

Ефективно визуелизирање на податоци

Ана Ристеска

За мене...

- Front-end
- UI
- Datavis
- Netcetera
- Реактор - Истражување во акција
- Хаклаб КИКА
- Слободен софтвер Македонија

Што е визуелизација?

Што е визуализација?

Визуелно презентирање и
интерпретирање на податоци.

Предизвик

Како да одбереме **најадекватен пристап** за
да ја раскажеме приказната што нашите
податоци ја носат.

Зошто токму оваа тема?



РОДОТ И ПОЛИТИКАТА

ГРАФИЦИ

[Почетна](#) > [Родот и политиката](#) > [Графици](#)

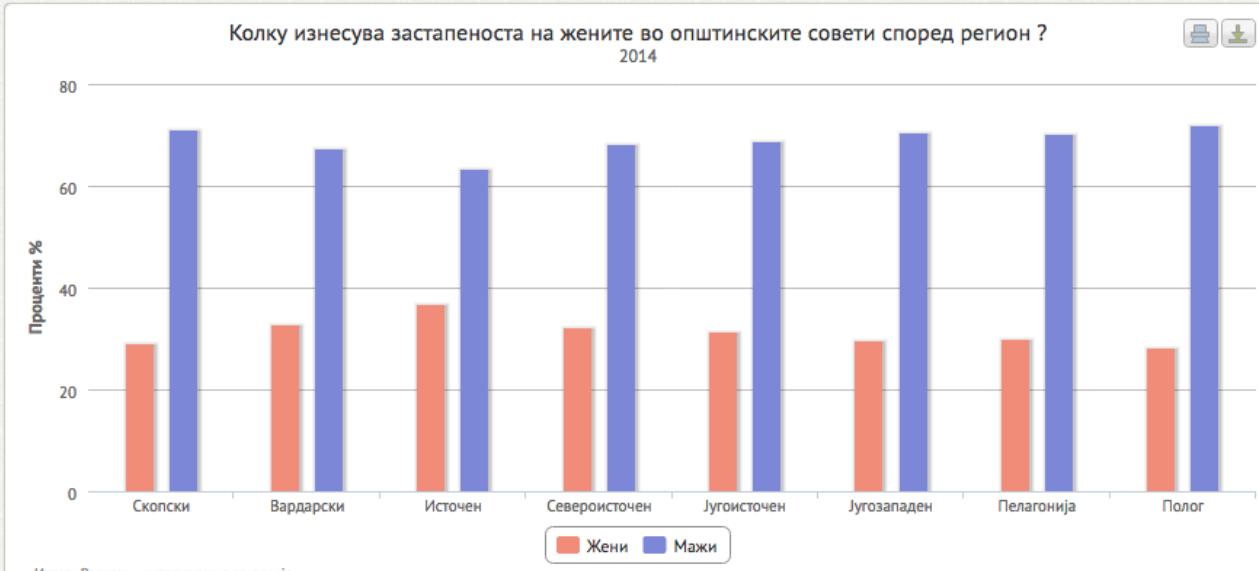
Застапеноста на жените во општинските совети според регион

График од истражувањето Непубликувани истражувања од Реактор - истражување во акција

Графикот кој е поделен според регионите на Република Македонија, го покажува процентот на жени советнички и мажи советници во општинските совети. Просечна застапеност на жените советнички низ регионите на Македонија е 31.16%, во споредба со застапеноста на мажи советници која е двојно поголма, и е во просек 68.85 %.

Според податоците прикажани на графикот, може да се забележи ниската вклученост на жените во носењето на одлуки во единиците на локалната самоуправа.

Упатство за користење



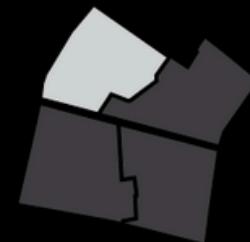
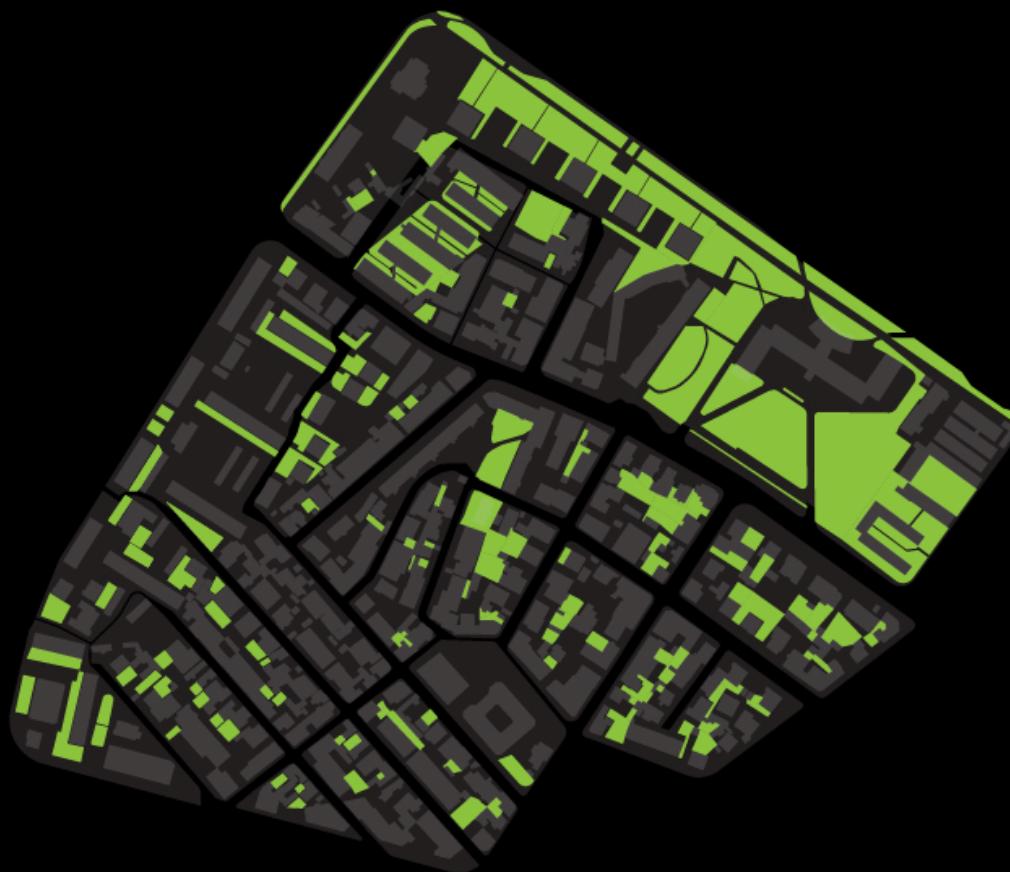
- › Политика
 - Истражувања
 - Графици
 - Инфографии
- › Семејство
- › Економија
- › Млади
- › Урбано планирање
- › Здравје
- › Образование
- › Социјална политика
- › Останати

Графикот припаѓа на категориите

Родот и политиката

Други истражувања

Јавни установи за згрижување и



ЗГРАДИ

ЈАВНИ

ОБРАЗОВАНИЕ

ЗДРАВСТВО

ПРИВРЕМЕНИ

БЕСПРАВНО

ЗЕЛЕНИЛО

СООБРАЌАЈ

ПЕШАЧКИ

КОЛСКИ

ПАРКИНГ

ПОВРШНИ

ГАРАЖИ

ПОДЗЕМНО

НАСЕЛБА

ГРАДСКА ЧЕТВРТ

БЛОК

ГОДИНА/ПЛАН

ЦЕНТАР

ДЕБАР МААЛО 1

1990

2012

2020



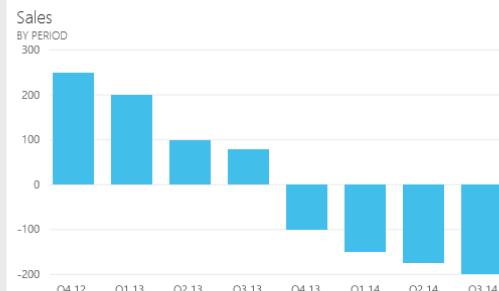
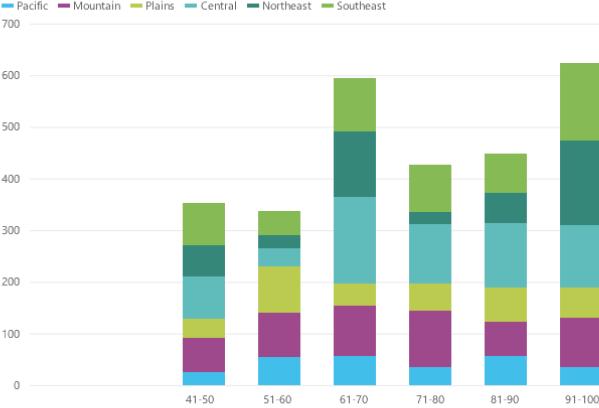


Travel Analysis

Ask a question about your data

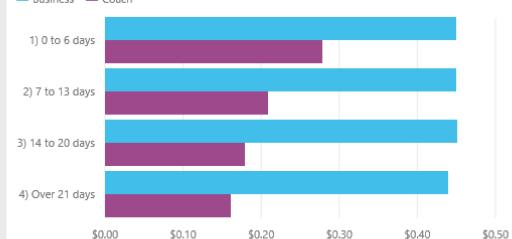
Regional Load
BY TERRITORY

Pacific Mountain Plains Central Northeast Southeast

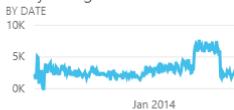


Average Cost Per Mile
BY ADVANCED BOOKING CATEGORY, TRIP CLASS

Business Coach



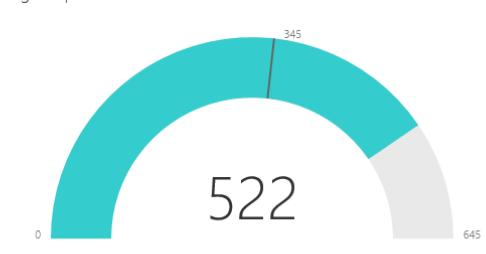
Delayed Flights



Actual Flight Expenditures, Bu...

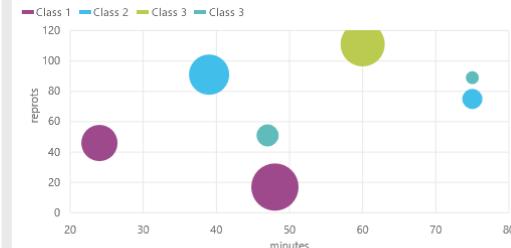
Budget Remaining
BY TRAVEL MONTH

Flight Expense



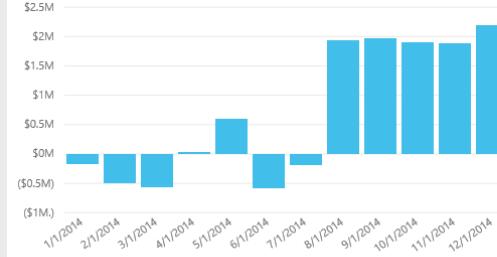
Rush Booking, Trip Class, Season
BY CATEGORY, TYPE

Class 1 Class 2 Class 3 Class 3



Budget Remaining
BY TRAVEL MONTH

\$2.5M



Variance to Budget

(\$1.39M)

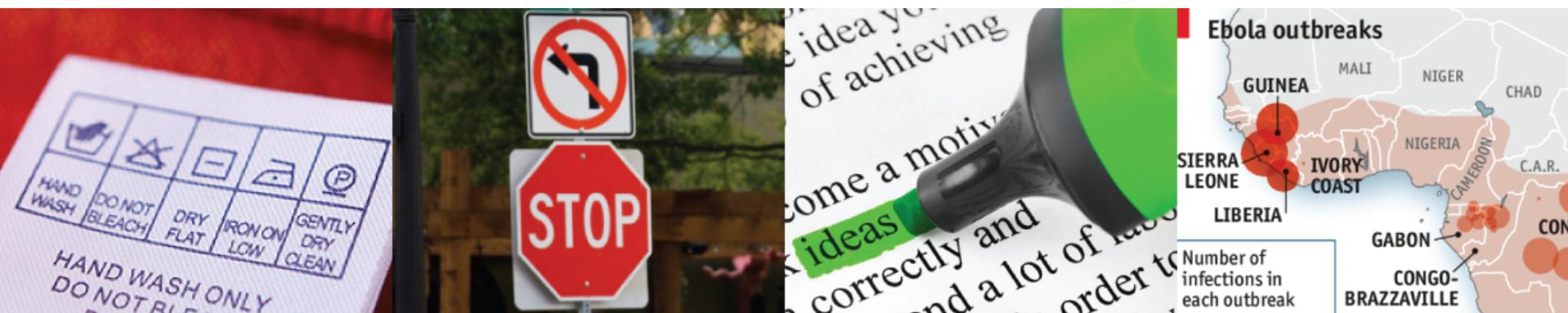
Average Cost Per Trip

\$723.16

Зошто визуелизација и front-end?

SVG, Canvas, Javascript, HTML5, CSS3

Визуелизацијата на податоци и информации е насекаде околу нас...



