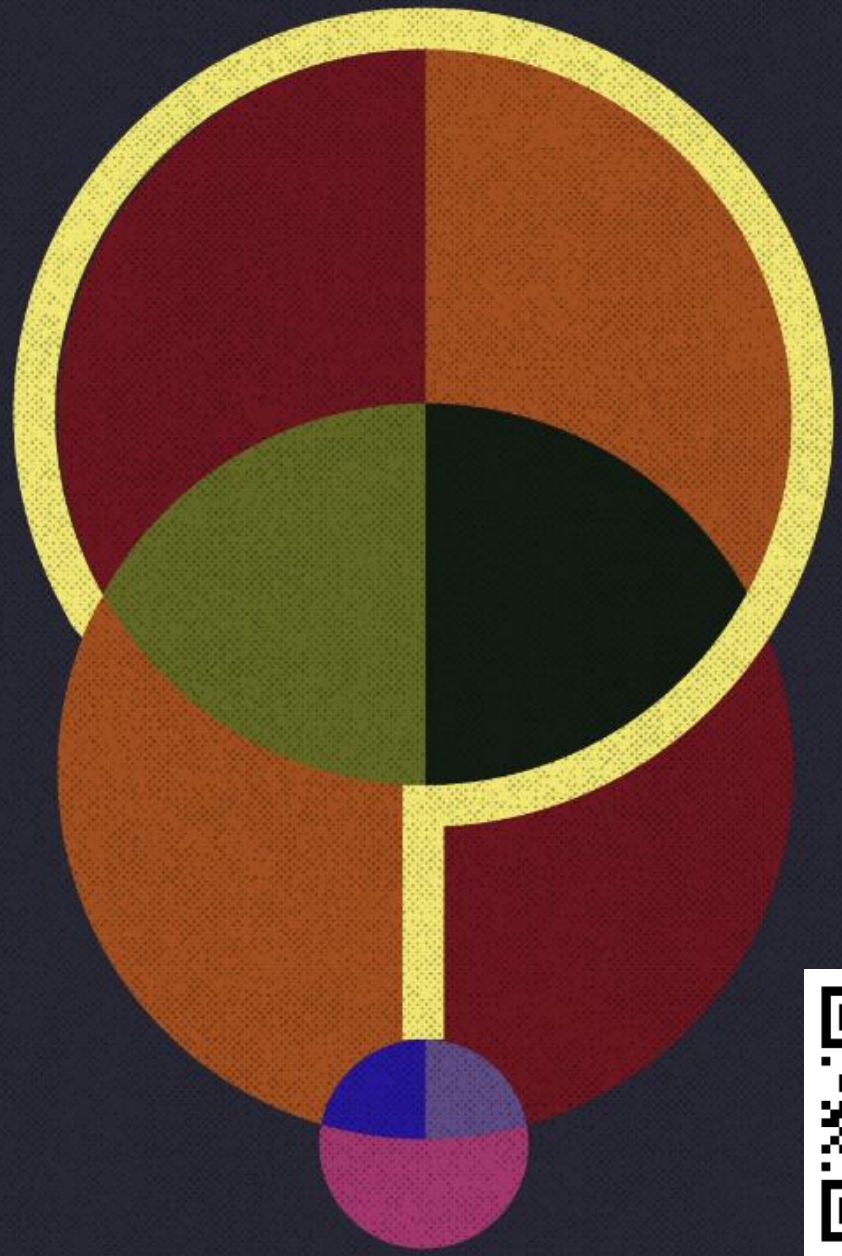
QUESTIONS IN DATAVIZ

NEIL RICHARDS

How **curiosity** will help your **creativity**



@theneilrichards
questionsindataviz.com
https://public.tableau.com/profile/neil.richards#!/
https://www.linkedin.com/in/neilrichards1/

First Questions

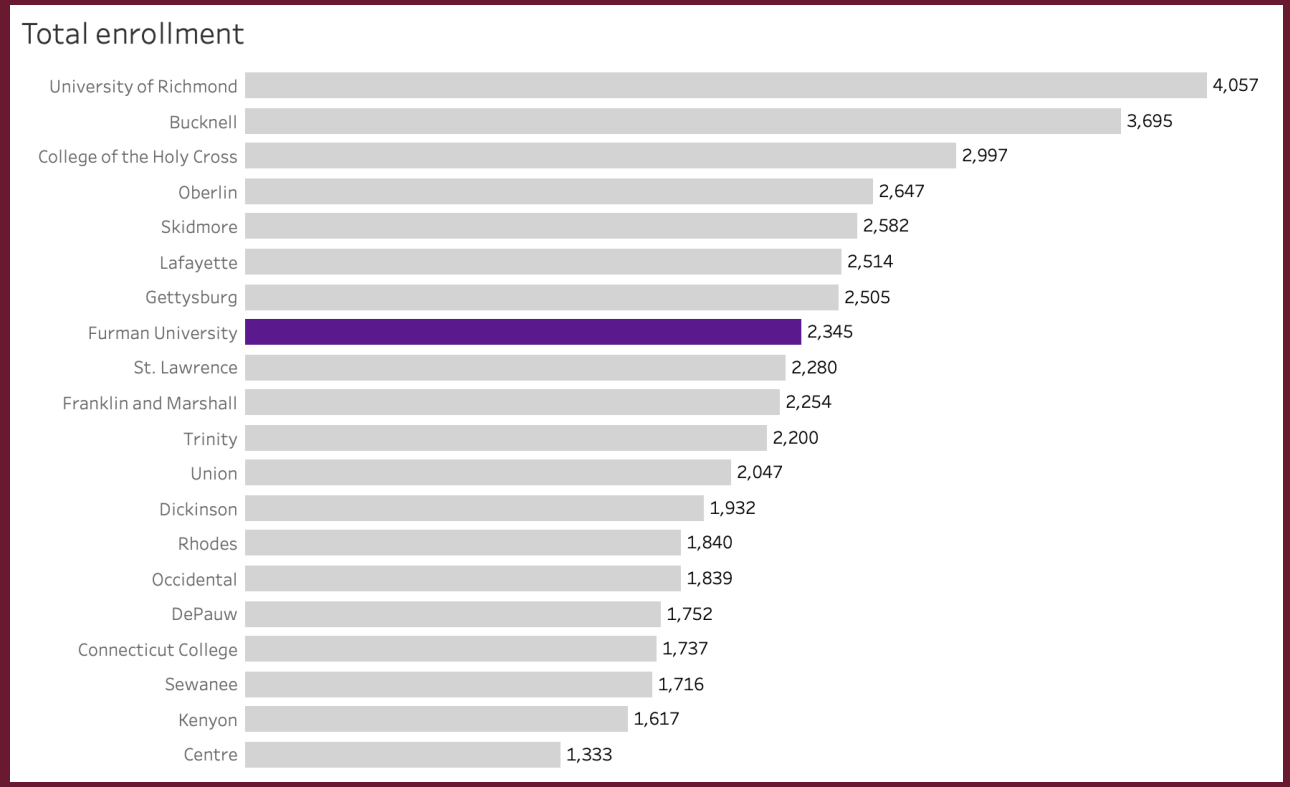
Challenging Questions

Idea Questions

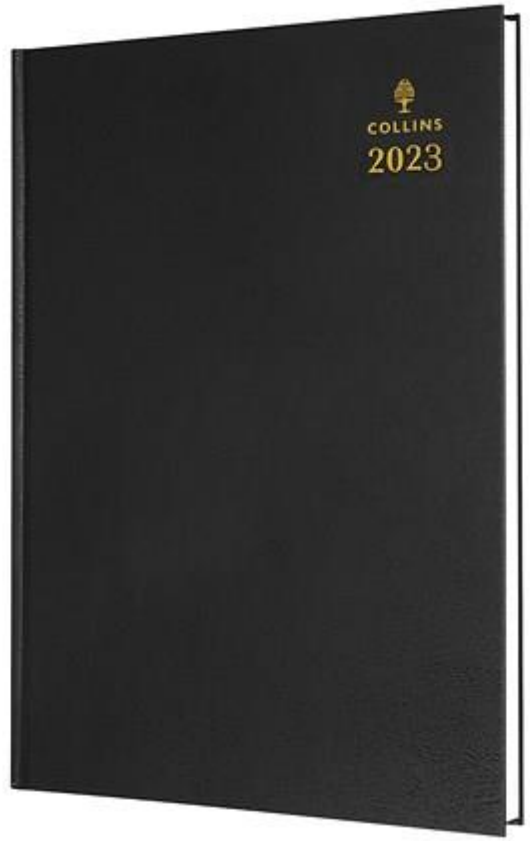

What’s in a colour?

