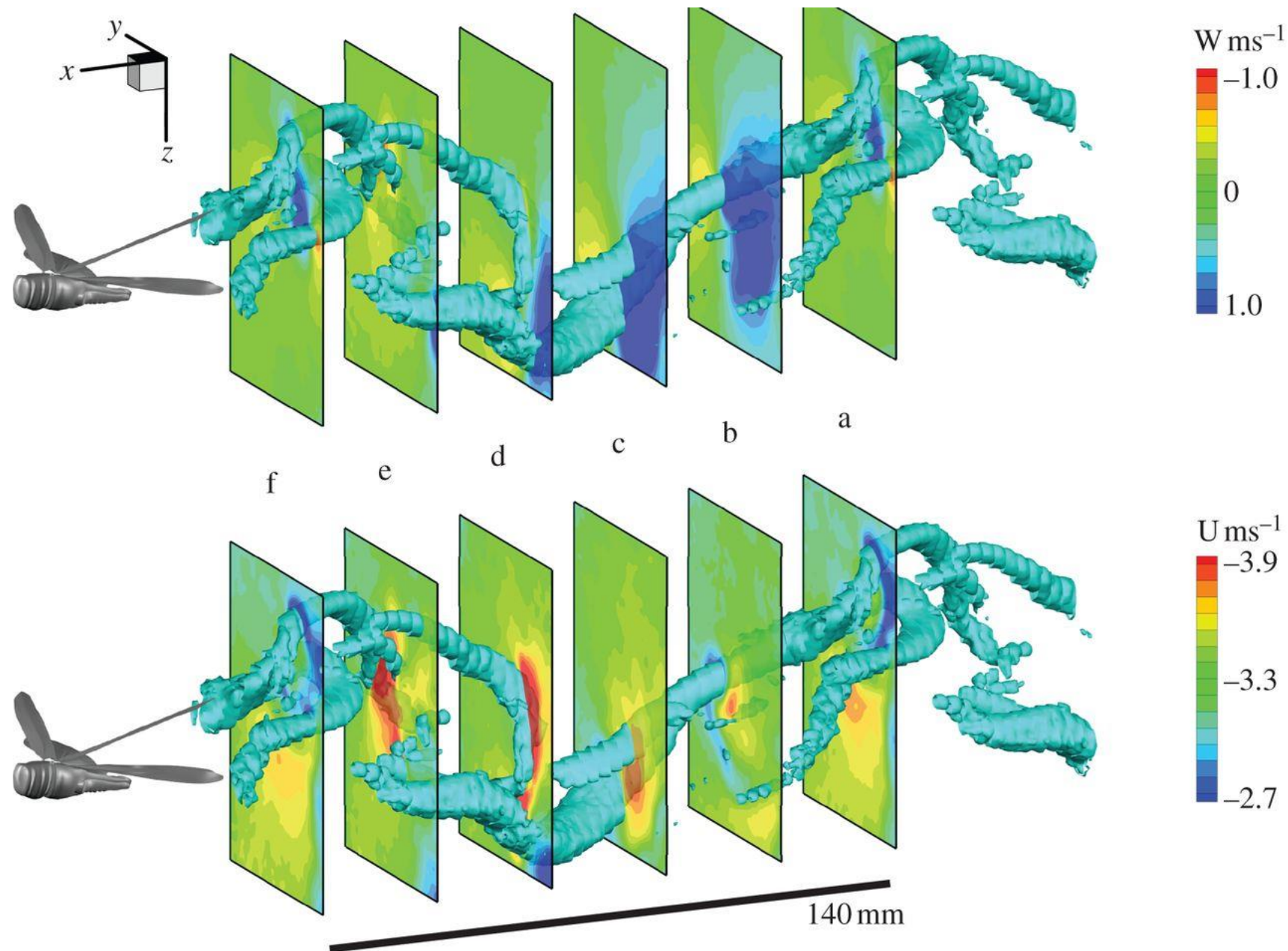
Dělení podle typu dat

- scientific visualization
- information visualization
- geographic visualization