...од сообраќајни знаци до извештаи на светски организации

**“Ме разбираш или да
ти нацртам?!”**

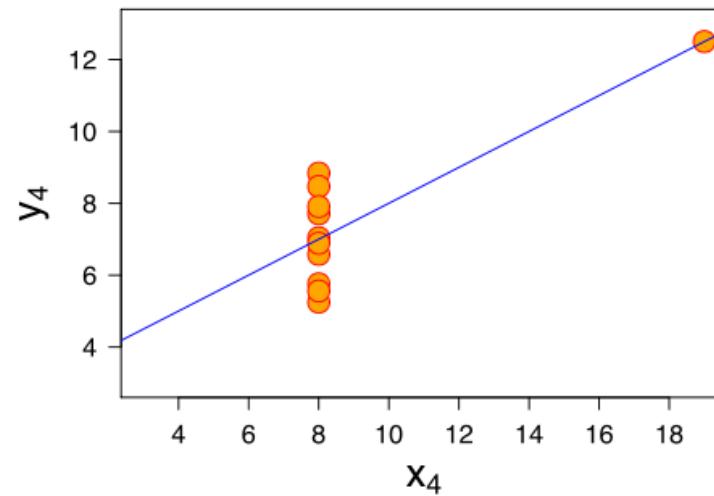
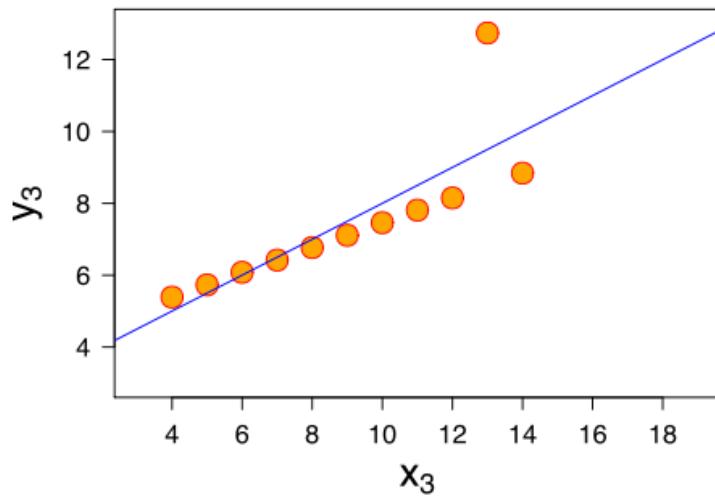
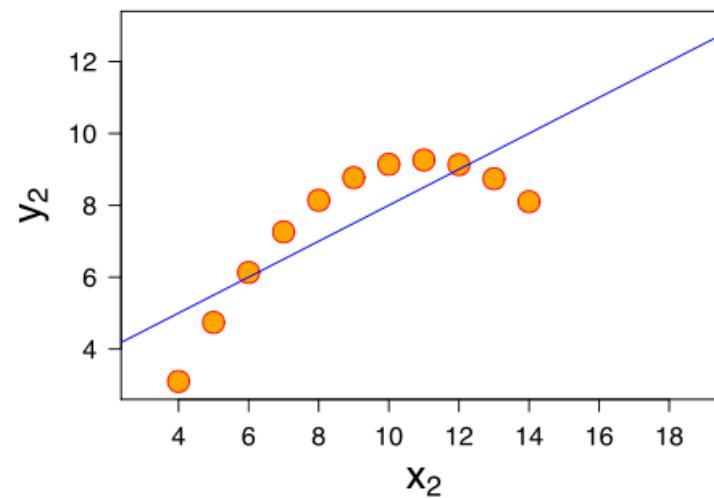
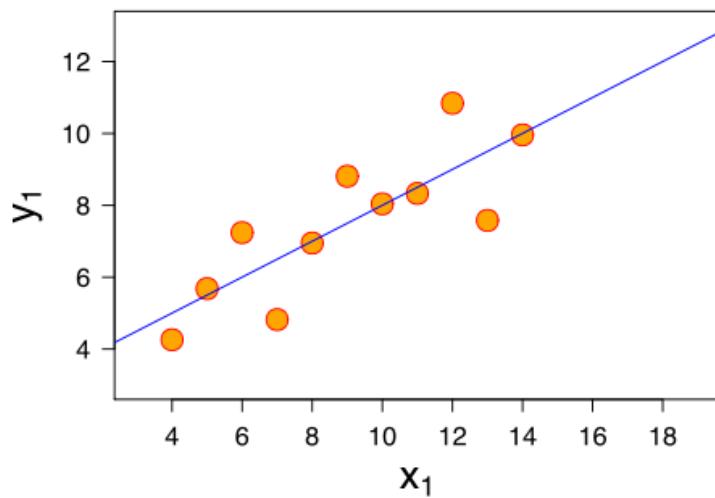
Анскомби Квартет

- 4 збира на податоци
- речиси слични вресности
- содржат единаесет (x,y) точки

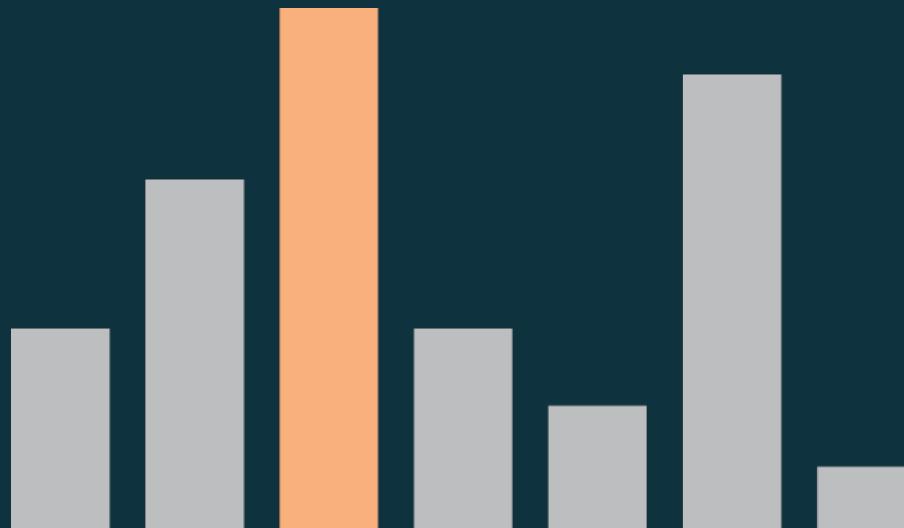
Ansccombe's quartet

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

Анскомби Квартет - визуелизиран

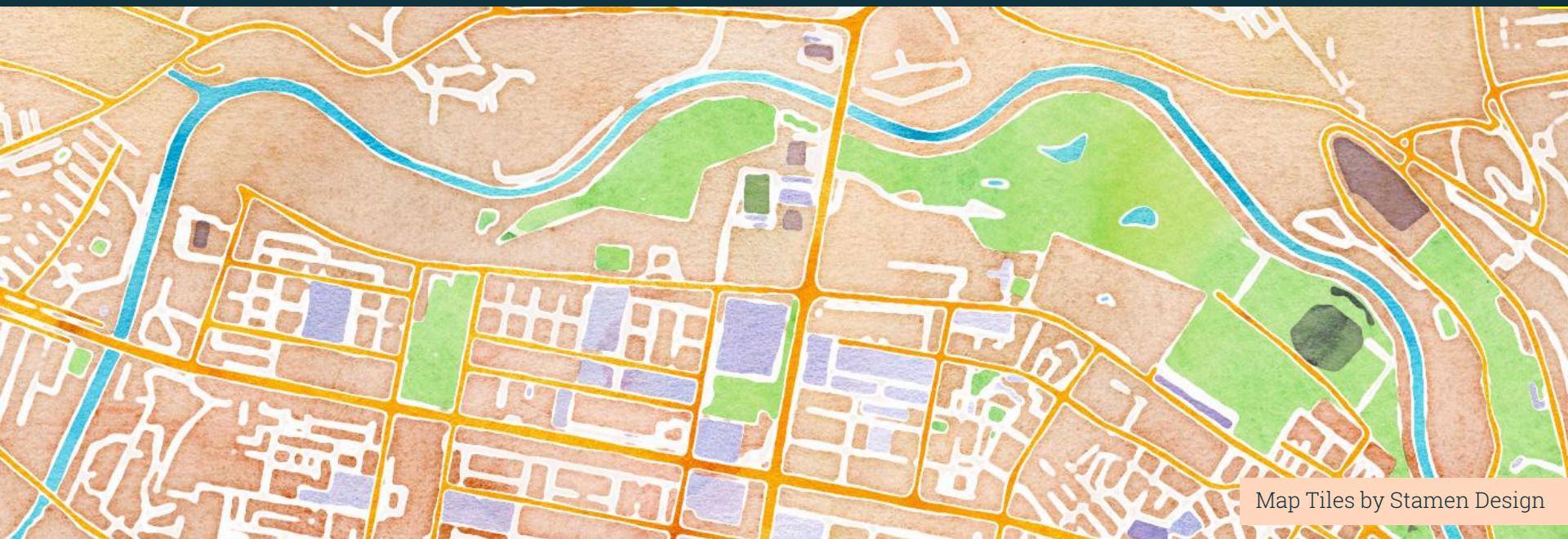


Графиците ни откриваат
информации, ни помагаат да
изразиме идеи и да потенцираме
разлики или екстреми.



Визуелизацијата е јазик

различен, универзален, невербален, комбиниран и умее да пренесе емоции, мислења, приказни и знаење.



**Како успеваме толку ефективно
да ги интерпретираме
визуализациите?**

Човечката перцепција:

Толкување преку систем 1 и систем 2

Човечката перцепција:

Толкување преку систем 1 и систем 2

потсвесен, неконтролиран, спонтан, секогаш активен

Човечката перцепција:

Толкување преку систем 1 и **систем 2**

инволвира намерен когнитивен ангажман,
свесно го активираме

Човечката перцепција:

Толкување преку **систем 1** и **систем 2**

потсвесен, неконтролиран, спонтан, секогаш активен

инволвира намерен когнитивен ангажман,
свесно го активираме

Човечката перцепција:

Толкување преку **систем 1** и **систем 2**

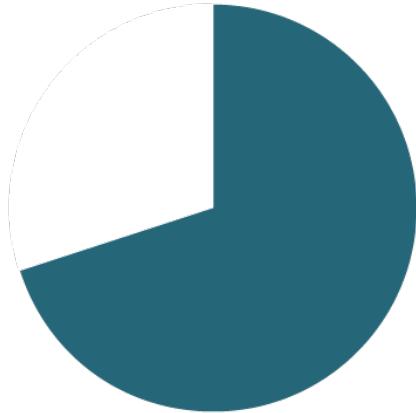
потсвесен, неконтролиран, спонтан, секогаш активен

инволвира намерен когнитивен ангажман,
свесно го активираме

Цел:

Да му се приближиме на системот 1, кој
потоа го ангажира системот 2 за
понатамошно процесирање.

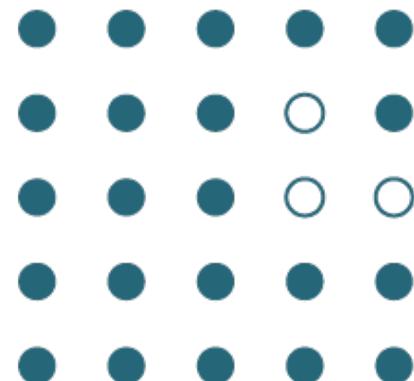
Зошто визуелизација?



70%

од сетилните рецептори на човечкиот организам се поврзани со видот.

Човечкиот мозок одлично препознава
патерни и отстапувања од патерни
(тренд, празнини, групации)

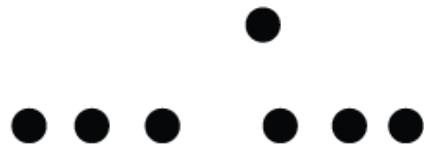


Преатентивни визуелни атибути

Не се учат и не се социално условени.

Нивната интерпретација не е произволна.

Позиција



Густина на патерн



Должина



Осветленост

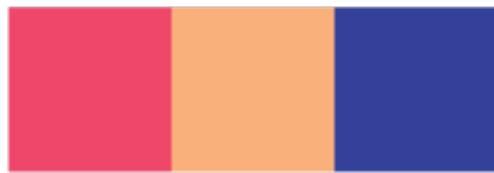


Други визуелни атибути

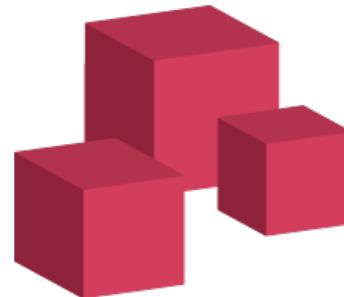
Добри за категории. Несоодветни за приказ на квантитет.

Категориите мора да бидат обележани со легенда.

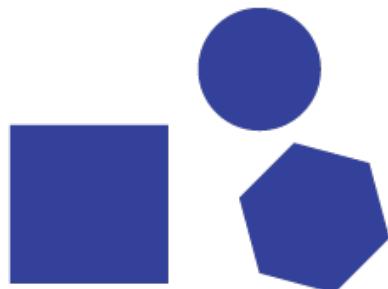
Боја



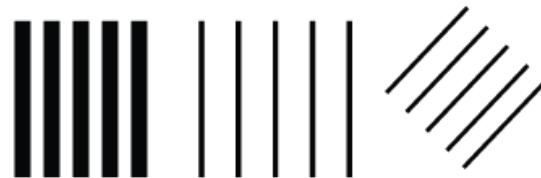
Волумен



Форма



Патерн



За многу прецизно
претставување на квантитет

Должина



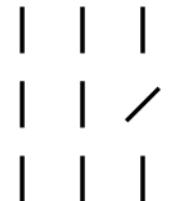
За не толку прецизно
претставување на квантитет

Ширина

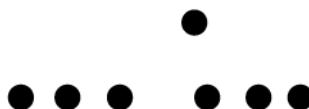


Претставување на податоци
кои не се квантитет

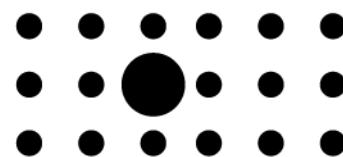
Ориентација



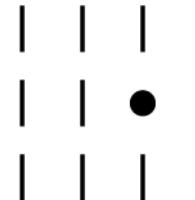
Позиција



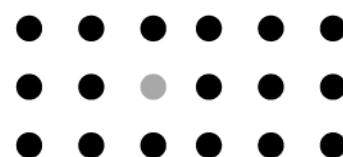
Големина



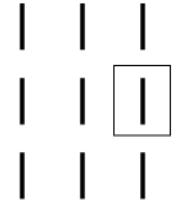
Форма



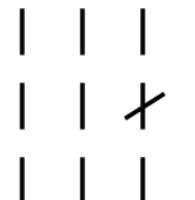
Интензитет



Со рамка



Со маркер



Properties and Best Uses of Visual Encodings

<u>Example</u>	<u>Encoding</u>	<u>Ordered</u>	<u>Useful values</u>	<u>Quantitative</u>	<u>Ordinal</u>	<u>Categorical</u>	<u>Relational</u>
	position, placement	yes	infinite	Good	Good	Good	Good
1, 2, 3; A, B, C	text labels	optional (alphabetical or numbered)	infinite	Good	Good	Good	Good
	length	yes	many	Good	Good		
	size, area	yes	many	Good	Good		
	angle	yes	medium/few	Good	Good		
	pattern density	yes	few	Good	Good		
	weight, boldness	yes	few		Good		
	saturation, brightness	yes	few		Good		
	color	no	few (< 20)			Good	
	shape, icon	no	medium			Good	
	pattern texture	no	medium			Good	
	enclosure, connection	no	infinite			Good	Good
	line pattern	no	few				Good
	line endings	no	few				Good
	line weight	yes	few		Good		



Податоците се вредности и врски.