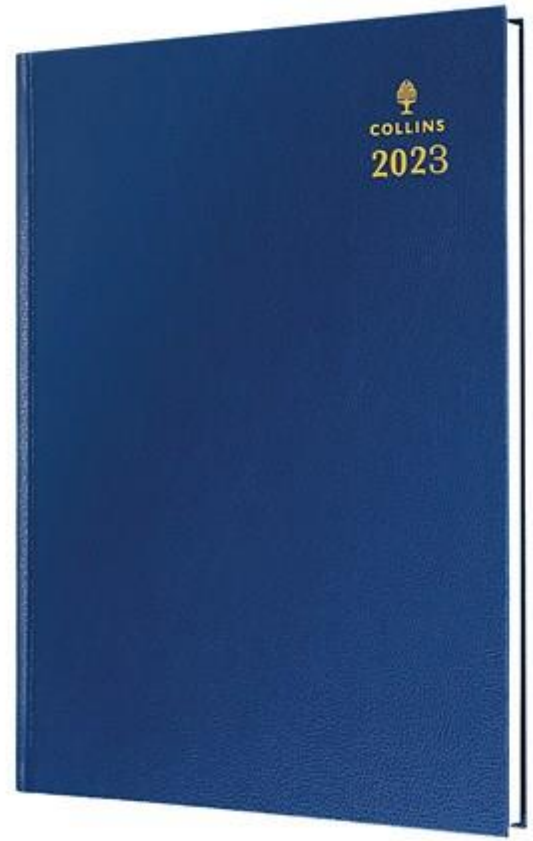
Colour Good Practices

- Use colour sparingly
- Reduce saturation
- Consider colour for highlighting
- Keep colour palettes to 5 colours
- Consider accessibility (red/green)




COLLINS
2023


COLLINS
2023


COLLINS
2023


Everton
Stake
.com


L.F.C.
standard
chartered

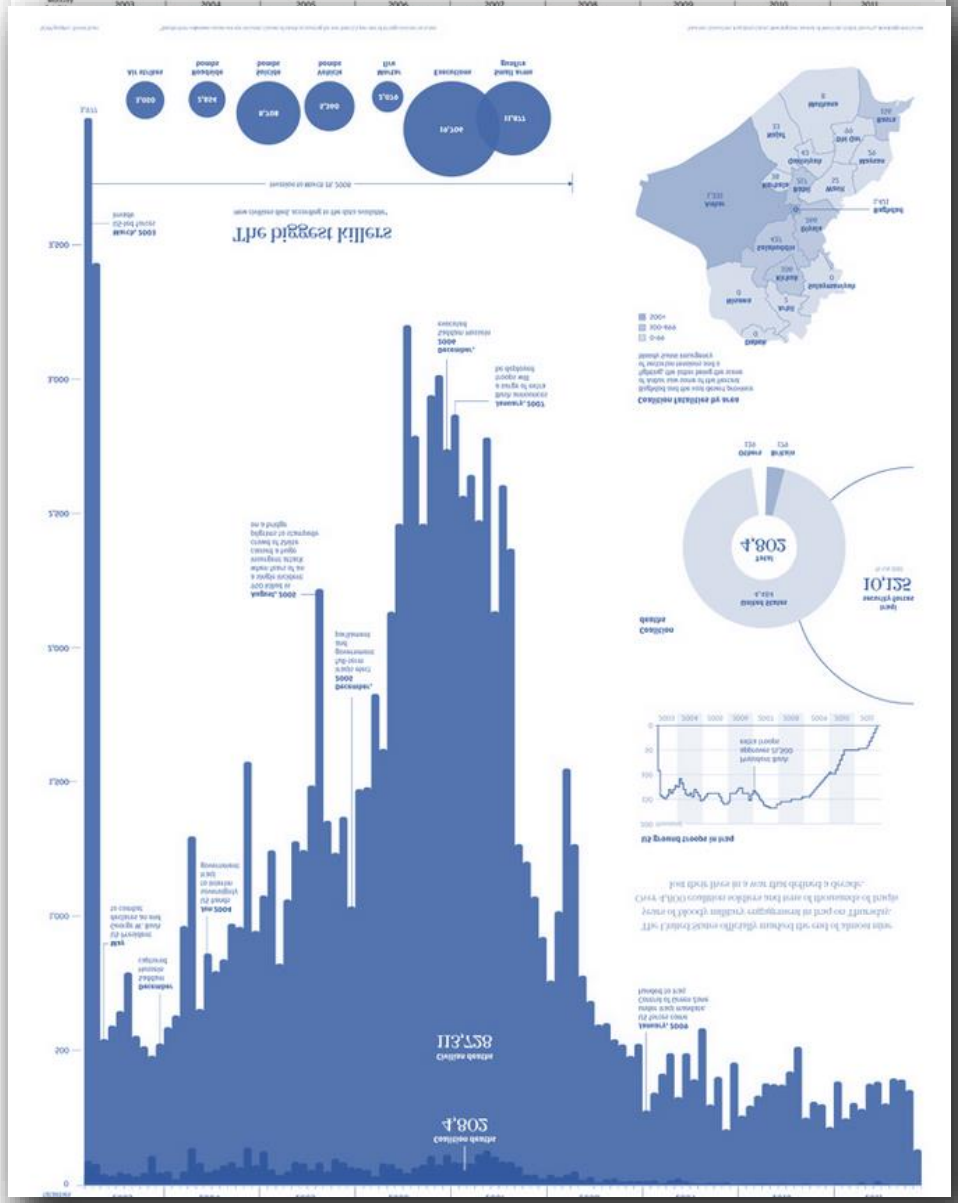
Colour associations

- **Hot** / **Cold**
- Does this mean **Good** / **Bad?**
  (is hot or cold better? – we like warmer weather …)

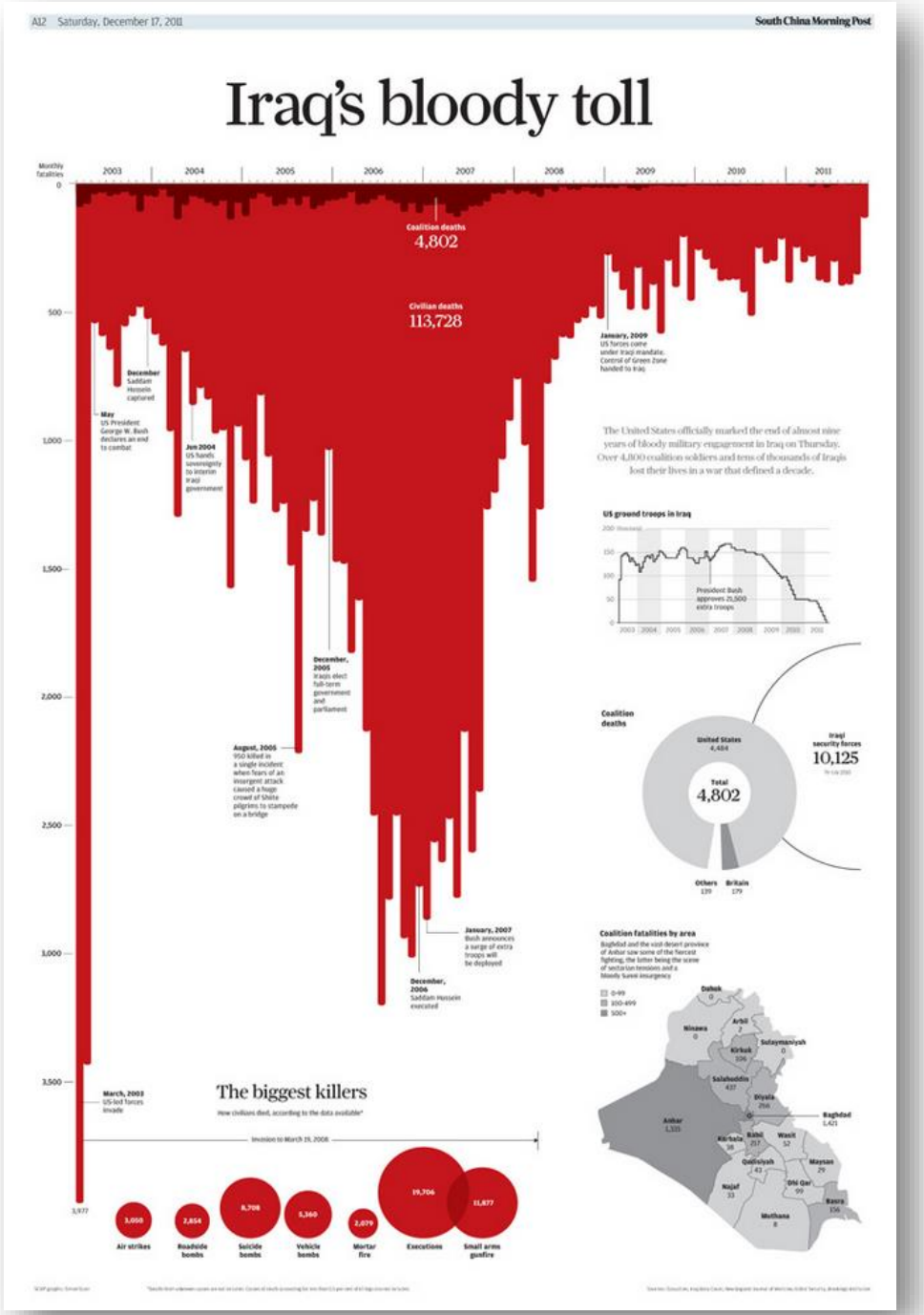
- **Stop** / **Wait** / **Go**
- Usually associated with **Bad** / **meh** / **Good**
- Or **down** / **level** / **up** (for stock prices, sales, profits, league positions)