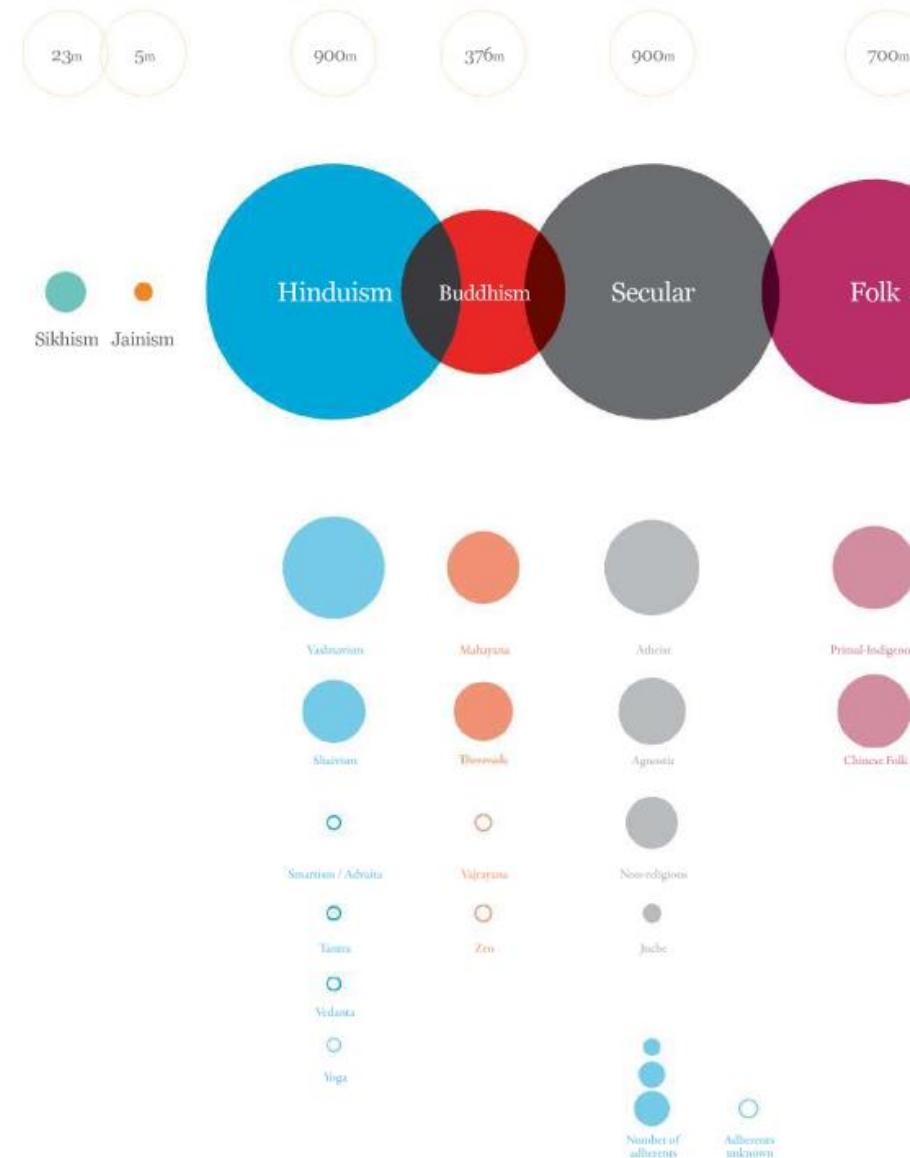