Кои врски и вредности сакаме да ги
прикажеме?

промена во текот на времето?

различни категории?

мали разлики и отстапувања?

рангирање?

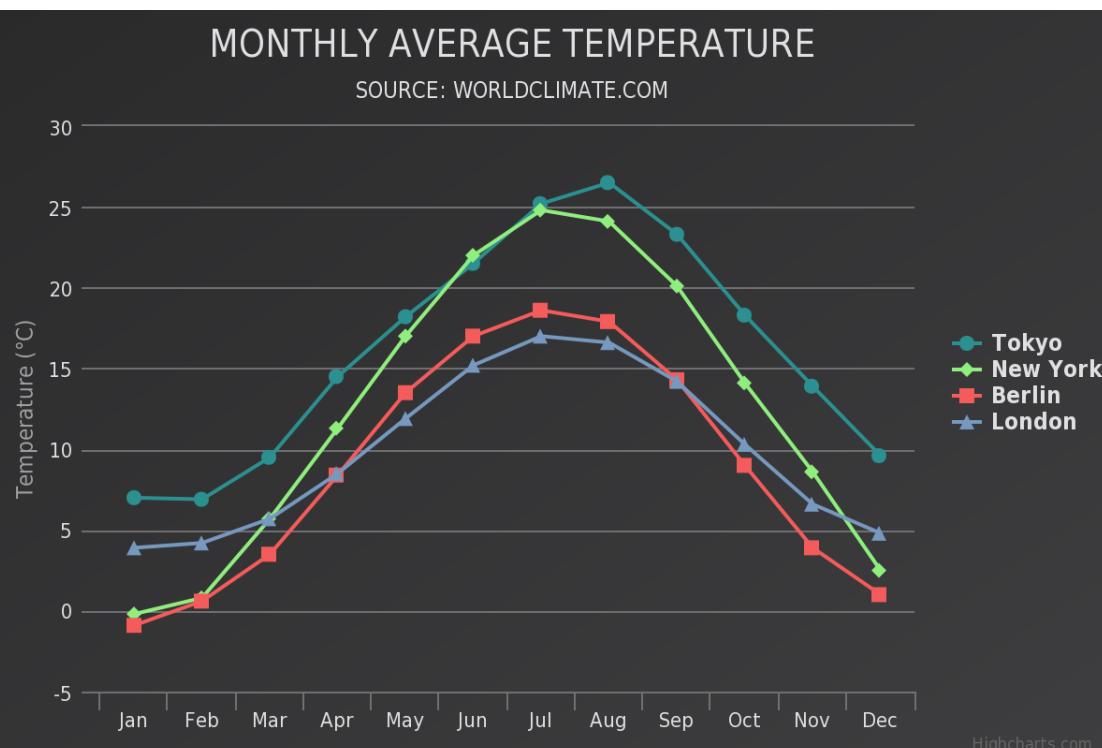
call to action?

Прашања со кои треба да почнеме:

- Која потреба за информација сакаме да ја задоволиме?
- Кои вредности ни се важни во овој контекст?
- Кои од овие вредности се најмногу, а кои најмалку важни?
- Дали постојат зависности кои треба да ги прикажеме?
- Кои вредности се поинтересни од други?
- Што очекуваме дека луѓето би направиле, откако ќе ја пренесеме информацијата?

Позицијата е најмоќниот визуелен атрибут

- Лесно увидуваме што не е на своето место.
- Се комбинира со оски.
- Оските даваат дополнителна информација и ни помагаат при пребарувањето.



Позицијата е најмоќниот визуелен атрибут



The Periodic Table of the Elements

by Robert Campion version 1.3

18

He
Helium
1⁹

20.1797
2372.3
He
Helium
1⁹

20.2080.7
Neon
Neon
1⁹ 2⁹

39.948
1520.6
Ar
Argon
1⁹ 3⁹ 3⁹

83.798
1350.9 3.00
Kr
Krypton
1⁹ 3⁹ 4⁹

131.293
1170.4 2.60
Xe
Xenon
1⁹ 4⁹ 5⁹

126.9044
1008.4 2.66
I
Iodine
1⁹ 4⁹ 5⁹

131.293
1170.4 2.60
Xe
Xenon
1⁹ 4⁹ 5⁹

127.60
869.5 2.10
Te
Tellurium
1⁹ 4⁹ 5⁹

121.760
840.4 2.05
Sb
Antimony
1⁹ 4⁹ 5⁹

121.760
834.0 2.05
Sn
Tin
1⁹ 4⁹ 5⁹

121.760
825.4 2.05
In
Indium
1⁹ 4⁹ 5⁹

121.760
816.9 2.05
Ge
Germanium
1⁹ 4⁹ 5⁹

121.760
808.4 2.05
As
Arsenic
1⁹ 4⁹ 5⁹

121.760
800.4 2.05
Se
Selenium
1⁹ 4⁹ 5⁹

121.760
792.4 2.05
Br
Bromine
1⁹ 4⁹ 5⁹

121.760
784.4 2.05
Kr
Krypton
1⁹ 4⁹ 5⁹

121.760
776.4 2.05
He
Helium
1⁹

group 1

1 1.00794
1312.0 2.20
H
Hydrogen
1⁹

2 6.941
520.2 0.98
Li
Lithium
1⁹ 2²

3 9.012182
899.5 1.57
Be
Beryllium
1⁹ 2²

4 22.98976
495.8 0.93
Na
Sodium
[Ne] 3s¹

5 24.3050
737.7 1.31
Mg
Magnesium
[Ne] 3s²

6 39.0983
418.8 0.82
K
Potassium
[Ar] 4s¹

7 40.078
589.8 1.00
Ca
Calcium
[Ar] 4s²

8 44.95591
633.1 1.36
Sc
Scandium
[Ar] 3d¹ 4s²

9 47.867
658.8 1.54
Ti
Titanium
[Ar] 3d² 4s²

10 50.9415
650.9 1.63
V
Vanadium
[Ar] 3d³ 4s²

11 51.9962
652.9 1.66
Cr
Chromium
[Ar] 3d⁵ 4s²

12 54.93804
717.3 1.55
Mn
Manganese
[Ar] 3d⁵ 4s²

13 55.845
762.5 1.83
Fe
Iron
[Ar] 3d⁶ 4s²

atomic mass
or most stable mass number
1st ionization energy
in kJ/mol

chemical symbol
name
electron configuration

55.845
762.5 1.83
26
Fe
Iron
[Ar] 3d⁶ 4s²

atomic number
electronegativity
oxidation states
most common are bold

alkali metals
alkaline metals
other metals
transition metals
lanthanoids
actinoids
metalloids
nonmetals
halogens
noble gases
unknown elements
radioactive elements have
masses in parentheses