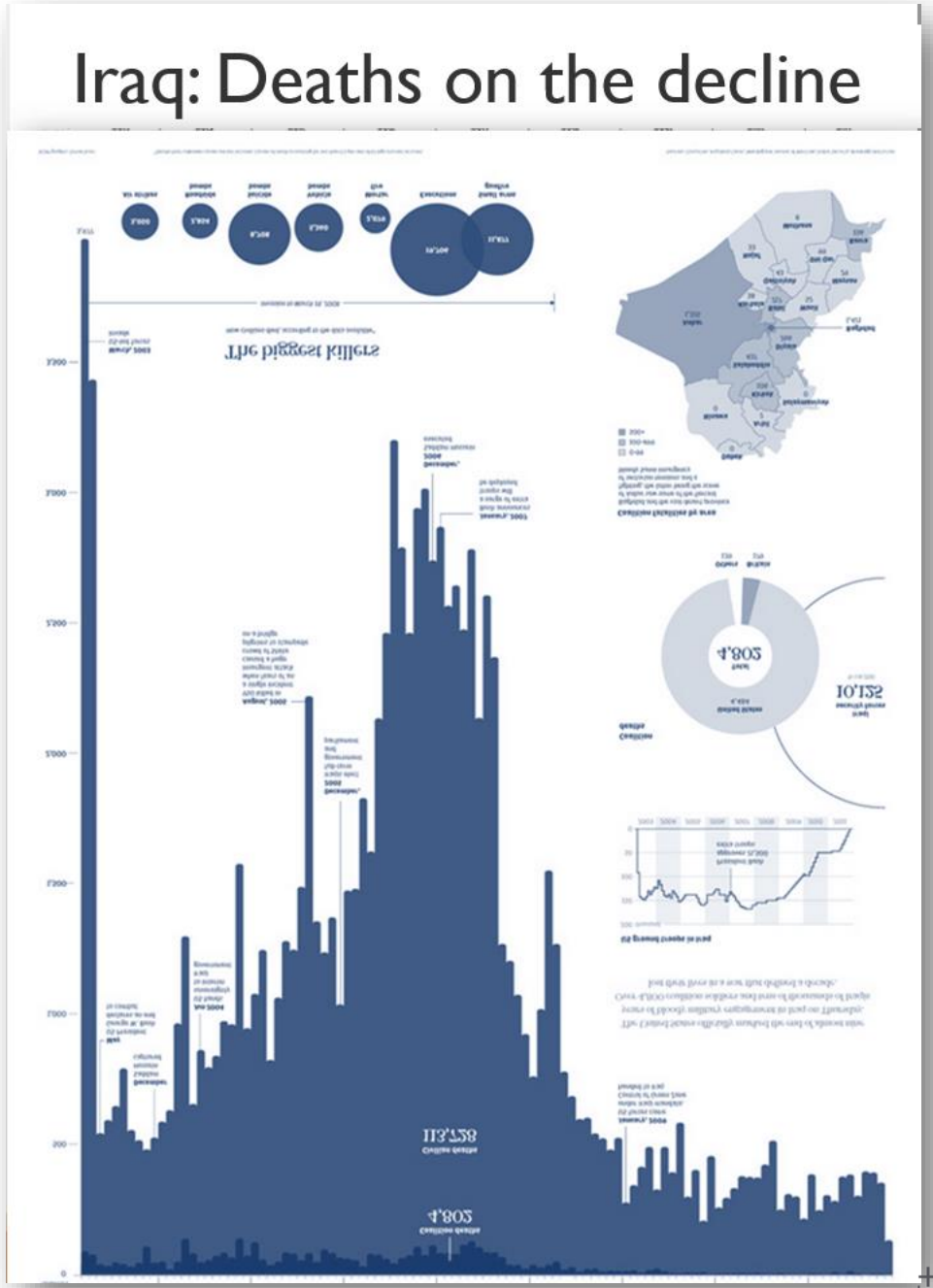
- So maybe **orange** / **blue** should be **bad** / **good**?

Iraq: Deaths on the decline



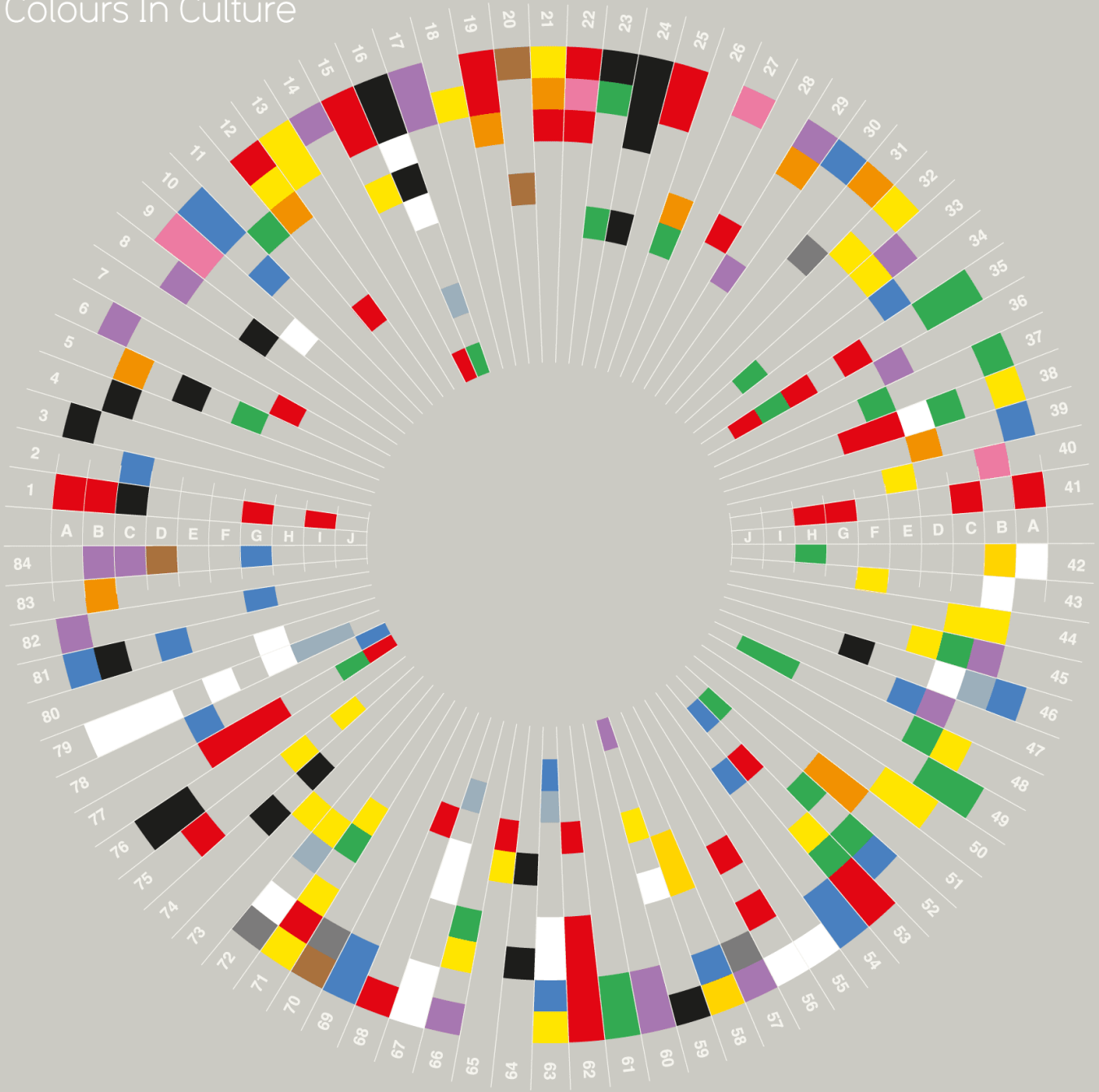
http://graphics-info.blogspot.hk/2012/09/malofiej-20-look-at-our-participation.html





http://graphics-info.blogspot.hk/2012/09/malofiej-20-look-at-our-participation.html

Colours In Culture



A Western / American
B Japanese
C Hindu
D Native American
E Chinese
F Asian
G Eastern European
H Arab
I African
J South American

1 Anger
2 Art / Creativity
3 Authority
4 Bad Luck
5 Balance
6 Beauty
7 Calm
8 Celebration
9 Children
10 Cold
11 Compassion
12 Courage
13 Cowardice
14 Cruelty
15 Danger
16 Death
17 Decadence
18 Deceit
19 Desire
20 Earthy
21 Energy
22 Erotic
23 Eternity
24 Evil
25 Excitement
26 Family
27 Femininity
28 Fertility
29 Flamboyance
30 Freedom
31 Friendly
32 Fun
33 God
34 Gods
35 Good Luck
36 Gratitude

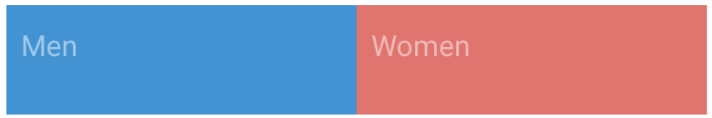
37 Growth
38 Happiness
39 Healing
40 Healthy
41 Heat
42 Heaven
43 Holiness
44 Illness
45 Insight
46 Intelligence
47 Intuition
48 Religion
49 Jealousy
50 Joy
51 Learning
52 Life
53 Love
54 Loyalty
55 Luxury
56 Marriage
57 Modesty
58 Money
59 Mourning
60 Mystery
61 Nature
62 Passion
63 Peace
64 Penance
65 Power
66 Personal power
67 Purity
68 Radicalism
69 Rational
70 Reliable
71 Repels Evil
72 Respect
73 Royalty
74 Self-cultivation
75 Strength
76 Style
77 Success
78 Trouble
79 Truce
80 Trust
81 Unhappiness
82 Virtue
83 Warmth
84 Wisdom