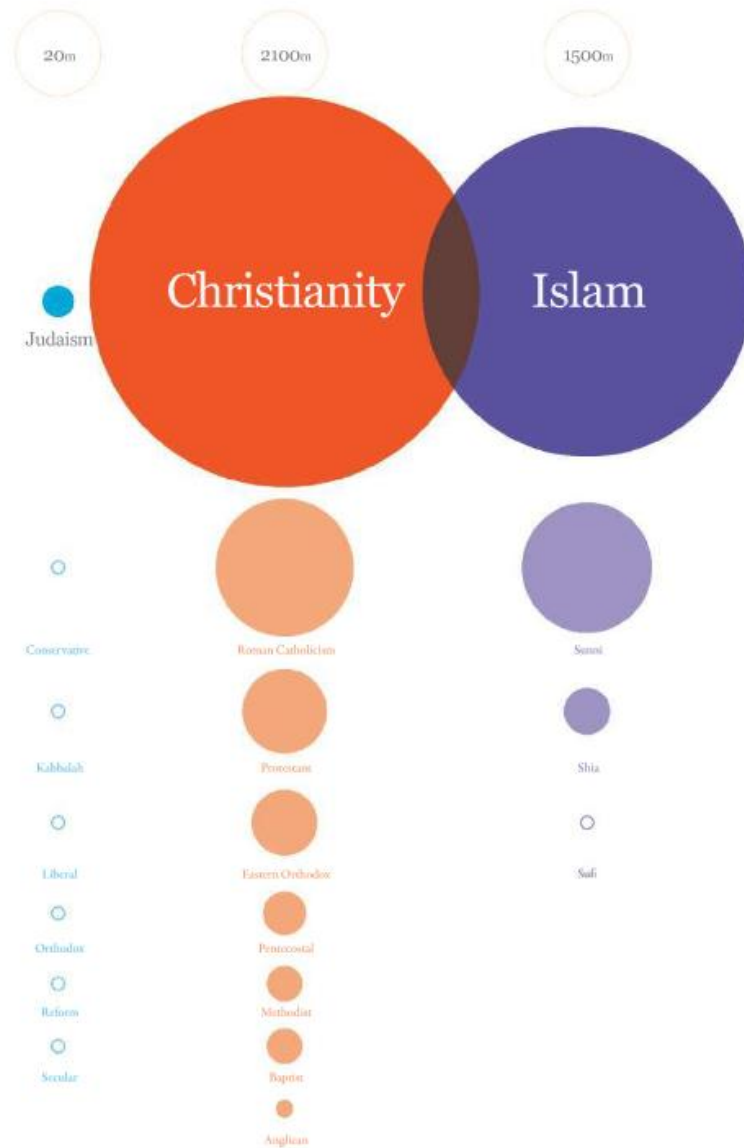
#sciviz