13 10.811
800.6 2.04
B
Boron
1⁹ 2² 2p¹

14 12.0107
1066.5 2.55
C
Carbon
1⁹ 2² 2p²

15 14.0067
1402.3 3.04
N
Nitrogen
1⁹ 2² 2p³

16 15.9994
1313.9 3.44
O
Oxygen
1⁹ 2² 2p⁴

17 18.998403
1681.0 3.98
F
Fluorine
1⁹ 2² 2p⁵

18 20.1797
2080.7
He
Helium
1⁹

19 20.2077
2372.3
He
Helium
1⁹

20 21.764
762.0 2.01
Ga
Gallium
1⁹ 2² 3p¹

21 22.065
947.0 2.18
Ge
Germanium
1⁹ 2² 3p²

22 23.986
941.0 2.55
As
Arsenic
1⁹ 2² 3p³

23 24.9043
1139.9 2.96
Se
Selenium
1⁹ 2² 3p⁴

24 25.9043
1350.9 3.00
Br
Bromine
1⁹ 3d¹⁰ 4s²

25 26.9043
1520.6
Kr
Krypton
1⁹ 3d¹⁰ 4s²

26 27.9043
1700.4 3.40
Xe
Xenon
1⁹ 3d¹⁰ 4s²

27 28.9043
1880.4 3.80
Rb
Rubidium
[K] 5s¹

28 29.9043
2060.4 4.20
Sr
Strontium
[K] 4d¹ 5s¹

29 30.97696
1011.8 4.60
Y
Yttrium
[K] 4d¹ 5s²

30 31.996
578.8 5.00
Nb
Zirconium
[K] 4d¹ 5s²

31 32.996
578.8 5.28
Ta
Tantalum
[K] 4d³ 5s²

32 33.996
762.0 5.56
Ru
Rhodium
[K] 4d⁷ 5s¹

33 34.996
947.0 5.84
Os
Osmium
[K] 4d⁹ 5s¹

34 35.996
1139.9 6.12
W
Tungsten
[K] 4f¹⁴ 5d⁴ 6s²

35 36.996
1350.9 6.40
Re
Rhenium
[K] 4f¹⁴ 5d⁵ 6s²

36 37.996
1520.6 6.68
Mo
Molybdenum
[K] 4f¹⁴ 5d⁵ 6s²

37 38.996
1700.4 7.06
Tc
Technetium
[K] 4f¹⁴ 5d⁵ 6s¹

38 39.996
1880.4 7.34
Rh
Rhodium
[K] 4f¹⁴ 5d⁷ 6s¹

39 40.996
2060.4 7.62
Pd
Palladium
[K] 4f¹⁴ 5d⁹ 6s¹

40 41.996
2230.4 7.90
Nb
Niobium
[K] 4f¹⁴ 5d¹ 6s²

41 42.996
2410.4 8.18
Nb
Niobium
[K] 4f¹⁴ 5d¹ 6s²

42 43.996
2590.4 8.46
Nb
Niobium
[K] 4f¹⁴ 5d¹ 6s²

43 44.996
2770.4 8.74
Nb
Niobium
[K] 4f¹⁴ 5d¹ 6s²

44 45.996
2950.4 9.02
Nb
Niobium
[K] 4f¹⁴ 5d¹ 6s²

45 46.996
3130.4 9.30
Nb
Niobium
[K] 4f¹⁴ 5d¹ 6s²

46 47.996
3310.4 9.58
Nb
Niobium
[K] 4f¹⁴ 5d¹ 6s²

47 48.996
3490.4 9.86
Nb
Niobium
[K] 4f¹⁴ 5d¹ 6s²

48 49.996
3670.4 10.14
Nb
Niobium
[K] 4f¹⁴ 5d¹ 6s²

49 50.996
3850.4 10.42
Nb
Niobium
[K] 4f¹⁴ 5d¹ 6s²

50 51.996
4030.4 10.70
Nb
Niobium
[K] 4f¹⁴ 5d¹ 6s²

51 52.996
4210.4 11.08
Nb
Niobium
[K] 4f¹⁴ 5d¹ 6s²

52 53.996
4390.4 11.36
Nb
Niobium
[K] 4f¹⁴ 5d¹ 6s²

53 54.996
4570.4 11.64
Nb
Niobium
[K] 4f¹⁴ 5d¹ 6s²

54 55.996
4750.4 11.92
Nb
Niobium
[K] 4f¹⁴ 5d¹ 6s²

55 56.996
4930.4 12.20
Nb
Niobium
[K] 4f¹⁴ 5d¹ 6s²

56 57.996
5110.4 12.48
Nb
Niobium
[K] 4f¹⁴ 5d¹ 6s²

57 58.996
5290.4 12.76
Nb
Niobium
[K] 4f¹⁴ 5d¹ 6s²

58 59.996
5470.4 13.04
Nb
Niobium
[K] 4f¹⁴ 5d¹ 6s²

59 60.996
5650.4 13.32
Nb
Niobium
[K] 4f¹⁴ 5d¹ 6s²

60 61.996
5830.4 13.60
Nb
Niobium
[K] 4f¹⁴ 5d¹ 6s²

61 62.996
6010.4 13.88
Nb
Niobium
[K] 4f¹⁴ 5d¹ 6s²

62 63.996
6190.4 14.16
Nb
Niobium
[K] 4f¹⁴ 5d¹ 6s²

63 64.996
6370.4 14.44
Nb
Niobium
[K] 4f¹⁴ 5d¹ 6s²

64 65.996
6550.4 14.72
Nb
Niobium
[K] 4f¹⁴ 5d¹ 6s²

65 66.996
6730.4 15.00
Nb
Niobium
[K] 4f¹⁴ 5d¹ 6s²

66 67.996
6910.4 15.28
Nb
Niobium
[K] 4f¹⁴ 5d¹ 6s²

67 68.996
7090.4 15.56
Nb
Niobium
[K] 4f¹⁴ 5d¹ 6s²

68 69.996
7270.4 15.84
Nb
Niobium
[K] 4f¹⁴ 5d¹ 6s²

69 70.996
7450.4 16.12
Nb
Niobium
[K] 4f¹⁴ 5d¹ 6s²

70 71.996
7630.4 16.40
Nb
Niobium
[K] 4f¹⁴ 5d¹ 6s²

71 72.996
7810.4 16.68
Nb
Niobium
[K] 4f¹⁴ 5d¹ 6s²

72 73.996
8000.4 16.96
Nb
Niobium
[K] 4f¹⁴ 5d¹ 6s²

73 74.996
8180.4 17.24
Nb
Niobium
[K] 4f¹⁴ 5d¹ 6s²

74 75.996
8360.4 17.52
Nb
Niobium
[K] 4f¹⁴ 5d¹ 6s²

75 76.996
8540.4 17.80
Nb
Niobium
[K] 4f¹⁴ 5d¹ 6s²

76 77.996
8720.4 18.08
Nb
Niobium
[K] 4f¹⁴ 5d¹ 6s²

77 78.996
8900.4 18.36
Nb
Niobium
[K] 4f¹⁴ 5d¹ 6s²

78 79.996
9080.4 18.64
Nb
Niobium
[K] 4f¹⁴ 5d¹ 6s²

79 80.996
9260.4 18.92
Nb
Niobium
[K] 4f¹⁴ 5d¹ 6s²

80 81.996
9440.4 19.20
Nb
Niobium
[K] 4f¹⁴ 5d¹ 6s²

81 82.996
9620.4 19.48
Nb
Niobium
[K] 4f¹⁴ 5d¹ 6s²

82 83.996
9800.4 19.76
Nb
Niobium
[K] 4f¹⁴ 5d¹ 6s²

83 84.996
10000.4 20.04
Nb
Niobium
[K] 4f¹⁴ 5d¹ 6s²

84 85.996
10180.4 20.32
Nb
Niobium
[K] 4f¹⁴ 5d¹ 6s²

85 86.996
10360.4 20.60
Nb
Niobium
[K] 4f¹⁴ 5d¹ 6s²

86 87.996
10540.4 20.88
Nb
Niobium
[K] 4f¹⁴ 5d¹ 6s²

87 88.996
10720.4 21.16
Nb
Niobium
[K] 4f¹⁴ 5d¹ 6s²

88 89.996
10900.4 21.44
Nb
Niobium
[K] 4f¹⁴ 5d¹ 6s²

89 90.996
11080.4 21.72
Nb
Niobium
[K] 4f¹⁴ 5d¹ 6s²

90 91.996
11260.4 22.00
Nb
Niobium
[K] 4f¹⁴ 5d¹ 6s²

91 92.996
11440.4 22.28
Nb
Niobium
[K] 4f¹⁴ 5d¹ 6s²

92 93.996
11620.4 22.56
Nb
Niobium
[K] 4f¹⁴ 5d¹ 6s²

93 94.996
11800.4 22.84
Nb
Niobium
[K] 4f¹⁴ 5d¹ 6s²

94 95.996
11980.4 23.12
Nb
Niobium
[K] 4f¹⁴ 5d¹ 6s²

95 96.996
12160.4 23.40
Nb
Niobium
[K] 4f¹⁴ 5d¹ 6s²

96 97.996
12340.4 23.68
Nb
Niobium
[K] 4f¹⁴ 5d¹ 6s²

97 98.996
12520.4 23.96
Nb
Niobium
[K] 4f¹⁴ 5d¹ 6s²

98 99.996
12700.4 24.24
Nb
Niobium
[K] 4f¹⁴ 5d¹ 6s²

99 100.996
12880.4 24.52
Nb
Niobium
[K] 4f¹⁴ 5d¹ 6s²

100 101.996
13060.4 24.80
Nb
Niobium
[K] 4f¹⁴ 5d¹ 6s²

101 102.996
13240.4 25.08
Nb
Niobium
[K] 4f¹⁴ 5d¹ 6s²

102 103.996
13420.4 25.36
Nb
Niobium
[K] 4f¹⁴ 5d¹ 6s²

103 104.996
13600.4 25.64
Nb
Niobium
[K] 4f¹⁴ 5d¹ 6s²

104 105.996
13780.4 25.92
Nb
Niobium
[K] 4f¹⁴ 5d¹ 6s²

105 106.996
13960.4 26.20
Nb
Niobium
[K] 4f¹⁴ 5d¹ 6s²

106 107.996
14140.4 26.48
Nb
Niobium
[K] 4f¹⁴ 5d¹ 6s²

107 108.996
14320.4 26.76
Nb
Niobium
[K] 4f¹⁴ 5d¹ 6s²

108 109.996
14500.4 27.04
Nb
Niobium
[K] 4f¹⁴ 5d¹ 6s²

109 110.996
14680.4 27.32
Nb
Niobium
[K] 4f¹⁴ 5d¹ 6s²

110 111.996
14860.4 27.60
Nb
Niobium
[K] 4f¹⁴ 5d¹ 6s²

111 112.996
15040.4 27.88
Nb
Niobium
[K] 4f¹⁴ 5d¹ 6s²

112 113.996
15220.4 28.16
Nb
Niobium
[K] 4f¹⁴ 5d¹ 6s²

113 114.996
15400.4 28.44
Nb
Niobium
[K] 4f¹⁴ 5d¹ 6s²

114 115.996
15580.4 28.72
Nb
Niobium
[K] 4f¹⁴ 5d¹ 6s²

115 116.996
15760.4 29.00
Nb
Niobium
[K] 4f¹⁴ 5d¹ 6s²

116 117.996
15940.4 29.28
Nb
Niobium
[K] 4f¹⁴ 5d¹ 6s²

117 118.996
16120.4 29.56
Nb
Niobium
[K] 4f¹⁴ 5d¹ 6s²

119 120.996
16300.4 29.84
Nb
Niobium
[K] 4f¹⁴ 5d¹ 6s²

120 121.996
16480.4 30.12
Nb
Niobium
[K] 4f¹⁴ 5d¹ 6s²

121 122.996
16660.4 30.40
Nb
Niobium
[K] 4f¹⁴ 5d¹ 6s²

122 123.996
16840.4 30.68
Nb
Niobium
[K] 4f¹⁴ 5d¹ 6s²

123 124.996
17020.4 30.96
Nb
Niobium
[K] 4f¹⁴ 5d¹ 6s²

124 125.996
17200.4 31.24
Nb
Niobium
[K] 4f¹⁴ 5d¹ 6s²

125 126.996
17380.4 31.52
Nb
Niobium
[K] 4f¹⁴ 5d¹ 6s²

126 127.996
17560.4 31.80
Nb
Niobium
[K] 4f¹⁴ 5d¹ 6s²

127 128.996
17740.4 32.08
Nb
Niobium
[K] 4f¹⁴ 5d¹ 6s²

128 129.996
17920.4 32.36
Nb
Niobium
[K] 4f¹⁴ 5d¹ 6s²

129 130.996
18100.4 32.64
Nb
Niobium
[K] 4f¹⁴ 5d¹ 6s²

130 131.996
18280.4 32.92
Nb
Niobium
[K] 4f¹⁴ 5d¹ 6s²

131 132.996
18460.4 33.20
Nb
Niobium
[K] 4f¹⁴ 5d¹ 6s²

132 133.996
18640.4 33.48
Nb
Niobium
[K] 4f¹⁴ 5d¹ 6s²

133 134.996
18820.4 33.76
Nb
Niobium
[K] 4f¹⁴ 5d¹ 6s²

134 135.996
19000.4 34.04
Nb
Niobium
[K] 4f¹⁴ 5d¹ 6s²

135 136.996
19180.4 34.32
Nb
Niobium
[K] 4f¹⁴ 5d¹ 6s²

136 137.996
19360.4 34.60
Nb
Niobium
[K] 4f¹⁴ 5d¹ 6s²

137 138.996
19540.4 34.88
Nb
Niobium
[K] 4f¹⁴ 5d¹ 6s²

138 139.996
19720.4 35.16
Nb
Niobium
[K] 4f¹⁴ 5d¹ 6s²

139 140.996
19900.4 35.44
Nb
Niobium
[K] 4f¹⁴ 5d¹ 6s²

140 141.996
20080.4 35.72
Nb
Niobium
[K] 4f¹⁴ 5d¹ 6s²

141 142.996
20260.4 36.00
Nb
Niobium
[K] 4f¹⁴ 5d¹ 6s²

142 143.996
20440.4 36.28
Nb
Niobium
[K] 4f¹⁴ 5d¹ 6s²

143 144.996
20620.4 36.56
Nb
Niobium
[K] 4f¹⁴ 5d¹ 6s²

144 145.996
20800.4 36.84
Nb
Niobium
[K] 4f¹⁴ 5d¹ 6s²

145



Facebook
October 2005

TheFacebook is now Facebook.



Sean Parker It only cost me \$200,000!

Like · Comment



Mark Zuckerberg Girlfriend in town!
Let's talk later.



Yahoo But what if we give you \$1 billion?

Like · Comment



Accel Partners ► Facebook
May 2005 *

We (and some other investors) are giving you
\$13 million.



Mark Zuckerberg likes this.

Like · Comment



Facebook ► Viacom
March 2005

Nice talking to you, but \$75 million isn't enough.

Like · Comment



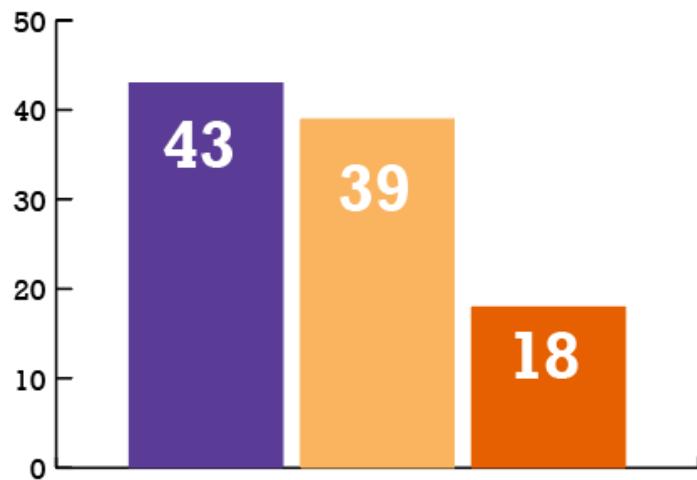
Cameron & Tyler Winklevoss ► Facebook

September 2004

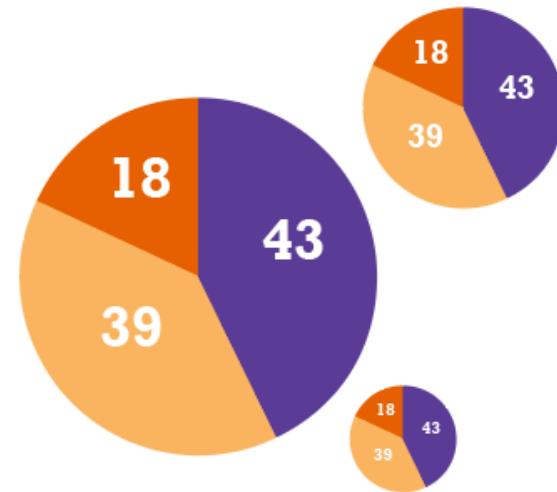
Watch out for a lawsuit, bro! **Mark** was supposed to
build our social network.

Должина

Столбовите се најпрецизни при споредба, особено кога има мали разлики.

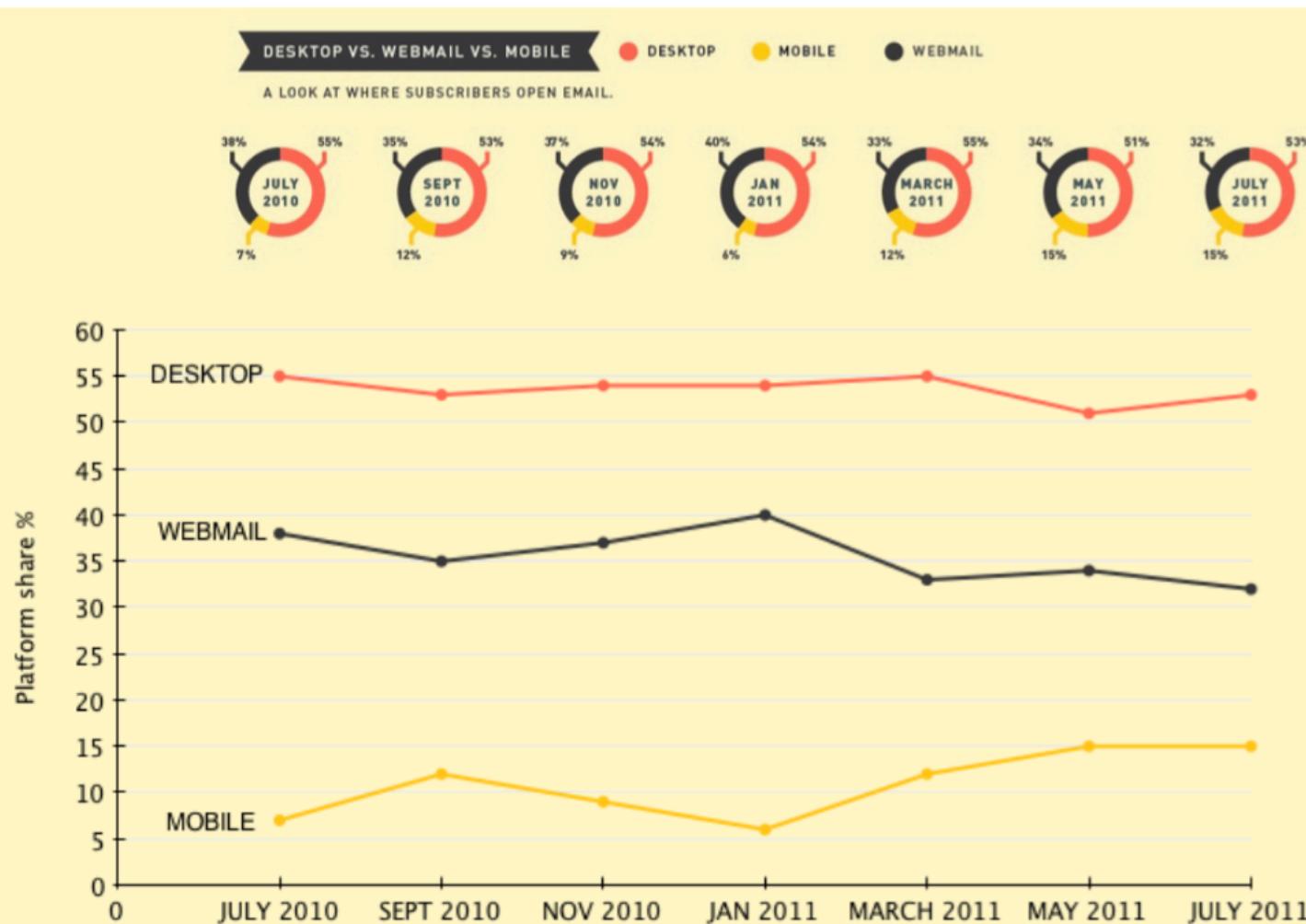


VS



Пити

Добри за помалку категории со големи разлики.
Неопходна им е легенда.



Боја

Добра за категоризирање: пол, возраст, држава, жанр,...