Yellow
Grey
Gold
Silver

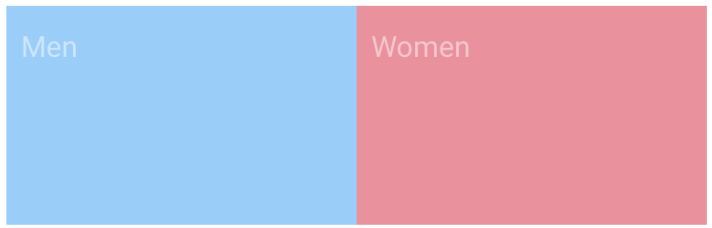
David McCandless & AlwaysWithHonor.com // v1.0 // Apr 09 // InformationIsBeautiful.net

source: Pantone, ColorMatters & web sources

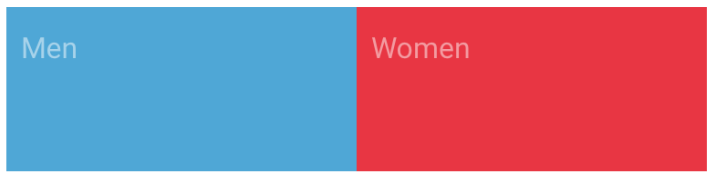
The Pudding, 2017: “Film Dialogue”



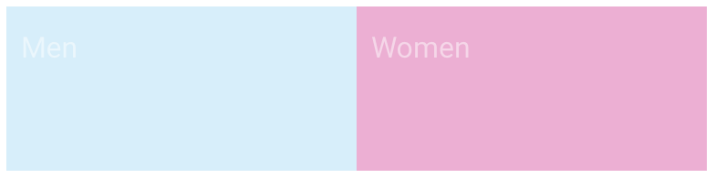
The Pudding, 2017: “She Giggles, He Gallops”



Bloomberg, 2016: “This Chart Shows Who Marries CEOs, Doctors, Chefs and Janitors”



NYT, 2015: “The Changing Nature of Middle-Class Jobs”



NYT, 2017: “The Words Men and Women Use When They Write About Love”

Wall Street Journal, 2016: “What’s Your Pay Gap?”