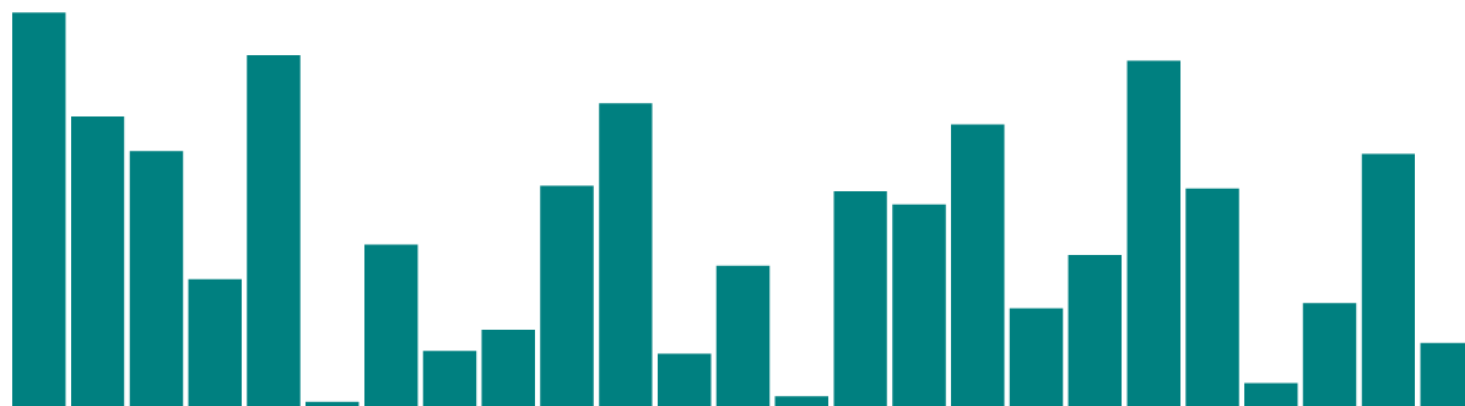
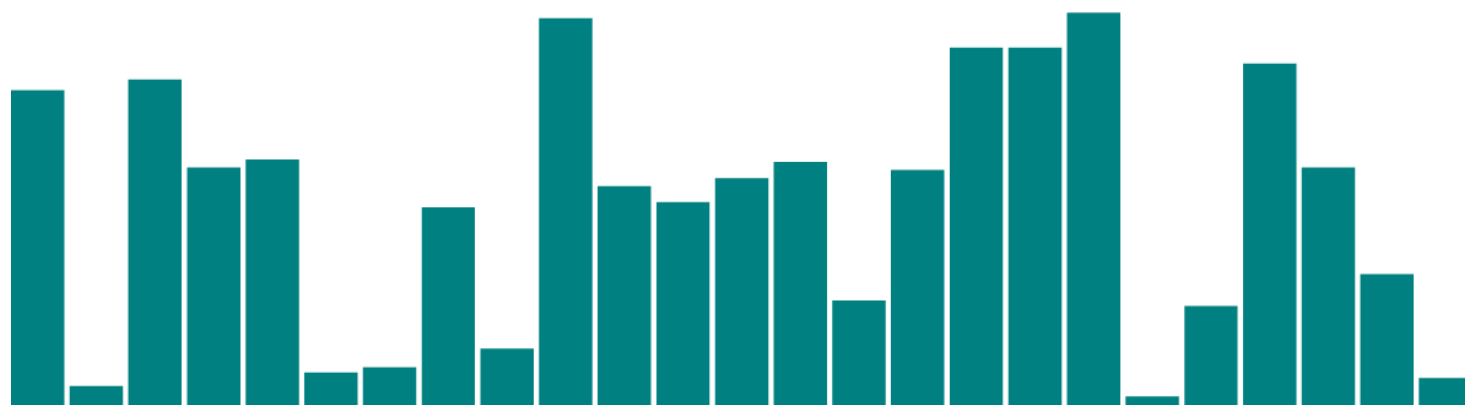
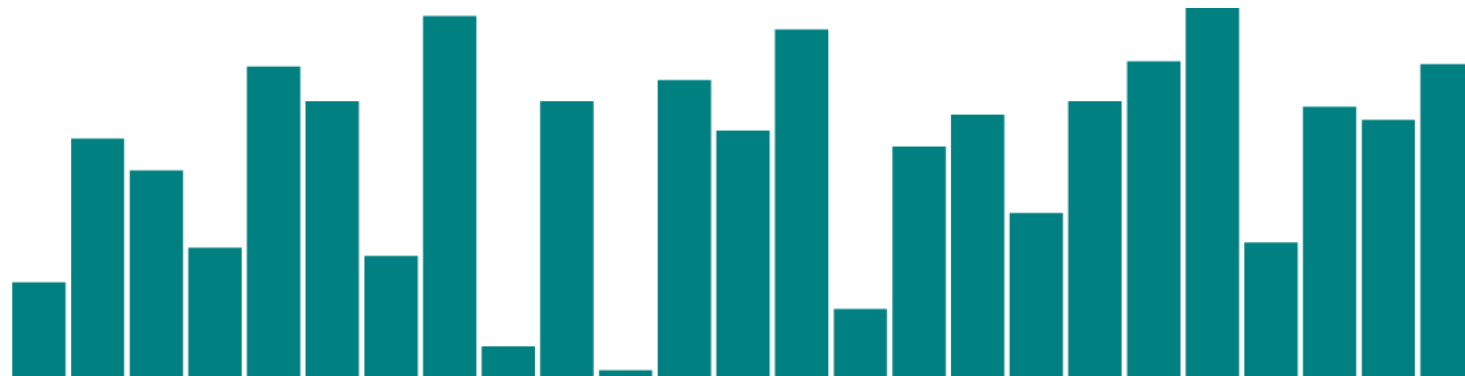
#sciviz