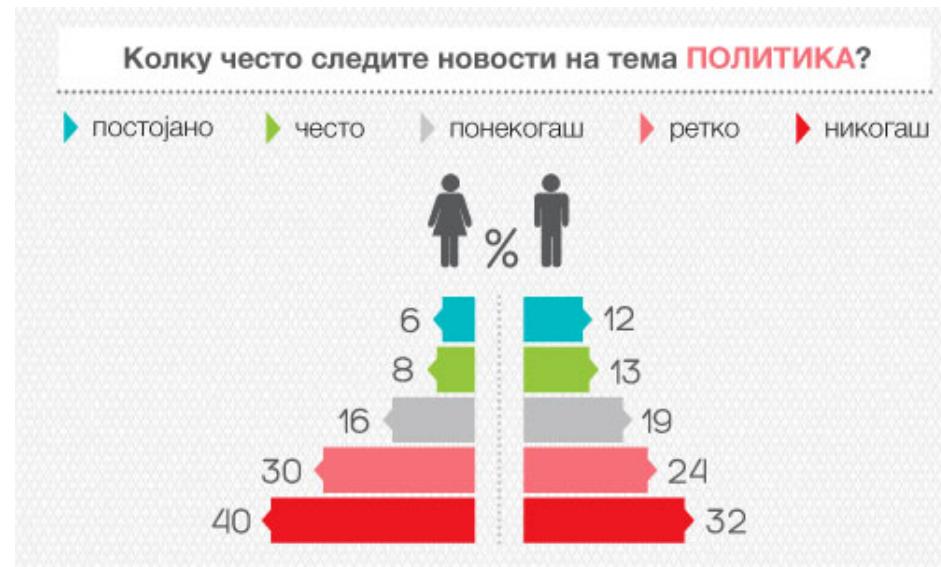
Лоша за рангирање (црвената не може да е поважна од сината)

Добра за потенцирање на разлики



Giving statements in informative programmes on TV

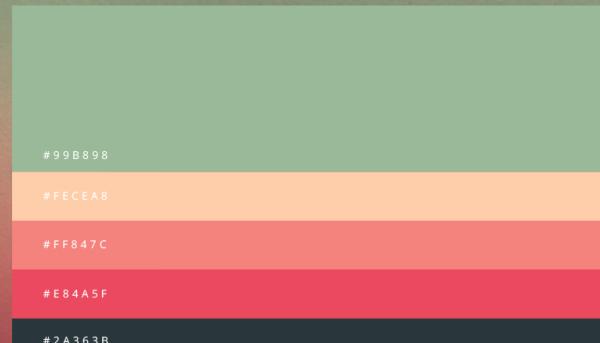
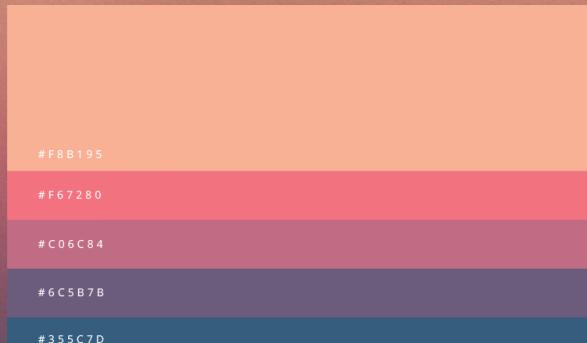
Source: Agency for audiovisual media services



Како да бираме бои?

Не е неопходно боите да се преразлични;
Можеме да варираме во осветленоста;
Можеме да користиме бои на брендот

Алатки: ColorBrewer, Adobe Kuler, Coolors



Minimalist Color Palettes 2015

DirectPoll

Create and conduct polls in a minute.
Use it in your flipped classroom, in your
lecture or just to amaze your audience.

78

60

93

[CREATE YOUR POLL NOW!](#)

Features

It's time to interact with your audience during your presentation. DirectPoll offers you a real-time responsive element on stage. Ask questions, feel the pulse of your audience and visualize the answers as they come in, right here, right now.

Preparation

Setup your poll in advance or on the fly. Combine single as well as multiple choice questions and more. Easy as a breeze with DirectPoll.

Presentation

Include your poll in your presentation. Automatically trigger new questions and integrate live visualization of incoming answers. Easy setup, automated handling: Concentrate on your presentation, not the technology.

Choose movie(s)

The Empire Stri...

6

The Kings of Su...

9

Chinatown

4

Fahrenheit 451

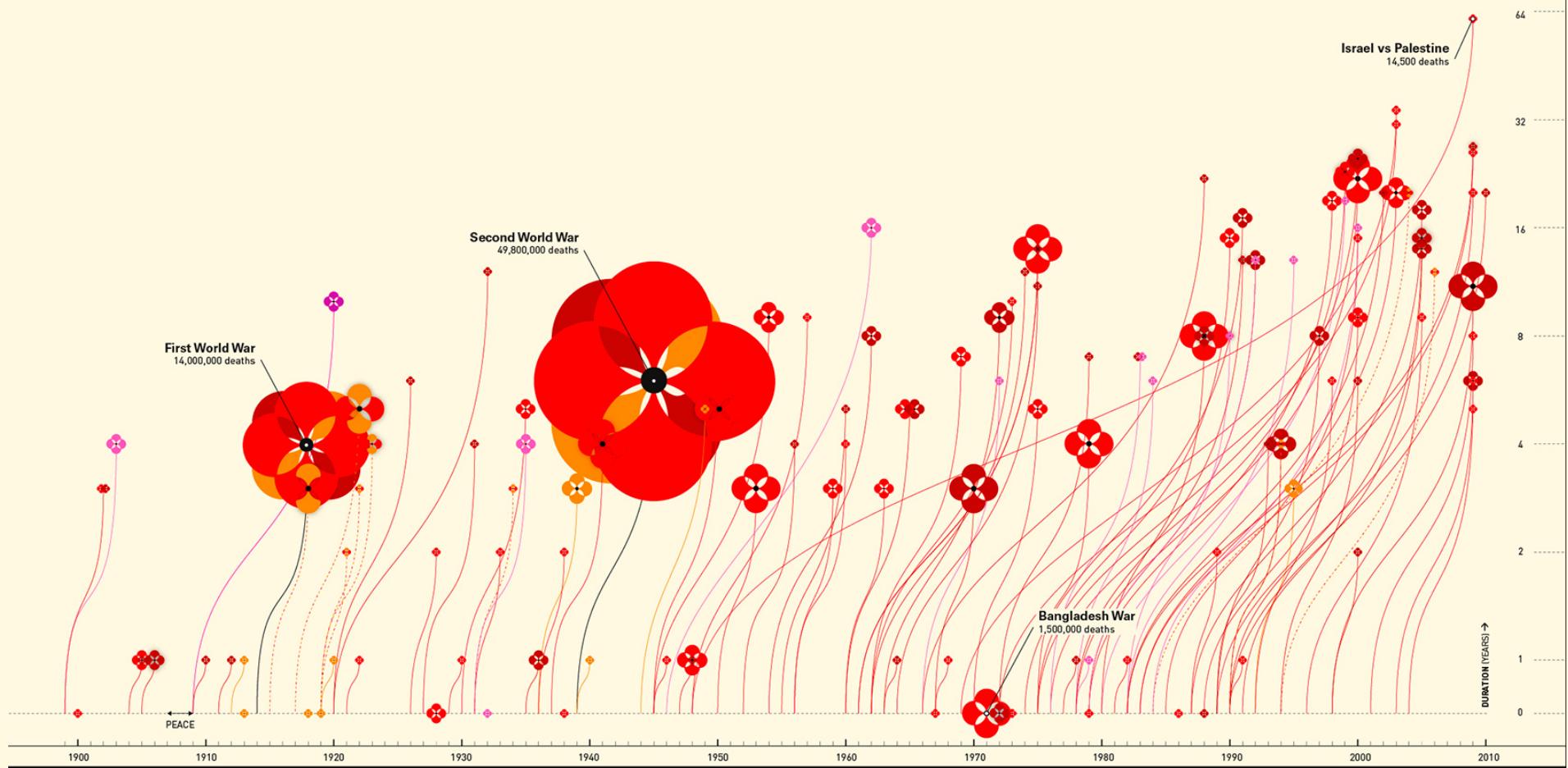
8

The Holy Mounta...

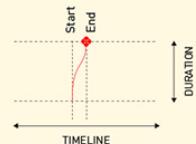
7

Total answers: 34

Креативни решенија



POPPY DIAGRAM



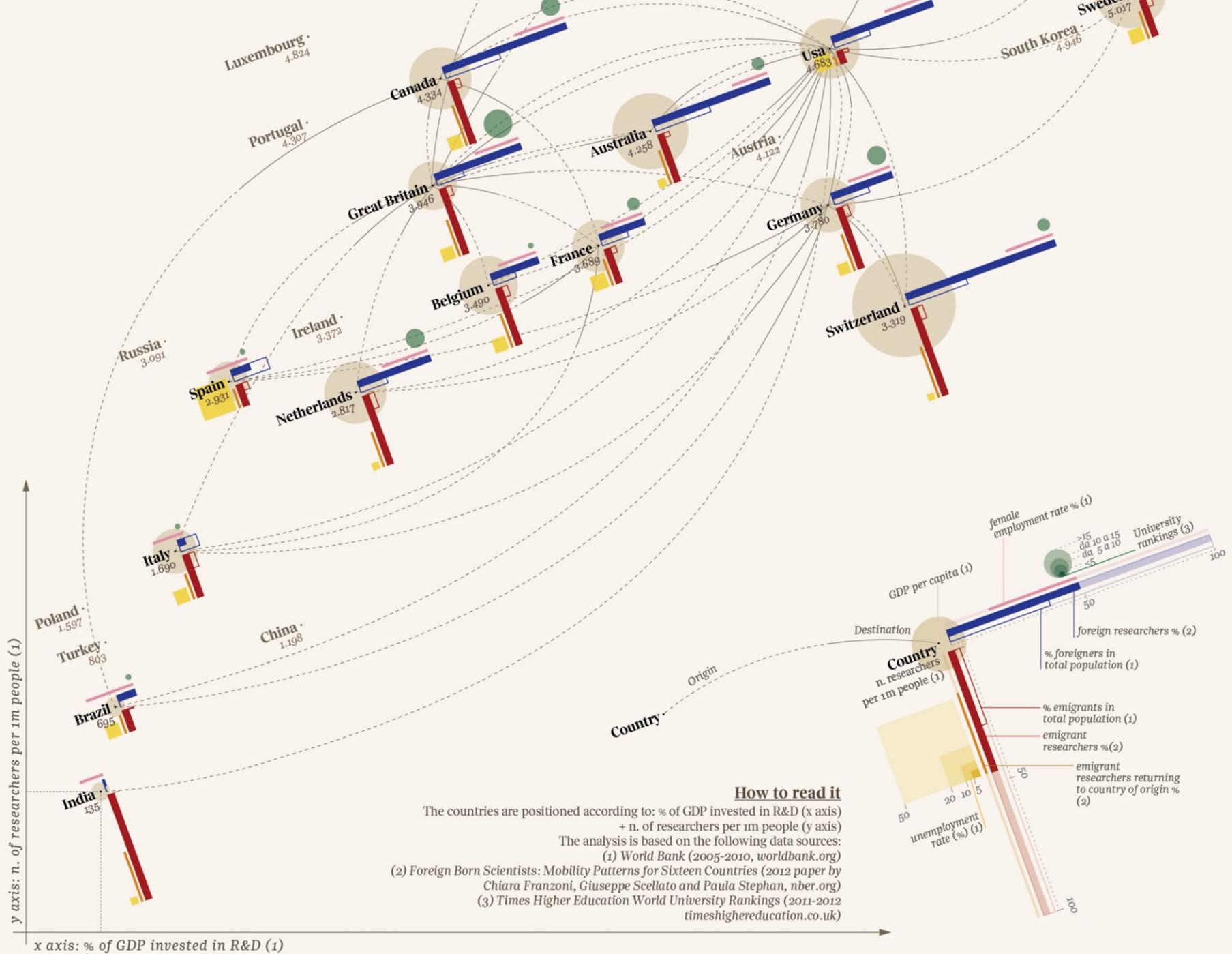
The remembrance poppy commemorates soldiers who have died in war. Each poppy in the diagram depicts a war of the last century (with more than 10,000 deaths). The stem grows from the year when the war started. The poppy flowers in the year the war ended. Its size shows the number of deaths.

NUMBER OF DEATHS IN THOUSANDS (POPPY'S SIZE)

0-99	
100-499	
500-999	
1,000-3,000	

REGIONS INVOLVED IN WARS (POPPY'S COLOUR)

Africa	
Asia	
Asia/Europe	
Europe	
N. America	
S. America	
Global	



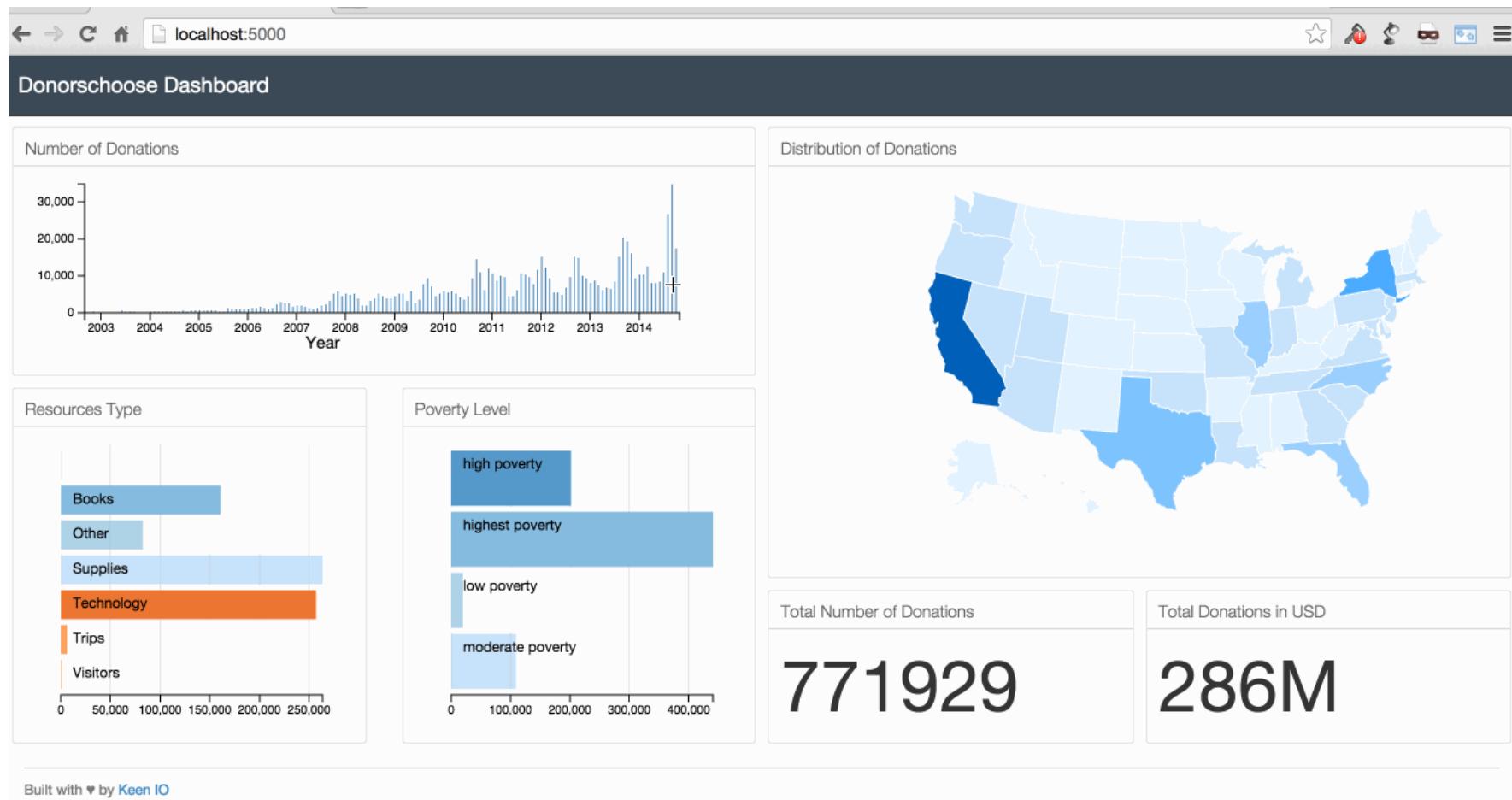
Интерактивност

Интерактивност

... или како да им овозможиме на другите самите
да истражуваат

Корисниците можат сами да истражуваат, да зумираат, да експортираат слики, да прават споредби на параметри кои тие ги избраle.