DailyMail, 2018

ZEIT 2016

ZEIT 2018

Economist, 2018

Morgenpost 2017

Guardian, 2018

Financial Times, 2018

Telegraph, 2018

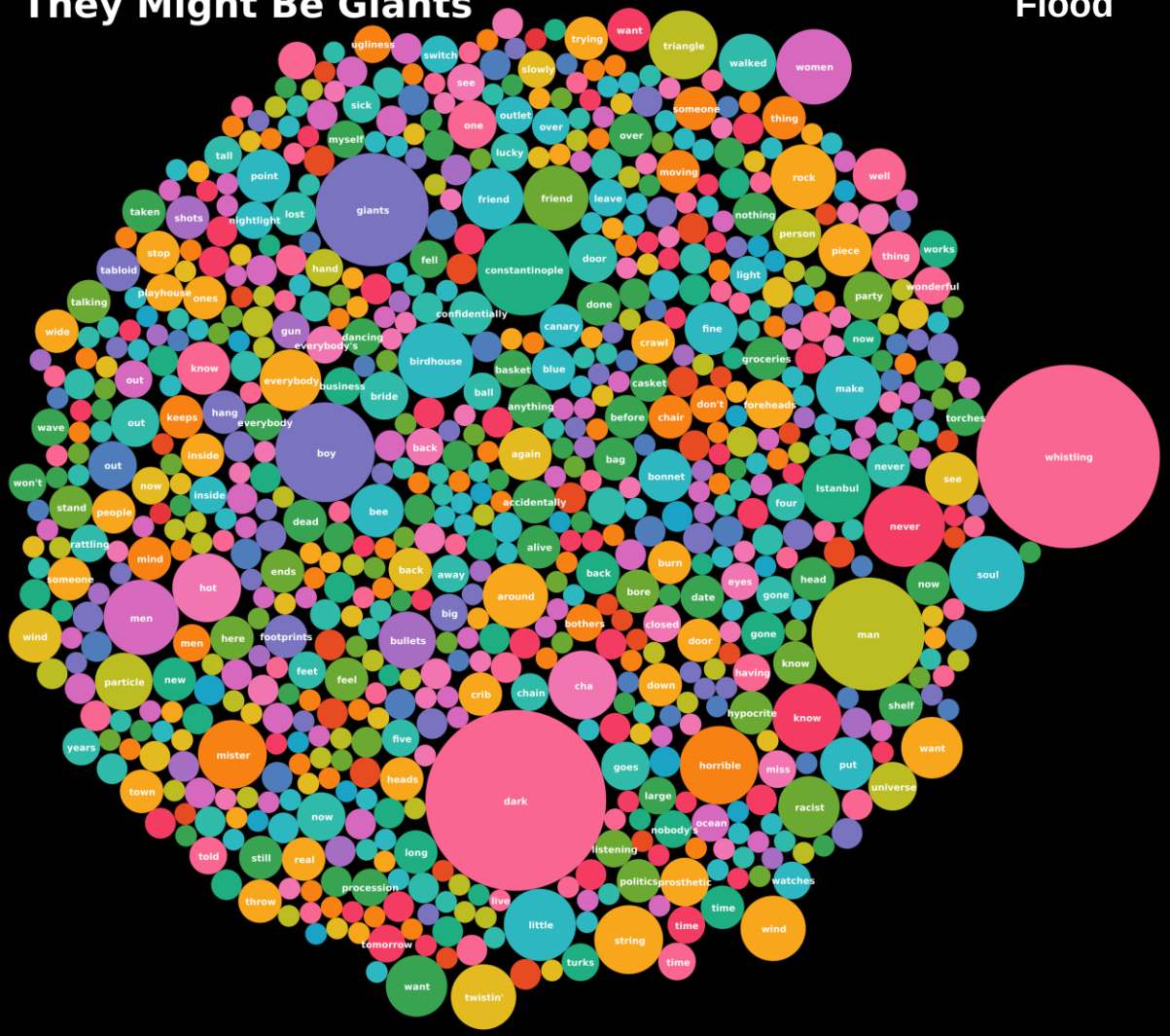
Information is beautiful, 2014

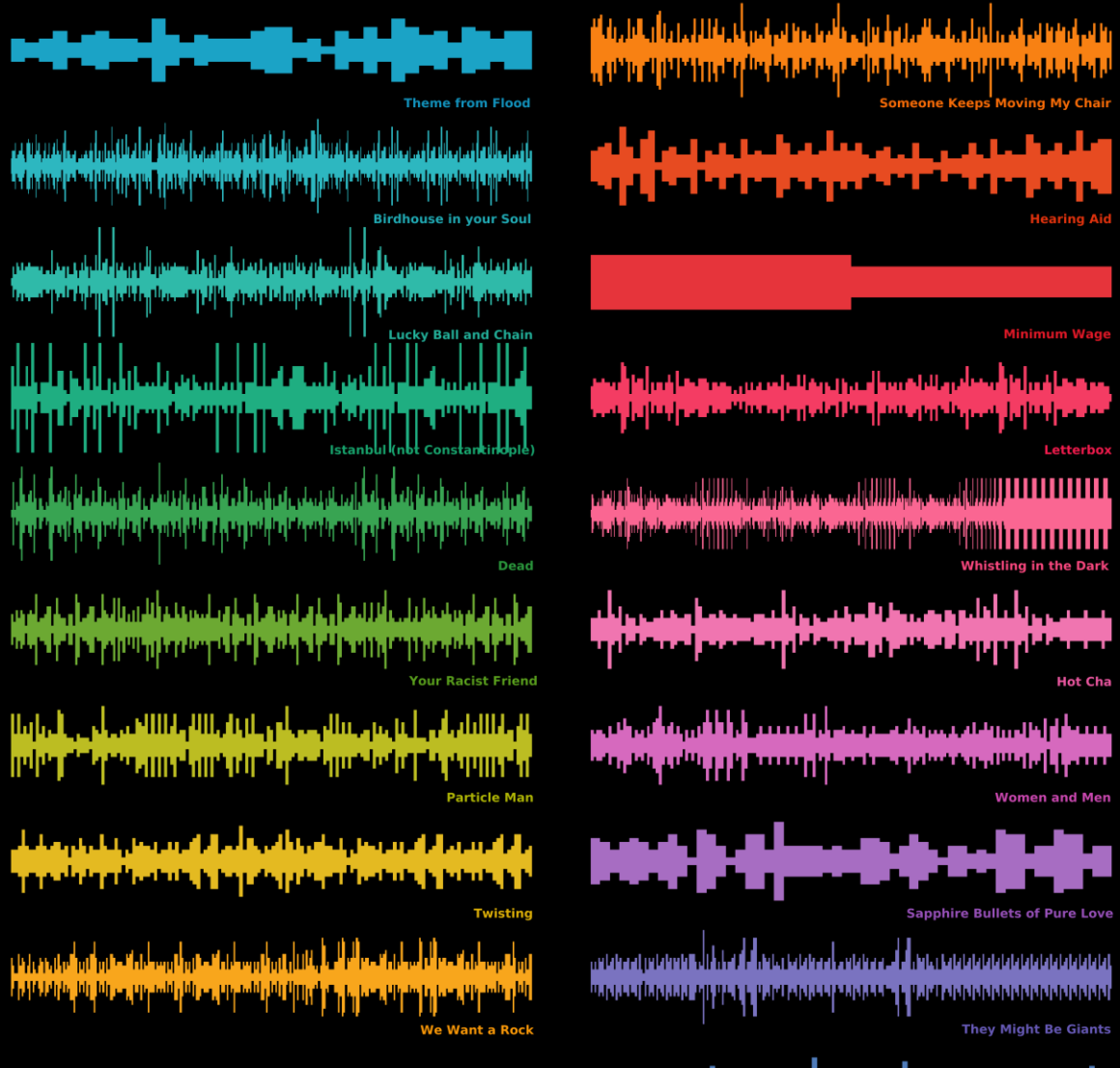
Washington Post, 2017

Bloomberg, 2018

BBC, 2017

BBC, 2018





They Might Be Giants
Flood

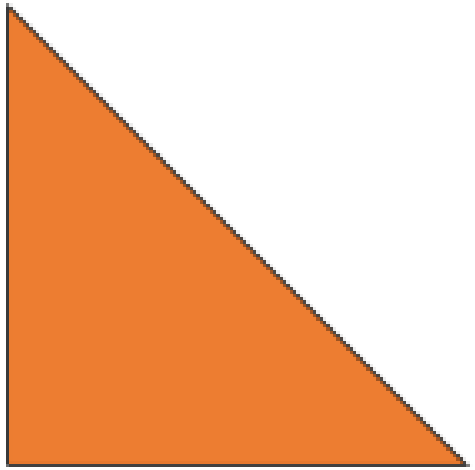
length of words in each song

@theneilrichards

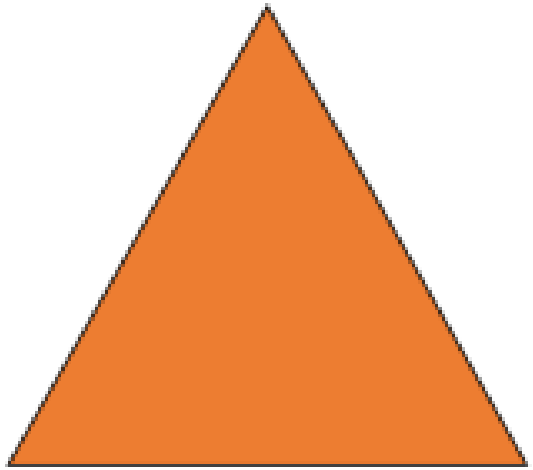
Colours of the London Underground

NEIL RICHARDS

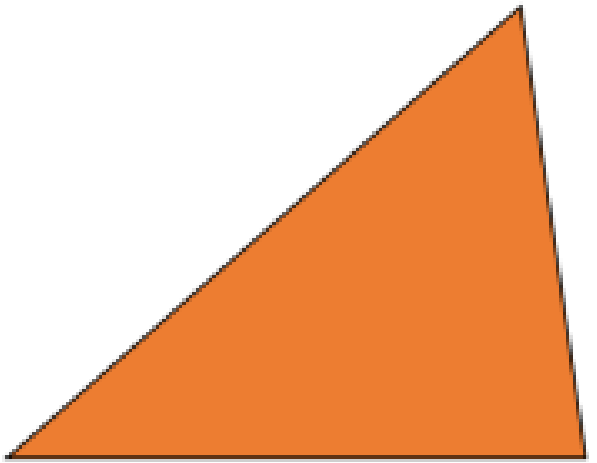
Why visualise using triangles?



right angled



equilateral

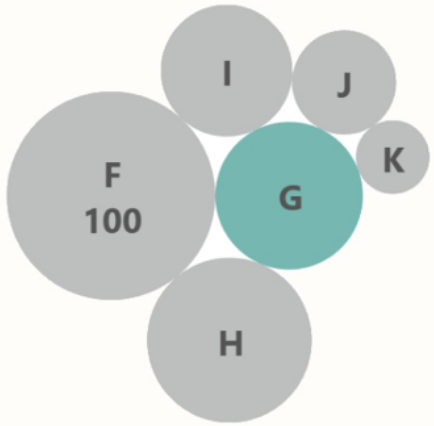


scalene

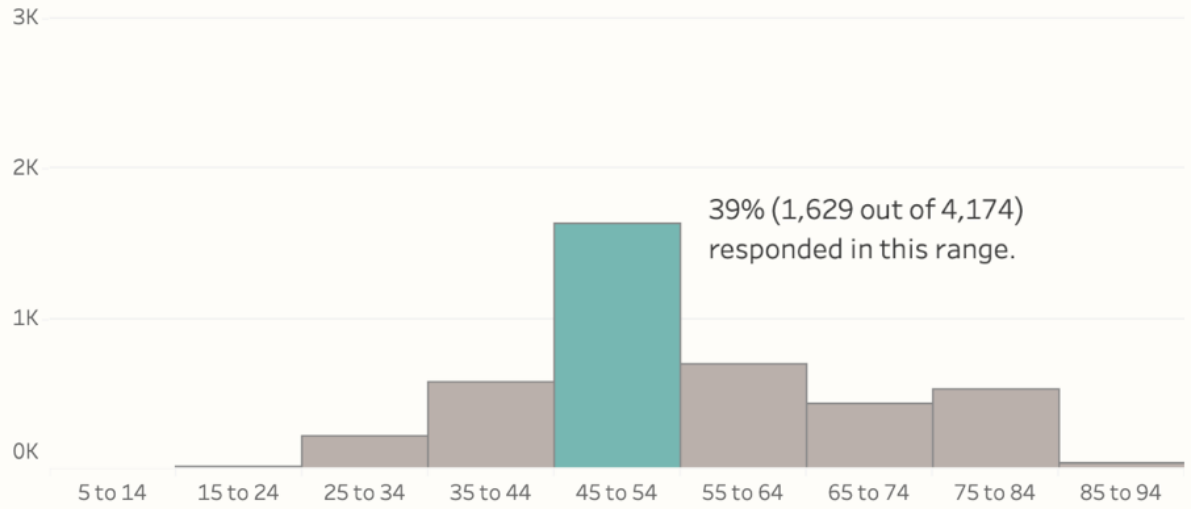
Circles and Bars: The Results

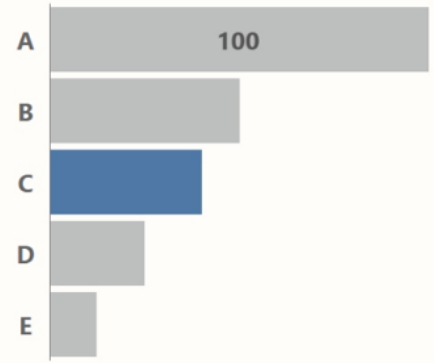
Show all responses

Responses: 4,174

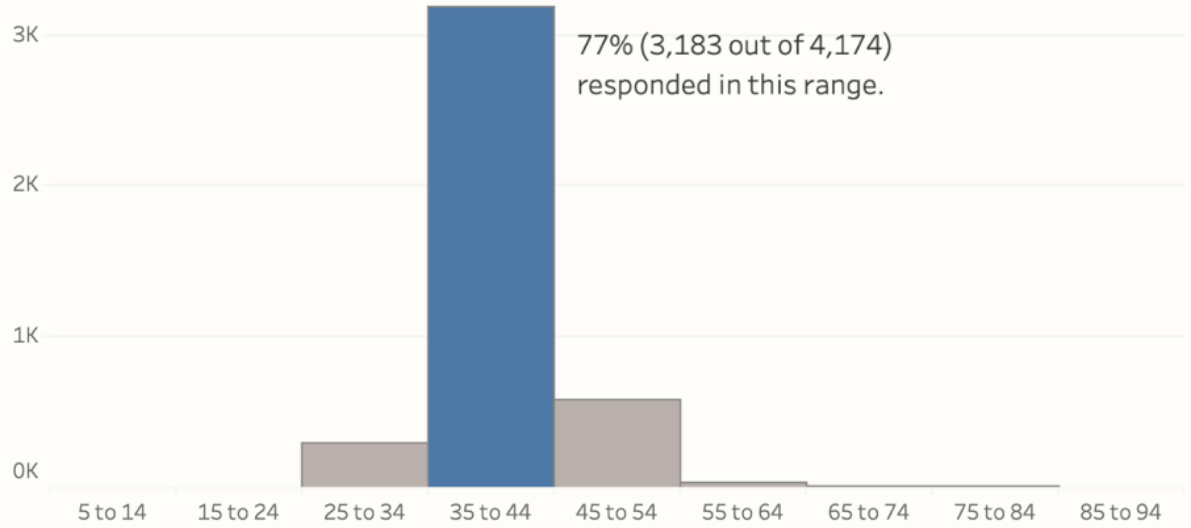


The circle is **50**. Here are the guesses.



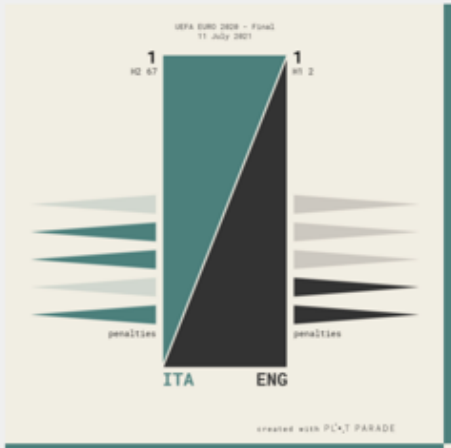


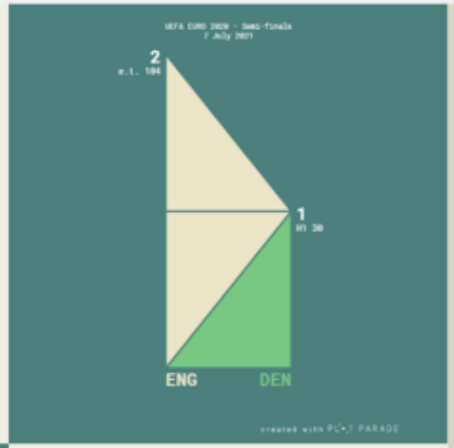
The bar is **40**. Here are the guesses.