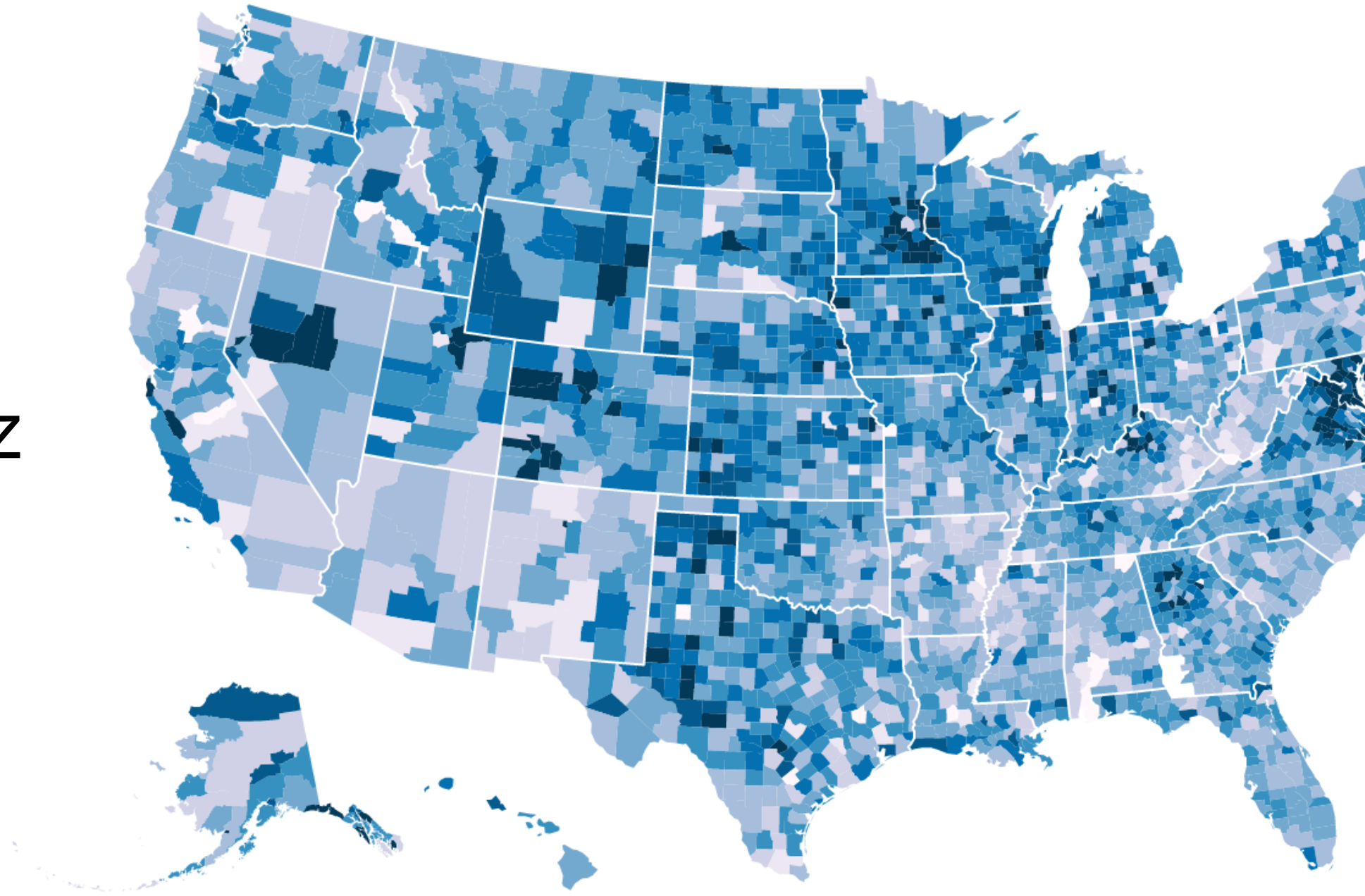
#infoviz



#infoviz



#geoviz



Co je dnes vizualizace?

Vizualizace dnes

- otevírání pole širokému spektru lidí (ve smyslu tvorby)
- stabilní **oblast studia** v akademické sféře
- vznikají samostatné studijní obory
- otevřené vzdělávání v oblasti - MOOC
- zmatení pojmů a představ (*nejen v umění*)

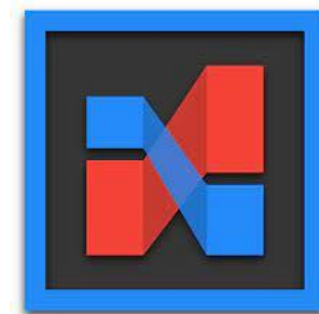
Objem a dostupnost dat

- data smog - přehlčení daty
- big data - krása, ale co s tím
- nefunguje bez “*information taming*” technologií

- široká dostupnost všem
- open data hnutí

Dostupnost nástrojů

- Demokratizace, laicizace
- Naklikávačky
- Tableau; D3.js,...
- Gephi, NodeXL - sítě
- ImagePlot, Voyant Tools - digital humanities
- Quadrigram, R, Processing
- [VDEs](#)



Komunita a spolupráce

- Sdílení
- Inspirace
- Podpora
- [DVS](#)



DATA
VISUALIZATION
SOCIETY

Otevřené vzdělávání

- Knihy zacílené na “*nevědce*”.
- Nathan Yau - Data Points
- Nathan Yau - Visualize This!
- MOOC a kurzy



A hned příště...

- A je toho víc... *data art*?
- Historie vizualizace.
- Jak to všechno začalo?
- Co se s ní děje dneska?
- Jaké si vzít poučení z předchozího vývoje?