Различни корисници - различни цели



Built with ❤ by [Keen IO](#)

Interactive Data Visualization with D3.js, DC.js, Python,
and MongoDB by Adil Moujahid

Интерактивност

overview first, zoom and filter, then details-on-demand

- Дополнителни UI - елементи
- повеќе информации на ховер, прецизни бројки
- секогаш да се имаат празни или состојби за приказ на грешка

Life expectancy, years [?](#)

80

70

60

50

40

30

20

1028

500

1000

2000

4000

8000

16k

32k

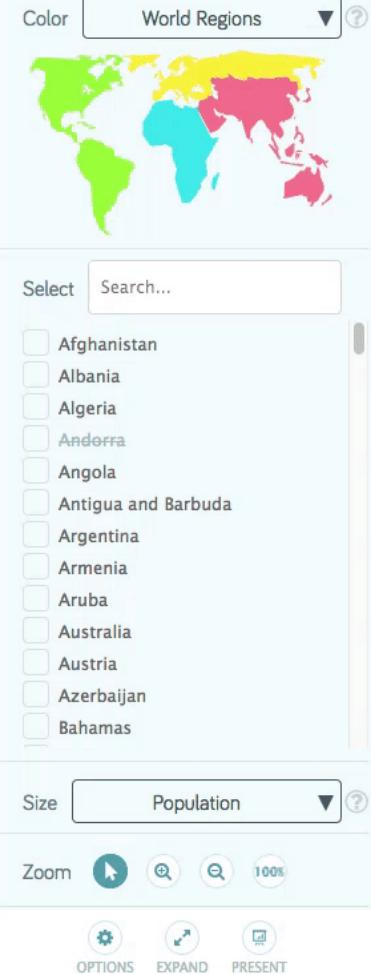
64k

128k

Income per person, GDP/capita in \$/year adjusted for inflation & prices [?](#)

1928

⚠ DATA DOUBTS



Кодирање на визуелизации

Преку front-end технологији до
динамични и интерактивни
визуелизации

Автоматизирање на обработка на податоци

Еднаш дефинираме изглед кој се аплицира на
било какво дата множество

Визуелизации на веб: достапни до сите. Колку
подостапни - толку поголем домет.

**SVG, Canvas, WebGL
CSS3, JavaScript, HTML5**

< canvas >

Црта on-the-fly

Базиран на JS

<canvas> е контејнер

Методи за различни форми: линии, квадрати, елипси, текст

Растер

Прецртува на секоја промена

HTML5 Canvas Cheat Sheet v1.1

<http://blog.nihilogic.dk/>

Canvas element

Attributes

Name	Type	Default
width	unsigned long	300
height	unsigned long	150

Methods

Return <code>string</code>	Name <code>toDataURL([Optional] string type, [Variadic] any args)</code>
<code>Object</code>	<code>getContext(string contextId)</code>

2D Context

Attributes

Name	Type
<code>canvas</code>	<code>HTMLCanvasObject [readonly]</code>

Methods

Return <code>void</code>	Name <code>save()</code>
<code>void</code>	<code>restore()</code>

Transformation

Methods

Return <code>void</code>	Name <code>scale(float x, float y)</code>
<code>void</code>	<code>rotate(float angle)</code>
<code>void</code>	<code>translate(float x, float y)</code>
<code>void</code>	<code>transform(float m11, float m12, float m21, float m22, float dx, float dy)</code>
<code>void</code>	<code>setTransform(float m11, float m12, float m21, float m22, float dx, float dy)</code>

Image drawing

Methods

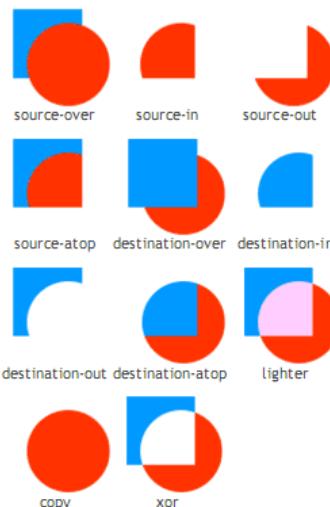
Return <code>void</code>	Name <code>drawImage(Object image, float dx, float dy, [Optional] float dw, float dh)</code>
Argument "image" can be of type <code>HTMLImageElement</code> , <code>HTMLCanvasElement</code> or <code>HTMLVideoElement</code>	
<code>void</code>	<code>drawImage(Object image, float sx, float sy, float sw, float sh, float dx, float dy, float dw, float dh)</code>

Compositing

Attributes

Name	Type	Default
<code>globalAlpha</code>	<code>float</code>	1.0
<code>globalCompositeOperation</code> string source-over		

Supports any of the following values:



Line styles

Attributes

Name	Type	Default
<code>lineWidth</code>	<code>float</code>	1.0
<code>lineCap</code> string butt		

Supports any of the following values: butt, round, square



lineJoin

Attributes

Supports any of the following values:



`miterLimit` float 10

Colors, styles and shadows

Attributes

Name	Type	Default
<code>strokeStyle</code>	<code>any</code>	black
<code>fillStyle</code>	<code>any</code>	black
<code>shadowOffsetX</code>	<code>float</code>	0.0
<code>shadowOffsetY</code>	<code>float</code>	0.0
<code>shadowBlur</code>	<code>float</code>	0.0
<code>shadowColor</code>	<code>string</code>	transparent black

Methods

Return	Name
<code>CanvasGradient</code>	<code>createLinearGradient(float x0, float y0, float x1, float y1)</code>
<code>CanvasGradient</code>	<code>createRadialGradient(float x0, float y0, float r0, float x1, float y1, float r1)</code>
<code>CanvasPattern</code>	<code>createPattern(Object image, string repetition)</code>

Argument "image" can be of type `HTMLImageElement`, `HTMLCanvasElement` or `HTMLVideoElement`
 "repetition" supports any of the following values:
 [repeat (default), repeat-x, repeat-y, no-repeat]

CanvasGradient interface

void	<code>addColorStop(float offset, string color)</code>
------	---

CanvasPattern interface

No attributes or methods.

Paths

Methods

Return	Name
<code>void</code>	<code>beginPath()</code>
<code>void</code>	<code>closePath()</code>
<code>void</code>	<code>fill()</code>
<code>void</code>	<code>stroke()</code>
<code>void</code>	<code>clip()</code>
<code>void</code>	<code>moveTo(float x, float y)</code>
<code>void</code>	<code>lineTo(float x, float y)</code>
<code>void</code>	<code>quadraticCurveTo(float cpx, float cpy, float x, float y)</code>
<code>void</code>	<code>bezierCurveTo(float cp1x, float cp1y, float cp2x, float cp2y, float x, float y)</code>
<code>void</code>	<code>arcTo(float x1, float y1, float x2, float y2, float radius)</code>
<code>void</code>	<code>arc(float x, float y, float radius, float startAngle, float endAngle, boolean anticlockwise)</code>
<code>void</code>	<code>rect(float x, float y, float w, float h)</code>
<code>boolean</code>	<code>isPointInPath(float x, float y)</code>

Text

Attributes

Name	Type	Default
<code>font</code>	<code>string</code>	10px sans-serif
<code>textAlign</code> string start		
Supports any of the following values: [start, end, left, right, center]		

Methods

Return	Name
<code>void</code>	<code>fillText(string text, float x, float y, [Optional] float maxWidth)</code>
<code>void</code>	<code>strokeText(string text, float x, float y, [Optional] float maxWidth)</code>
<code>TextMetrics</code>	<code>measureText(string text)</code>

TextMetrics interface

`width` float [readonly]

Rectangles

Methods

Return	Name
<code>void</code>	<code>clearRect(float x, float y, float w, float h)</code>
<code>void</code>	<code>fillRect(float x, float y, float w, float h)</code>
<code>void</code>	<code>strokeRect(float x, float y, float w, float h)</code>

Pixel manipulation

Methods

Return	Name
<code>ImageData</code>	<code>createImageData(float sw, float sh)</code>
<code>ImageData</code>	<code>createImageData(ImageData)</code>
<code>void</code>	<code>getImageData(float sx, float sy, float sw, float sh)</code>

<code>void</code>	<code>putImageData(ImageData imagedata, float dx, float dy, [Optional] float dirtyX, float dirtyY, float dirtyWidth, float dirtyHeight)</code>
<code>ImageData</code> interface	

ImageData interface

`width` unsigned long [readonly]

`height` unsigned long [readonly]

`data` `CanvasPixelArray` [readonly]

CanvasPixelArray interface

`length` unsigned long [readonly]

<svg>

Вектор

Секоја форма се памти како објект

Ако атрибутите се променат – се прецртува и DOM-от

Базиран на mark-up

right-expand.svg

```
1 <?xml version="1.0" encoding="utf-8"?>
2 <!DOCTYPE svg PUBLIC "-//W3C//DTD SVG 1.1//EN" "http://www.w3.
 .org/Graphics/SVG/1.1/DTD/svg11.dtd">
3 <svg version="1.1" id="Layer_1" xmlns="http://www.w3.
 org/2000/svg" xmlns:xlink="http://www.w3.org/1999/xlink" x="
 0px" y="0px"
4      viewBox="0 0 100 100" enable-background="new 0 0 100 100
 " xml:space="preserve">
5 <g>
6   <path d="M49.5,49.9L15.3,85L1.5,70.8L21.9,50L1.5,29.2L15.
 3,15L49.5,49.9z"/>
7   <path d="M98.5,49.9L64.3,85L50.5,70.8L70.9,50L50.5,29.
 2L64.3,15L98.5,49.9z"/>
8 </g>
9 </svg>
10
```



Screenshot of a browser developer tools Inspector panel showing an SVG element.

The top navigation bar includes tabs for Inspector, Console, Debugger, Style Editor, Performance, Network, and Rules. The Rules tab is currently selected.

The bottom left shows the raw SVG XML code:

```
<!--Generator: Adobe Illustrator 17.1.0, SVG Export Plug-In . SVG Version: 6.00 Build 0-->
<!DOCTYPE svg PUBLIC "-//W3C//DTD SVG 1.1//EN" "http://www.w3.org/Graphics/SVG/1.1/DTD/svg11.dtd">
<svg id="Layer_1" version="1.1" xmlns="http://www.w3.org/2000/svg"
  xmlns:xlink="http://www.w3.org/1999/xlink" x="0px" y="0px" viewBox="0 0 100 100" enable-
background="new 0 0 100 100" xml:space="preserve">
  <g>
    <path d="M49.5,49.9L15.3,85L1.5,70.8L21.9,50L1.5,29.2L15.3,15L49.5,49.9z"></path>
    <path d="M98.5,49.9L64.3,85L50.5,70.8L70.9,50L50.5,29.2L64.3,15L98.5,49.9z"></path>
  </g>
</svg>
```

The bottom right pane displays the CSS rules for the selected element:

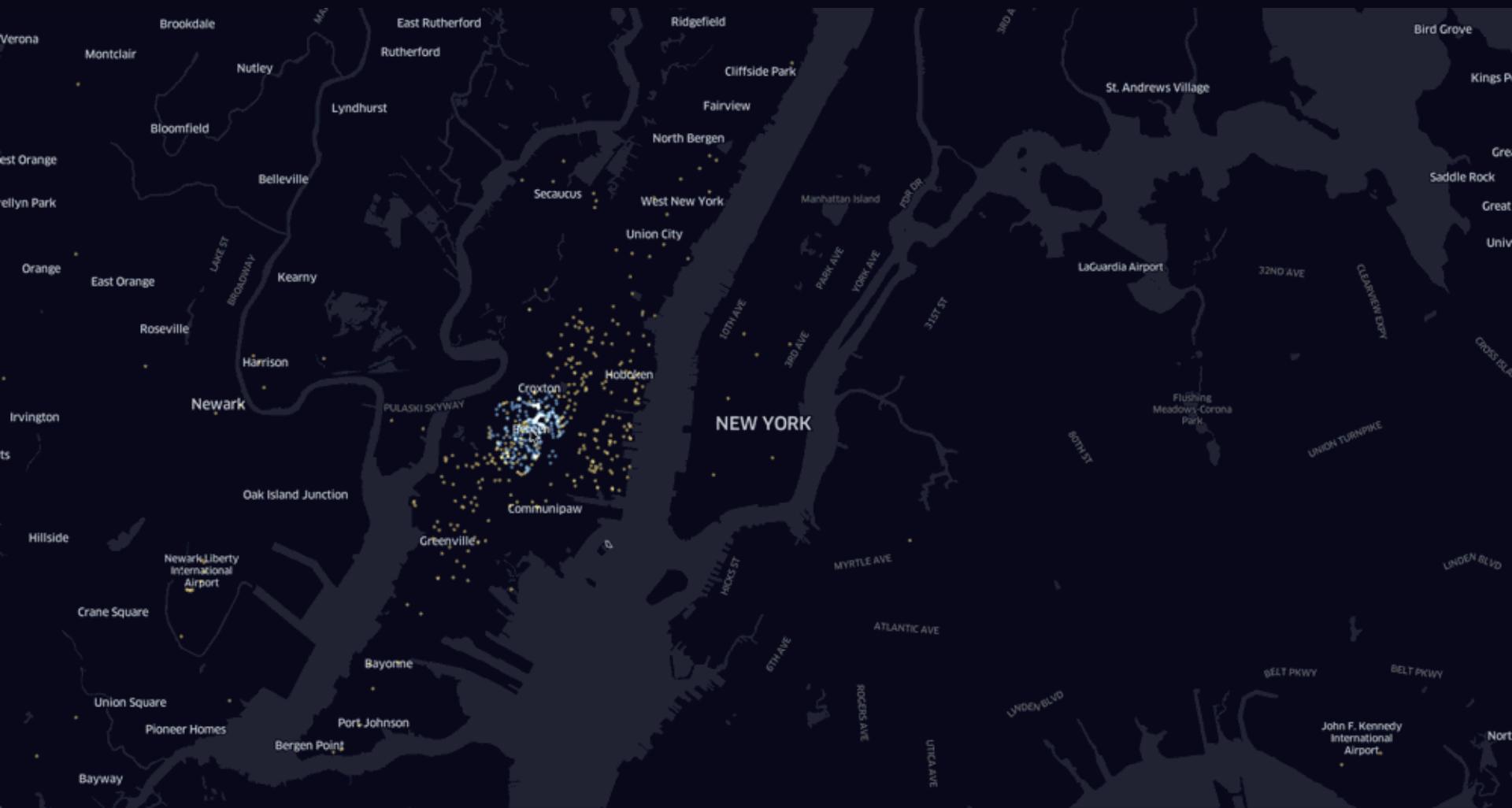
```
element {
```

WebGL (Web Graphics Library)