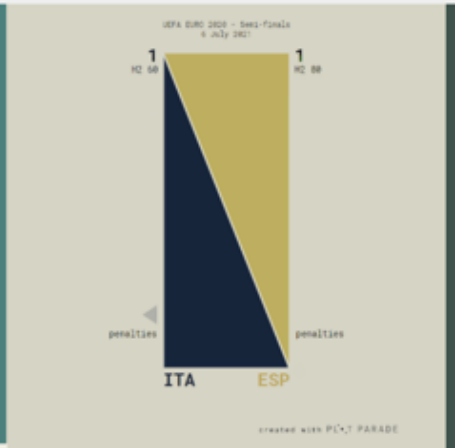


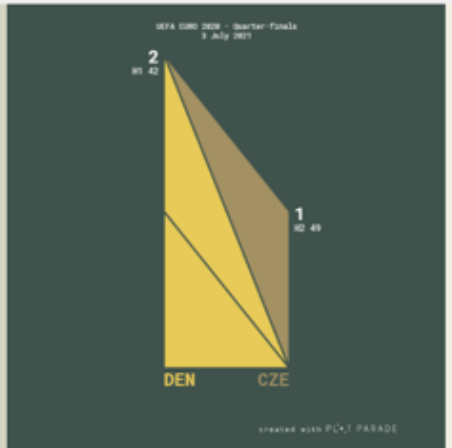
Reservoirs in and around California running dry