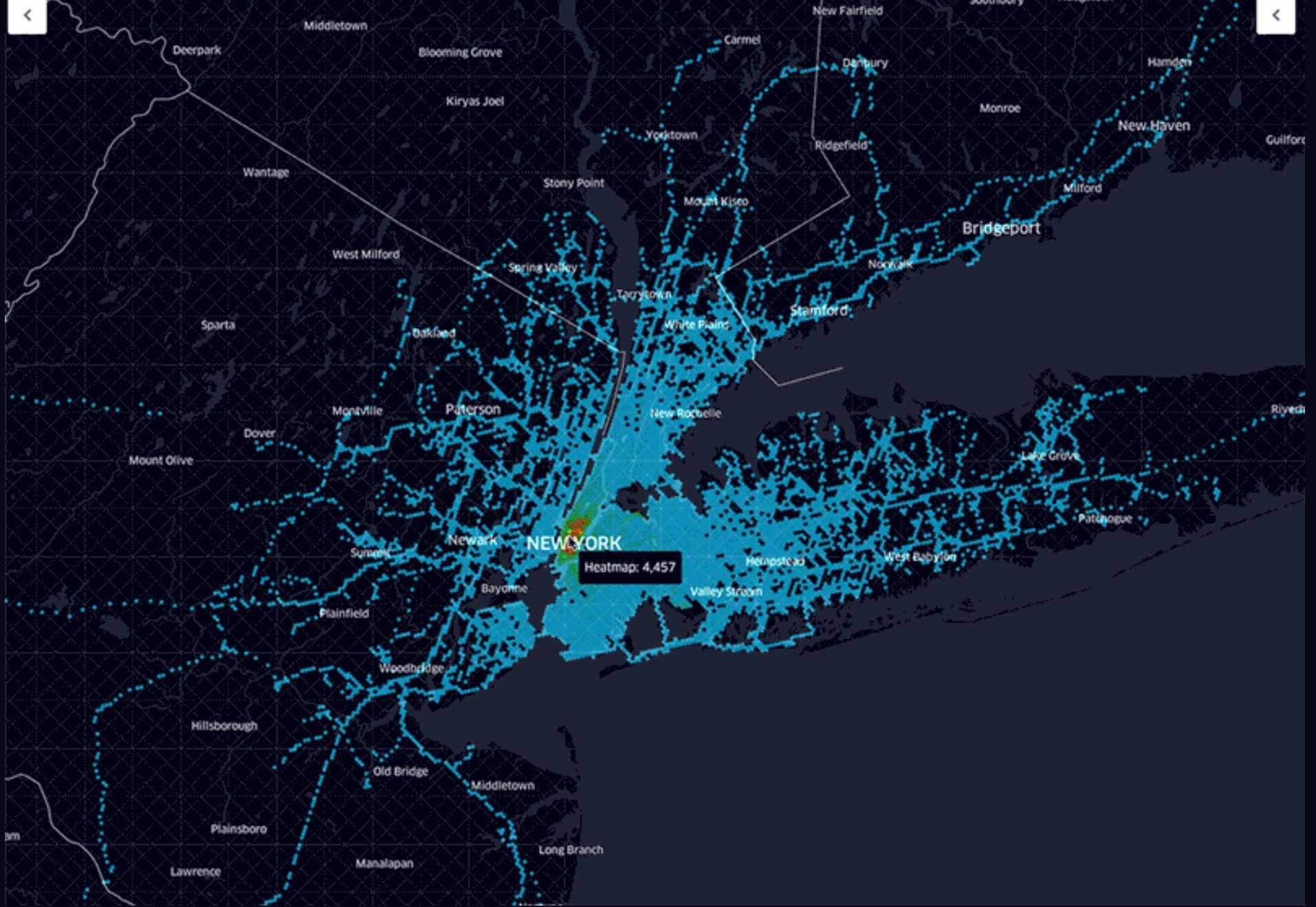
API на Canvas

Се рендерира во реално време

Се користи за интерактивни 3Д-графици



Data Visualization at Uber



Data Visualization at Uber

Библиотеки



Data-Driven Documents



d3

1. **Вчитување на податоците** во меморијата на прелистувачот
2. **Поврзување на податоците** со елементите во документот, создавајќи нови по потреба (DOM)
3. **Трансформирање** на овие елементи преку интерпретирање на податоците
4. **Транзиција** на елементите во различни состојби според инпутот на корисниците

* D3 не генерира предефинирани визуелизации

```
var dataset = [ 5, 10, 15, 20, 25 ];

d3.select("body").selectAll("div")
  .data(dataset)
  .enter()
  .append("div")
  .attr("class", "bar");
```



div.bar 20px × 75px

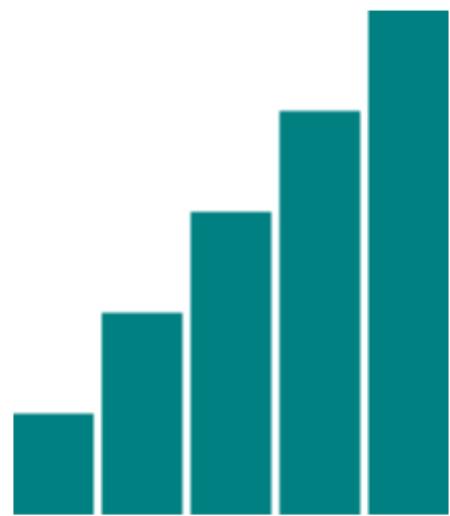
X ⌂ ⌃ ⌁ ⌂ ⌃ drawing_divs_1.html > DOM Tree > E html > E body > E div.bar

```
<!DOCTYPE html>
<html lang="en">
  <head>...</head>
  <body>
    <script type="text/javascript">...</script>
    <div class="bar"></div>
    <div class="bar"></div> (This node is selected)
    <div class="bar"></div>
    <div class="bar"></div>
    <div class="bar"></div>
  </body>
</html>
```

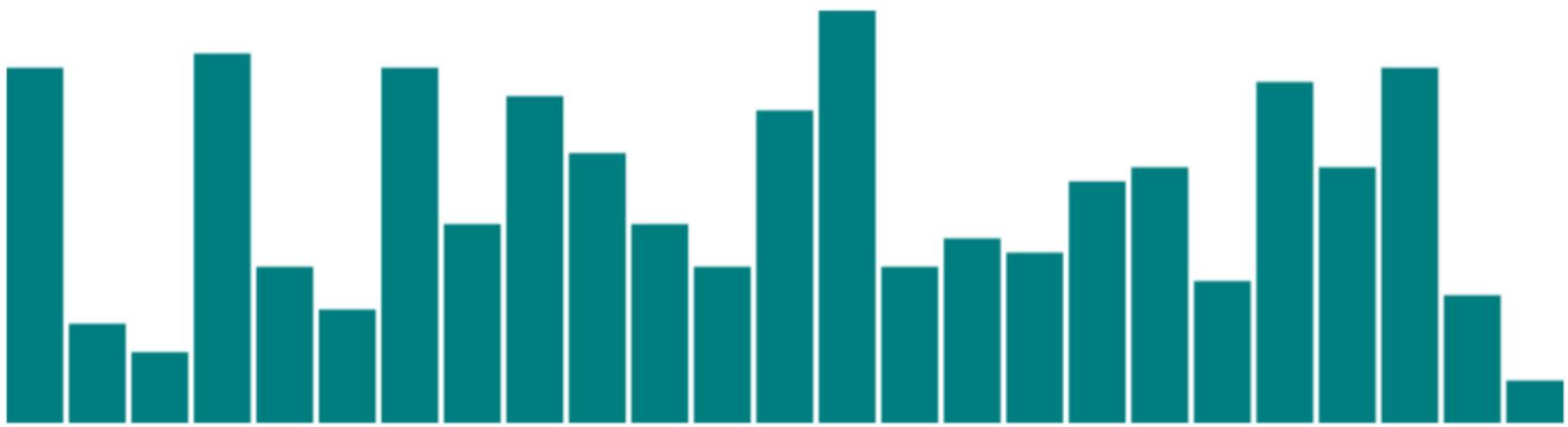
```
var dataset = [ 5, 10, 15, 20, 25 ];

d3.select("body").selectAll("div")
  .data(dataset)
  .enter()
  .append("div")
  .attr("class", "bar")
  .style("height", function(d) { return d + "px";
});

margin-right: 2px;
```



```
var dataset = [ 25, 7, 5, 26, 11, 8, 25, 14, 23, 19, 14, 11, 22, 29, 11,  
    13, 12, 17, 18, 10, 24, 18, 25, 9, 3 ];
```



Highcharts

IMPORT

TEMPLATES

CUSTOMIZE

SHARE

1

2

3

4

Paste your data here 

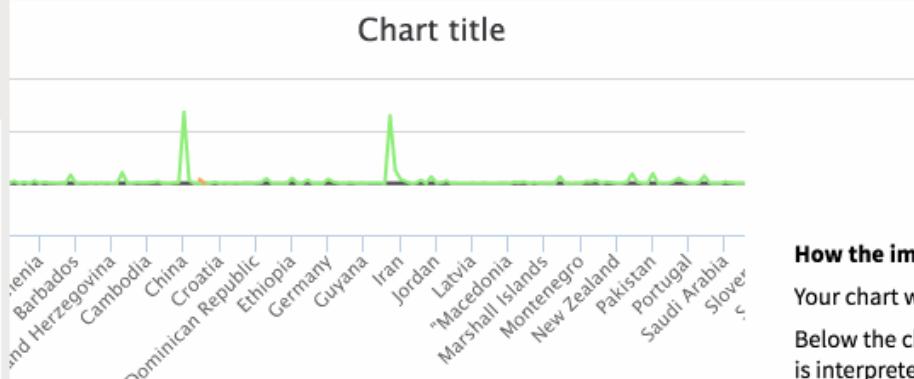
```
Turkmenistan,15865,67.9,5373502
Uganda,1680,60.8,39032383
Ukraine,8449,72.1,44823765
United Arab Emirates,60749,76.6,9156963
United Kingdom,38225,81.4,64715810
United States,53354,79.1,321773631
Uruguay,20438,77.3,3431555
Uzbekistan,5598,70.1,29893488
Vanuatu,2912,65,264652
Venezuela,15753,75.8,31108083
Vietnam,5623,76.5,93447601
West Bank and Gaza,4319,75.2,4668466
Yemen,3887,67.6,26832215
Zambia,4034,58.96,16211767
Zimbabwe,1801,60.01,15602751
```

 Switch rows and columns

 Use categories

Sample datasets

If you want to try the editor and have no data available, try the [sample data](#).



headsheets

Add Row		Remove Current Row		Add Column	Export	Reset
country	income	health	population	Series 4		
Turkmenistan	1925	57.63	32526			
Uganda	10620	76	2896			
Ukraine	13434	76.5	39666			
United Arab Emirates	46577	84.1	70			
United Kingdom	7615	61	25021			
United States	21049	75.2	91			
Uruguay	17344	76.2	43416			
Zambia	7615	61	25021			
Zimbabwe	46577	84.1	70			

How the import works

Your chart will appear here after

Below the chart, a spreadsheet is interpreted and added to the data source for the chart.