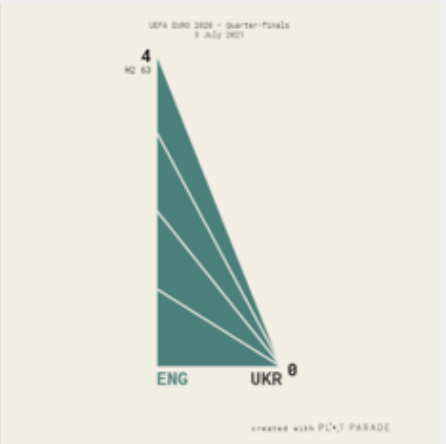
UEFA 2020 chart gallery

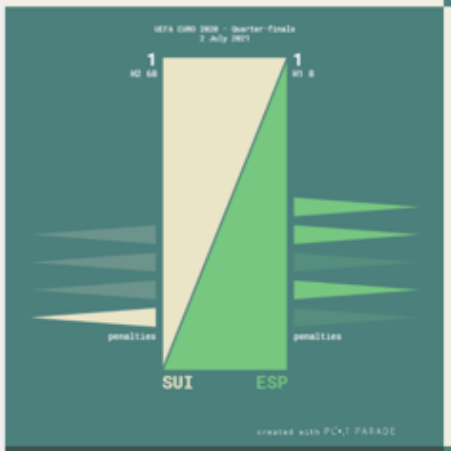


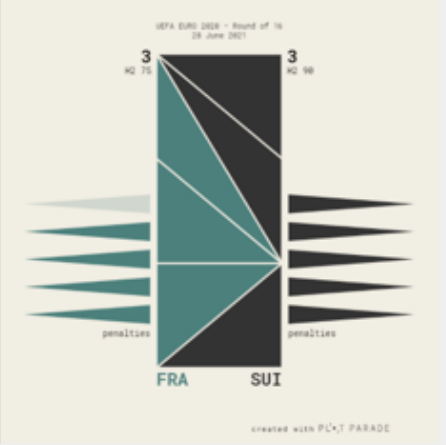


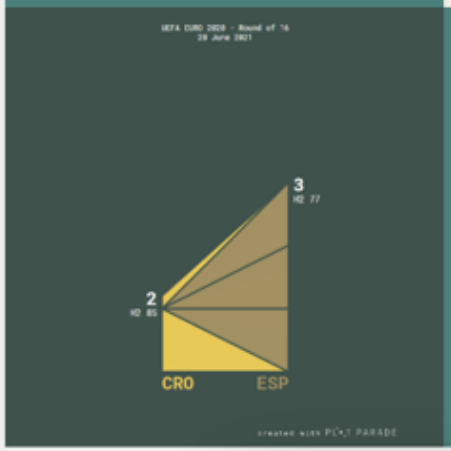


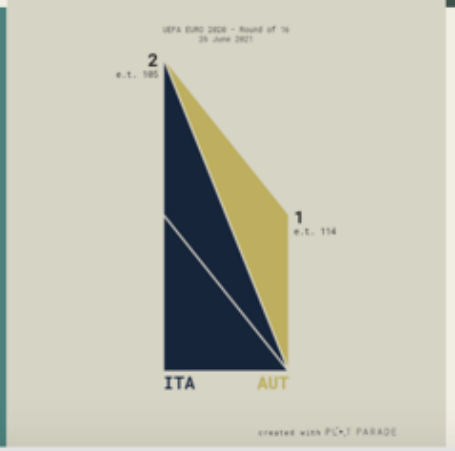


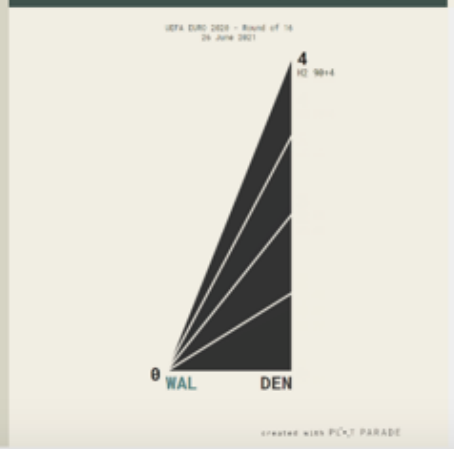






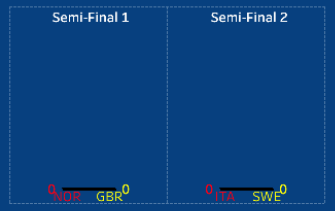




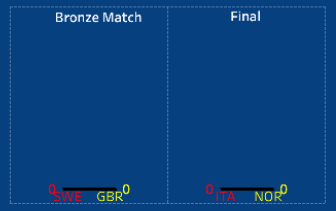


Olympic Curling Mixed Doubles - Beijing 2022

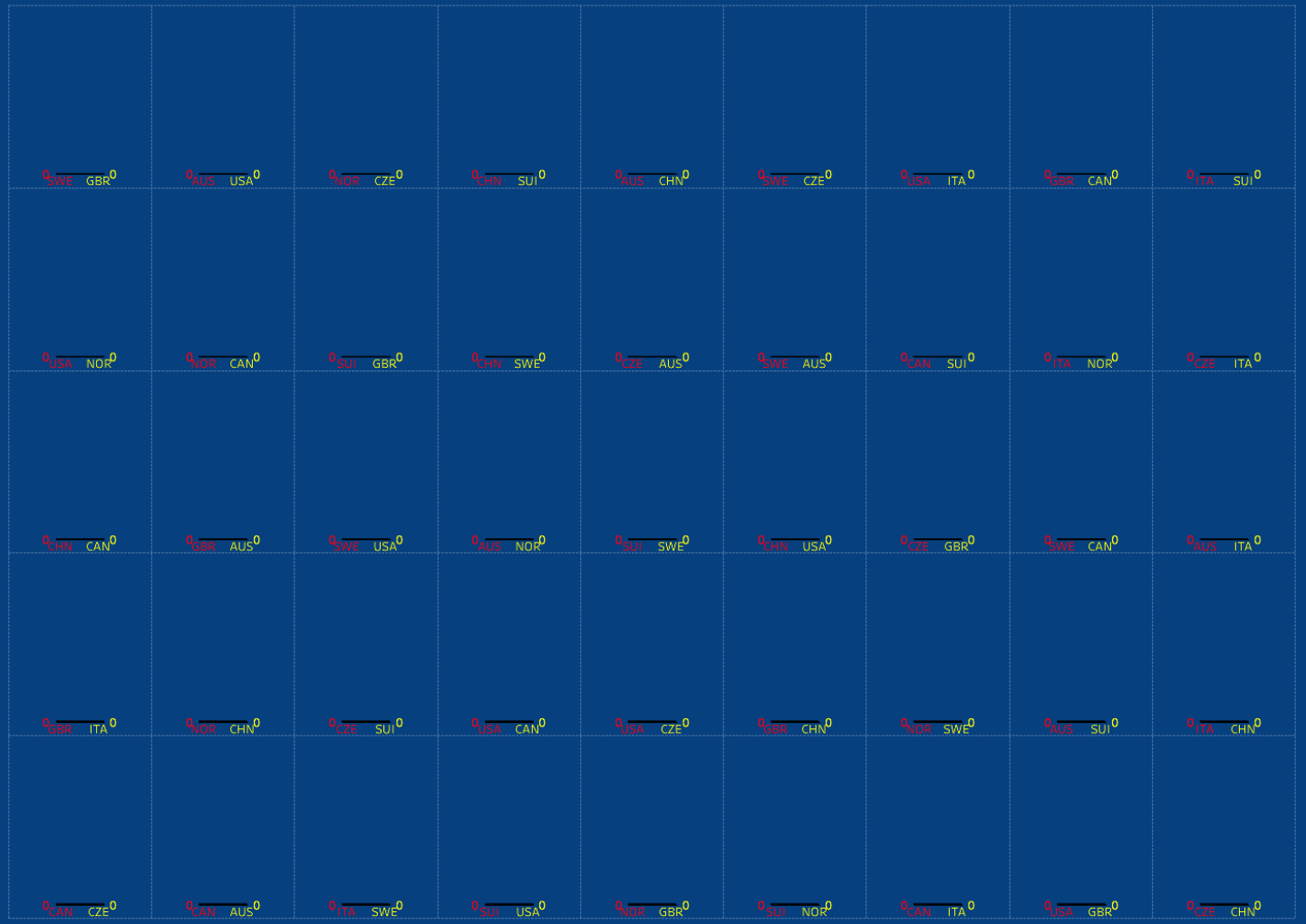
Semi Finals



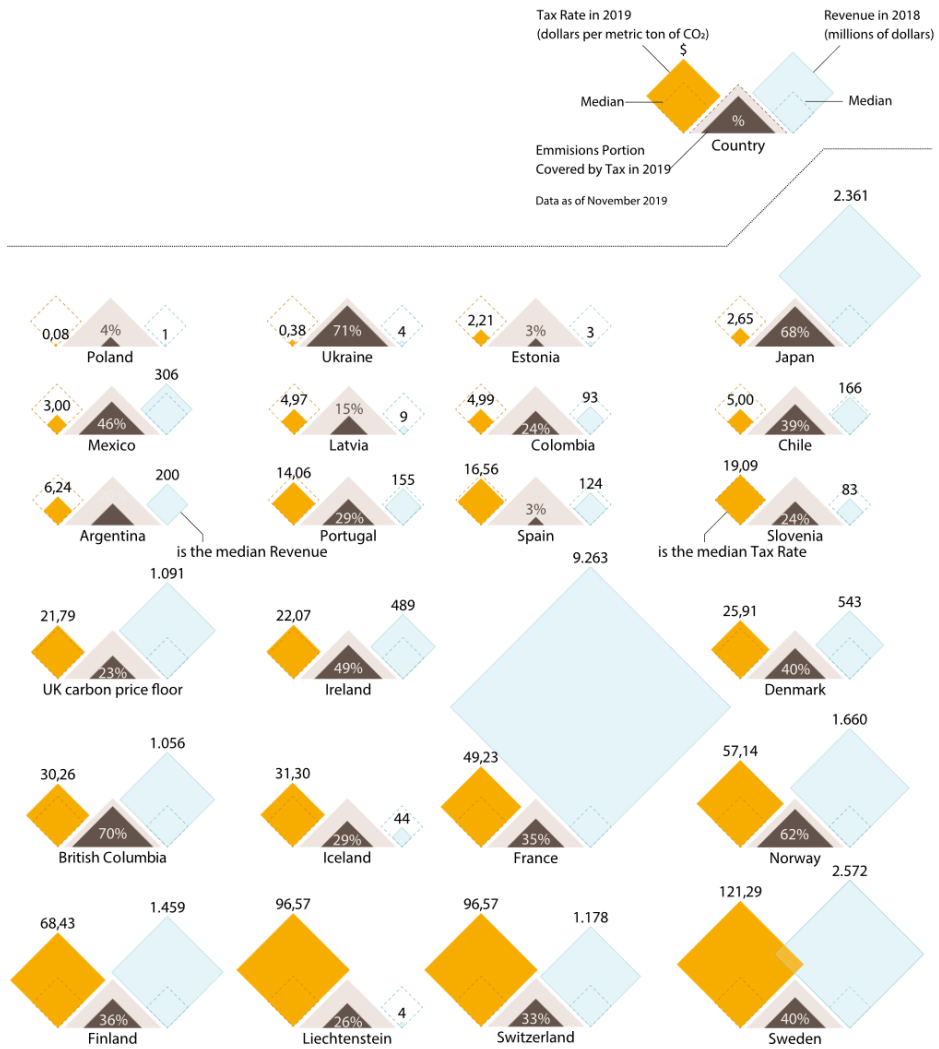
Medal Matches

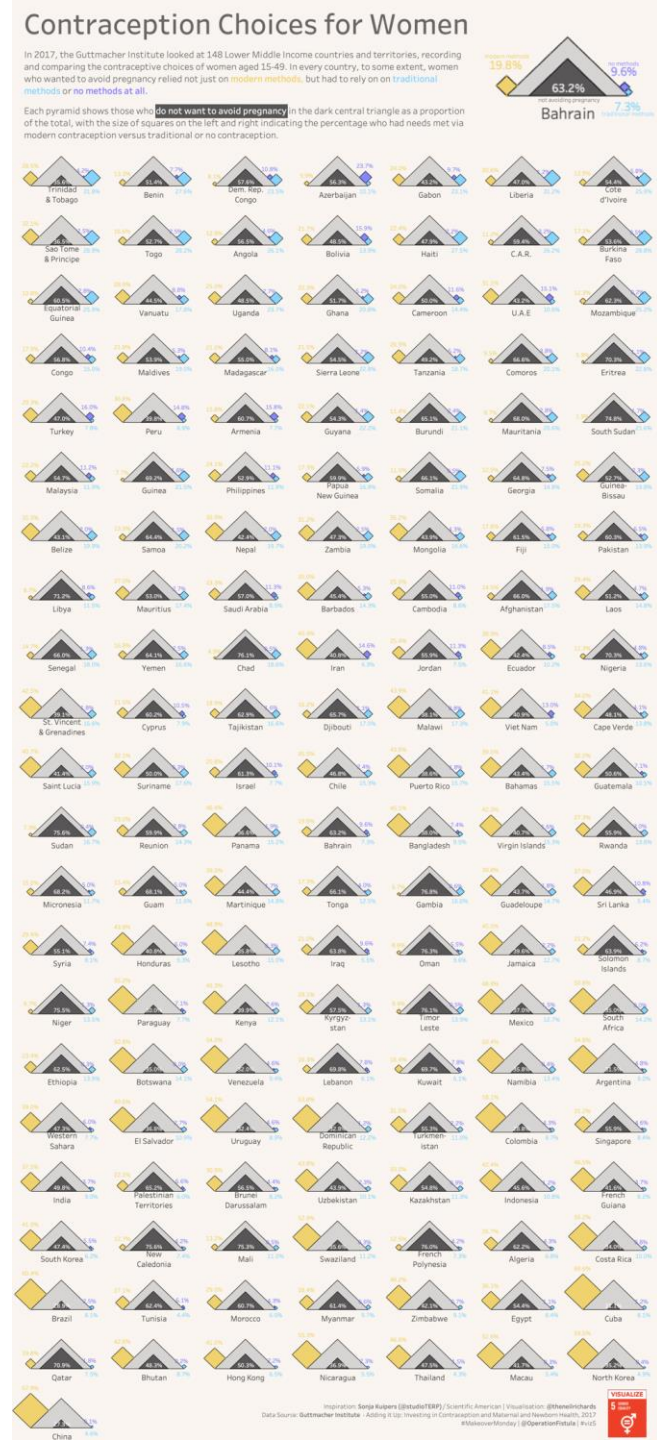


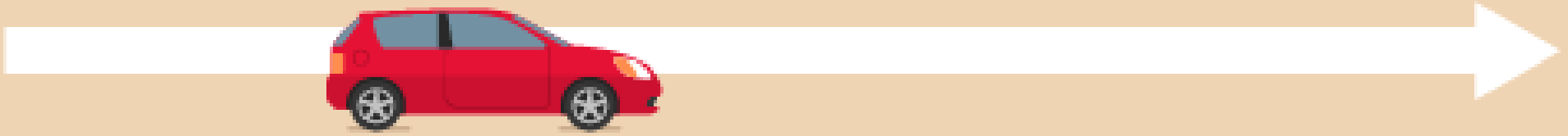
Round Robin Matches



Source: olympics.com | visualisation: Neil Richards (@theneilrichards) | inspiration: Krisztina Scücz (@scuczi)


Tax Rate in 2019
(dollars per metric ton of CO_2)
$
Median
%
Country
Emmisions Portion
Covered by Tax in 2019
Revenue in 2018
(millions of dollars)
Median
Data as of November 2019
0,08
4%
1
Poland
0,38
71%
4
Ukraine
2,21
3%
3
Estonia
2,65
68%
2.361
Japan
3,00
46%
306
Mexico
4,97
15%
9
Latvia
4,99
24%
93
Colombia
5,00
39%
166
Chile
6,24
200
Argentina
14,06
29%
155
Portugal
16,56
3%
124
Spain
19,09
24%
83
Slovenia
is the median Revenue
is the median Tax Rate
21,79
23%
1.091
UK carbon price floor
22,07
49%
489
Ireland
49,23
35%
9.263
France
25,91
40%
543
Denmark
30,26
70%
1.056
British Columbia
31,30
29%
44
Iceland
57,14
62%
1.660
Norway
68,43
36%
1.459
Finland
96,57
26%
4
Liechtenstein
96,57
33%
1.178
Switzerland
121,29
40%
2.572
Sweden