Alternatively, you can [open the](#)

Google Charts

CUSTOMIZE THE CHART

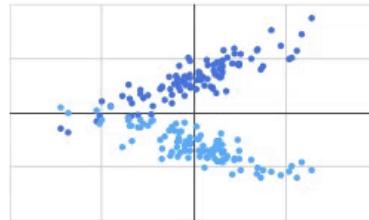
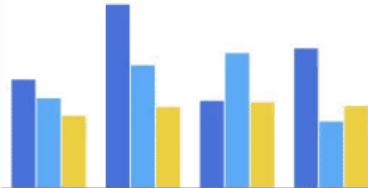
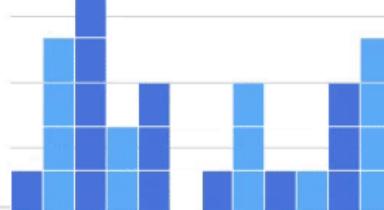
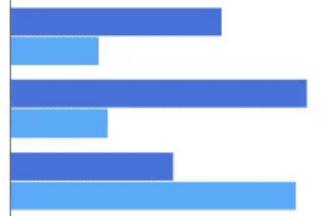
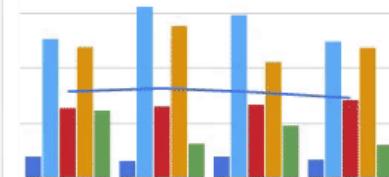
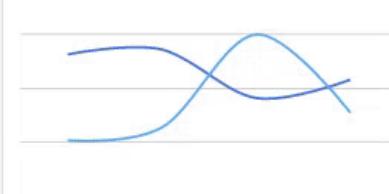
[Draw the Chart](#)
[Draw Multiple Charts](#)

Chart Types

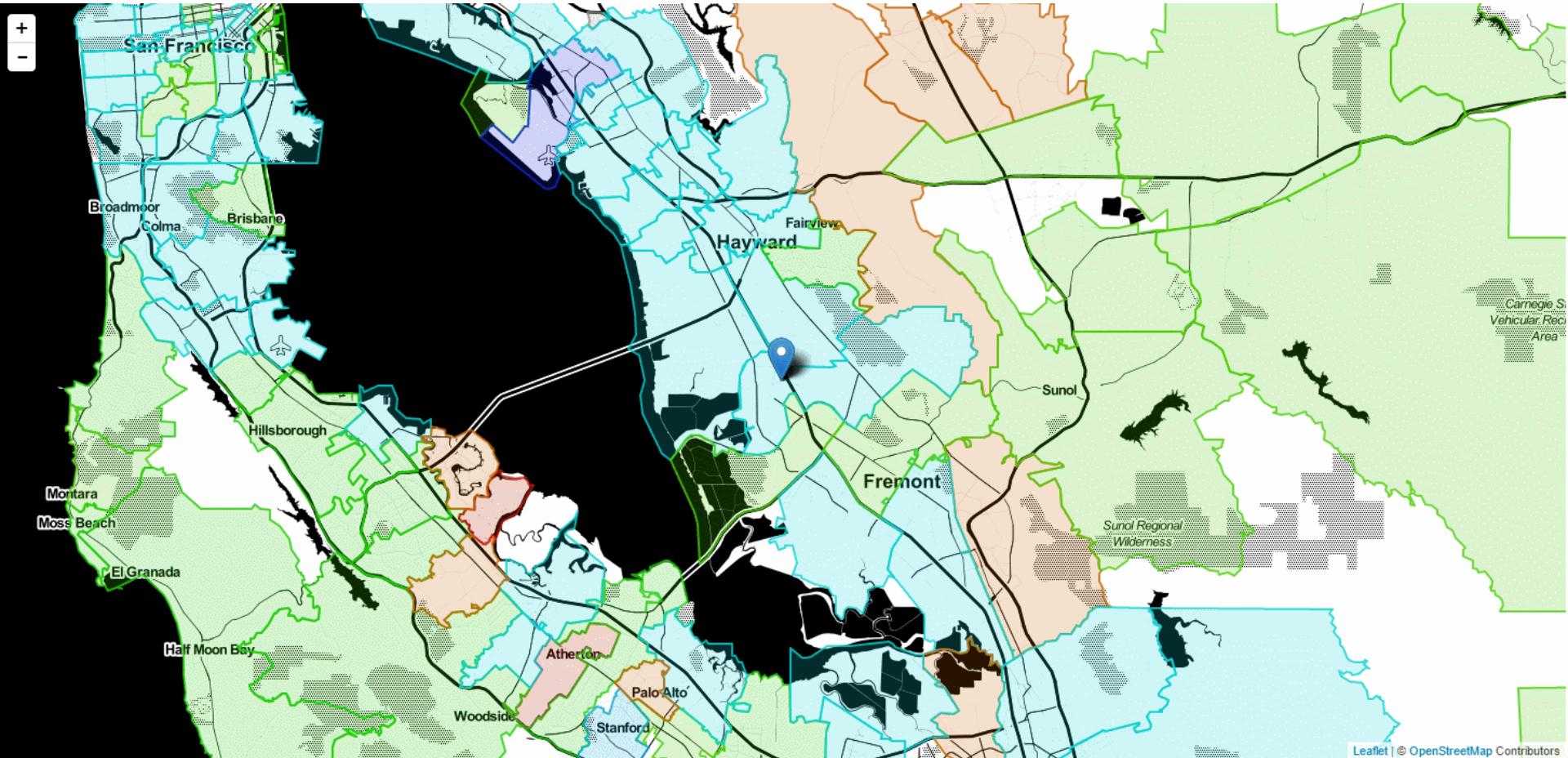
[Chart Gallery](#)[Annotation Charts](#)[Area Charts](#)[Bar Charts](#)[Bubble Charts](#)[Calendar Charts](#)[Candlestick Charts](#)[Column Charts](#)[Combo Charts](#)[Diff Charts](#)[Donut Charts](#)[Gantt Charts](#) [Gauge Charts](#)[GeoCharts](#)[Histograms](#)[Intervals](#)[Line Charts](#)[Maps](#)[Org Charts](#)[Pie Charts](#)[Sankey Diagrams](#)[Scatter Charts](#)[Stepped Area Charts](#)[Table Charts](#)[Timelines](#)[Tree Map Charts](#)[Trendlines](#)[Waterfall Charts](#)[Word Trees](#)[Miscellaneous Examples](#)[How to Draw Charts](#)[Introduction](#)[chart.draw\(\)](#)[ChartWrapper](#)[Add Interactivity](#)

Our gallery provides a variety of charts designed to address your data visualization needs. These charts are based on pure HTML5/SVG technology (adopting VML for old IE versions), so no plugins are required. All of them are interactive, and many are pannable and zoomable. Adding these charts to your page can be done in [a few simple steps](#).

Some additional community-contributed charts can be found on the [Additional Charts page](#).

Geo Chart**Scatter Chart****Column Chart****Histogram****Bar Chart****Combo Chart****Area Chart****Stepped Area Chart****Line Chart**

Leaflet



AngularJS

Angular Chart

Reactive, responsive, beautiful charts for [AngularJS](#) based on [Chart.js](#)

[Code on Github](#)[!\[\]\(cb942b8cebb39e39ef3bb5d985720db2_img.jpg\) Download \(1.0.3\)](#)[get this with bower !\[\]\(976ed27d450a1e7f12be023482e94461_img.jpg\)](#)[!\[\]\(9ac8ffc0bbd8cf6a394a9fa6f90141a6_img.jpg\) Watch](#)[!\[\]\(45defa115faa9a5913c5592193856506_img.jpg\) Fork](#)[!\[\]\(802adb8b0ce60e249f1beb98ba083b9b_img.jpg\) Follow @jtblin](#) 77[!\[\]\(79e78cb1c61d2af62a252f1eb21d2b86_img.jpg\) Tweet](#)

Getting started

Dependencies

This repository contains a set of **native AngularJS directives** for Chart.js. The **only required dependencies** are:

- [AngularJS](#) (tested with 1.2.x, 1.3.x, 1.4.x and 1.5.x although it probably works with older versions)
- [Chart.js](#) (requires Chart.js 2.0.x).

Files to download

The easiest is to download with **npm**:

```
npm install angular-chart.js --save
```

Home > Extensions > AngularJS Charts

Angular Charts

Easy to use **AngularJS charts** plugin for adding interactive charts to your website.

AngularJS is one of the most popular JavaScript frameworks out there and if you are using it to build your app, this **Angular charts** plugin is for you. You can use this Angular chart plugin along with our core library to add interactive JavaScript graphs and charts to your web/mobile applications - with just a single directive. You can access all the rich charting features of FusionCharts like events, annotations, macros, themes, image-export etc. to make your visualizations stand-out.

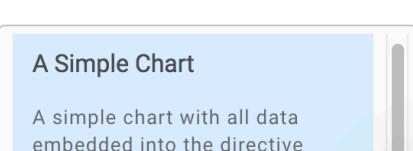
Explore some live **AngularJS charts examples** and the quick guide below that to get started!



Download Plugin



View it on Github



Harry's SuperMart
Top 5 stores in last month by revenue

\$900K

30K

Зошто визуализациите се важни?

Информацијата која не е успешно
пренесена нема вредност

Визуелизацијата им помага на
луксето да поставуваат (подобри)
прашања

Скопје 2014 под лупа

База на податоци за згради, фасади, скулптури, споменици, фонтани и други видови објекти финансирали од јавни пари, кои го сочинуваат новиот лик на Скопје.



Изберете објект



Прикажи



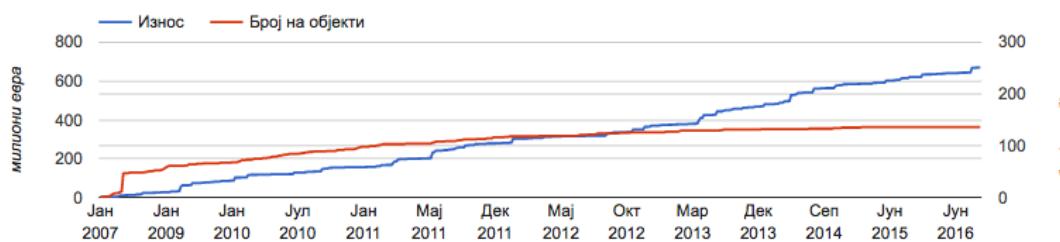
40

промовирани
објекти во 2010
година

136

документирани
објекти до 2018
година

Пораст на износ и број на објекти од 2010 до 2018 година



136

објекти

32

инвеститори

137

фирми

9

леарници

148

автори на идејни
решенија

669+

милиони €

27

згради



418,04+
милиони €

6

катни гаражи



~56,68
милиони €

6+

фасади



41,71+
милиони €

34

споменици



33,62+
милиони €

5

плоштади



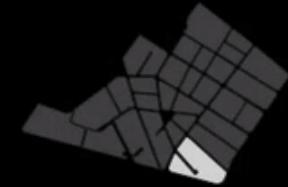
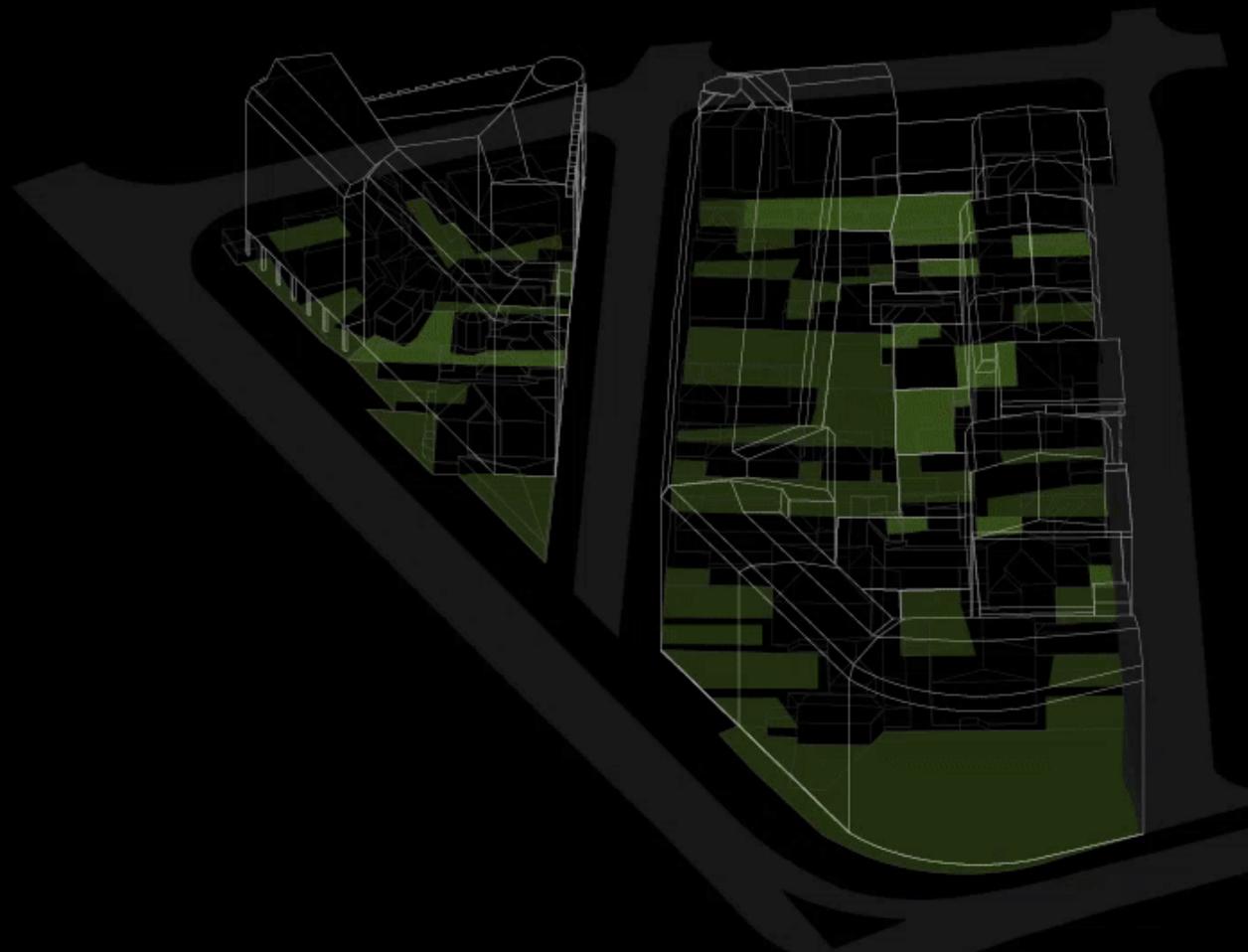
31,85
милиони €

1

панорамско
тркало



18,94
милиони €



ЗГРАДИ

ЈАВНИ

ОБРАЗОВАНИЕ

ЗДРАВСТВО

ПРИВРЕМЕНИ

БЕСПРАВНО

ЗЕЛЕНИЛО

СООБРАЌАЈ

ПЕШАЧКИ

КОЛСКИ

ПАРКИНГ

ПОВРШИНИ

ГАРАЖИ

ПОДЗЕМНО

НАСЕЛБА

ГРАДСКА ЧЕТВРТ

БЛОК

ГОДИНА/ПЛАН

ЦЕНТАР

ДЕБАР МААЛО 2

14

1990

2012

2020

Да го искористиме потенцијалот на
на визуелните атрибути и фронт-
енд технологиите за споделување
на знаење и идеи!

Благодарам!

Ана Ристеска
a.risteska@gmail.com

Mapping America's Futures

<http://apps.urban.org/features/mapping-americas-futures/#map>

Скопје Растве

<http://skopjeraste.mk/>

Граѓанско учество

<http://graganskoucestvo.mk/>

Родов јаз во плата

<http://www.edplako.mk/#/visualization>

Guardian Interactive

Колку изнесуваат трошоците а колку бенефитите на девет јавни политики?

<http://www.ficast.mk/cost-benefit/>

Скопје 2014 под лупа

<http://skopje2014.prizma.birn.eu.com/>

Pixelspace

http://joshworth.com/dev/pixelspace/pixelspace_solarsystem.html

Untangling Tennis

[http://untangling-tennis.net/tool/ Untangling tennis](http://untangling-tennis.net/tool/)

News Map

<http://www.newsmap.jp>