Contraception Choices for Women
In 2017, the Guttmacher Institute looked at 148 Lower Middle Income countries and territories, recording and comparing the contraceptive choices of women aged 15-49. In every country, to some extent, women who wanted to avoid pregnancy relied not just on modern methods, but had to rely on on traditional methods or no methods at all.
Each pyramid shows those who do not want to avoid pregnancy in the dark central triangle as a proportion of the total, with the size of squares on the left and right indicating the percentage who had needs met via modern contraception versus traditional or no contraception.
19.8%
63.2%
9.6%
not avoiding pregnancy
Bahrain
7.3%
Trinidad & Tobago
Benin
Dem. Rep. Congo
Azerbaijan
Gabon
Liberia
Cote d'Ivoire
Sao Tome & Principe
Togo
Angola
Bolivia
Haiti
C.A.R.
Burkina Faso
Equatorial Guinea
Vanuatu
Uganda
Ghana
Cameroon
U.A.E
Mozambique
Congo
Maldives
Madagascar
Sierra Leone
Tanzania
Comoros
Eritrea
Turkey
Peru
Armenia
Guyana
Burundi
Mauritania
South Sudan
Malaysia
Guinea
Philippines
Papua New Guinea
Somalia
Georgia
Guinea-Bissau
Belize
Samoa
Nepal
Zambia
Mongolia
Fiji
Pakistan
Libya
Mauritius
Saudi Arabia
Barbados
Cambodia
Afghanistan
Laos
Senegal
Yemen
Chad
Iran
Jordan
Ecuador
Nigeria
St. Vincent & Grenadines
Cyprus
Tajikistan
Djibouti
Malawi
Viet Nam
Cape Verde
Saint Lucia
Suriname
Israel
Chile
Puerto Rico
Bahamas
Guatemala
Sudan
Reunion
Panama
Bahrain
Bangladesh
Virgin Islands
Rwanda
Micronesia
Guam
Martinique
Tonga
Gambia
Guadeloupe
Sri Lanka
Syria
Honduras
Lesotho
Iraq
Oman
Jamaica
Solomon Islands
Niger
Paraguay
Kenya
Kyrgyzstan
Timor Leste
Mexico
South Africa
Ethiopia
Botswana
Venezuela
Lebanon
Kuwait
Namibia
Argentina
Western Sahara
El Salvador
Uruguay
Dominican Republic
Turkmenistan
Colombia
Singapore
India
Palestinian Territories
Brunei Darussalam
Uzbekistan
Kazakhstan
Indonesia
French Guiana
South Korea
New Caledonia
Mali
Swaziland
French Polynesia
Algeria
Costa Rica
Brazil
Tunisia
Morocco
Myanmar
Zimbabwe
Egypt
Cuba
Qatar
Bhutan
Hong Kong
Nicaragua
Thailand
Macau
North Korea
China
Inspiration: Sonja Kuipers (@studioTERP) / Scientific American | Visualisation: @thenelrichards
Data Source: Guttmacher Institute - Adding It Up: Investing in Contraception and Maternal and Newborn Health, 2017
#MakeoverMonday | @OperationFistula | #vis5
VISUALIZE

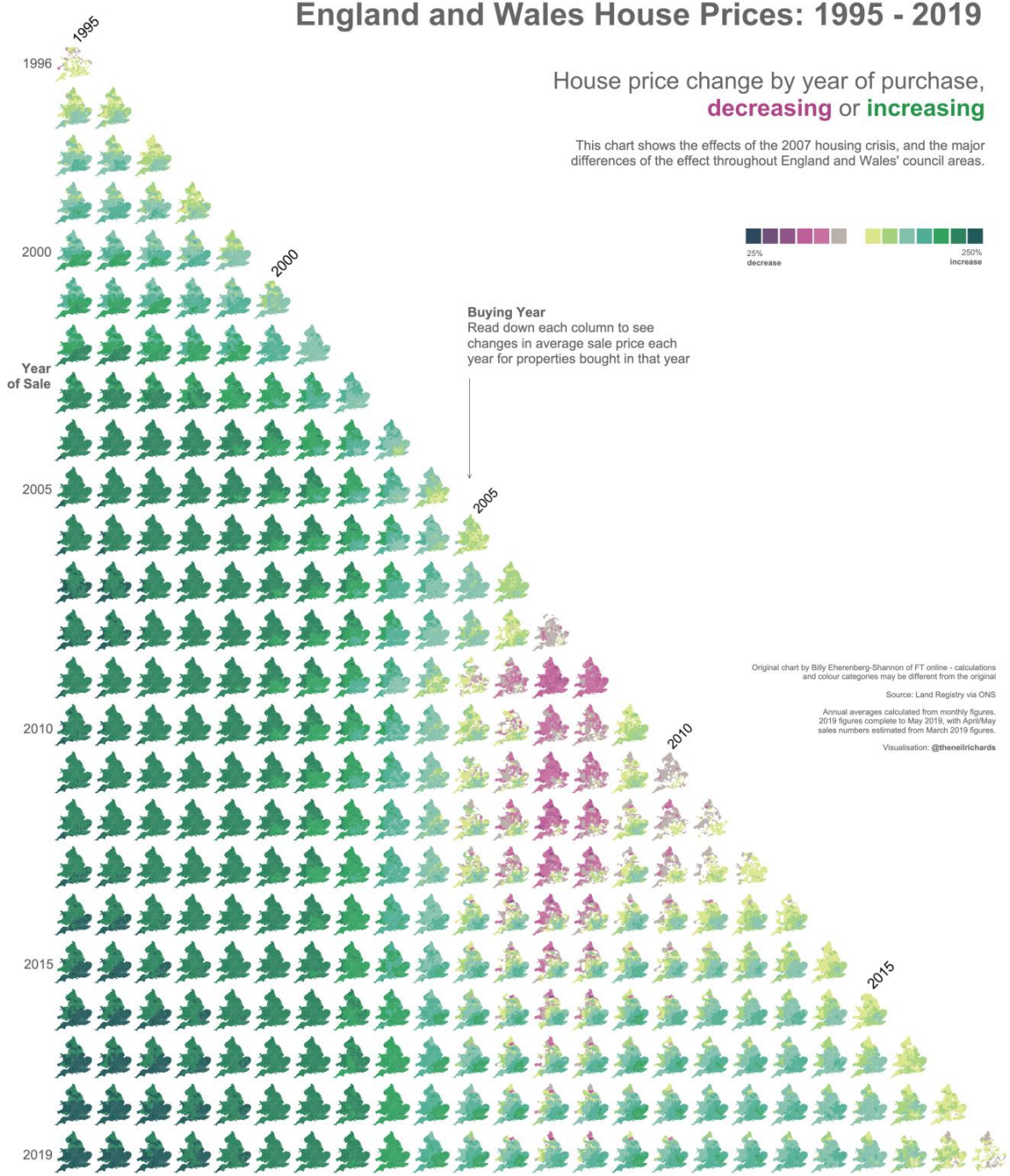


EDINBURGH								
290	BIRMINGHAM							
373	102	CARDIFF						
496	185	228	DOVER					
193	110	208	257	LEEDS				
214	90	165	270	73	LIVERPOOL			
412	118	150	81	191	198	**LONDON**		
222	86	173	285	41	34	201	MANCHESTER	
112	207	301	360	94	155	288	141	NEWCASTLE
186	129	231	264	25	97	194	66	82	YORK

England and Wales House Prices: 1995 - 2019

House price change by year of purchase,
decreasing or **increasing**

This chart shows the effects of the 2007 housing crisis, and the major differences of the effect throughout England and Wales' council areas.

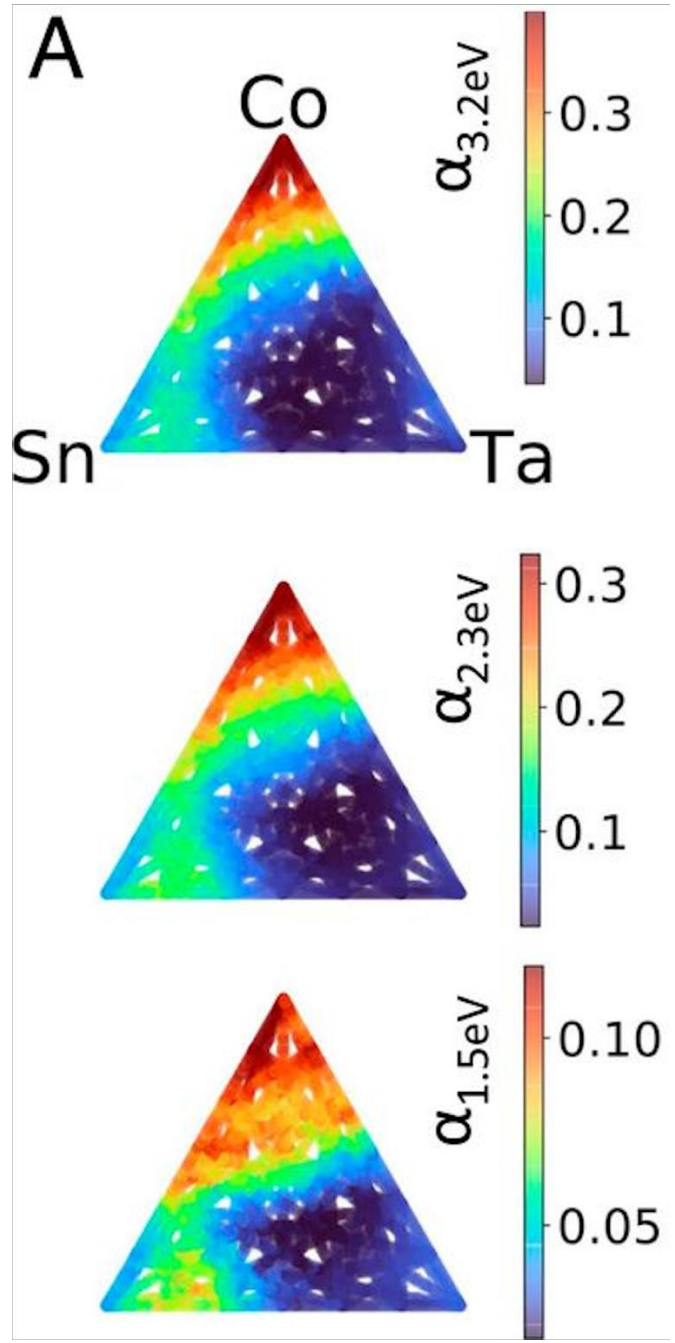


Original chart by Billy Ehrenberg-Shannon of FT online - calculations and colour categories may be different from the original

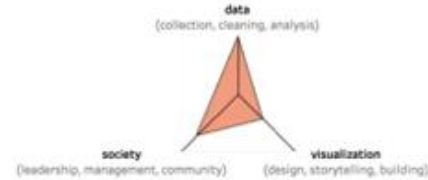
Source: Land Registry via ONS

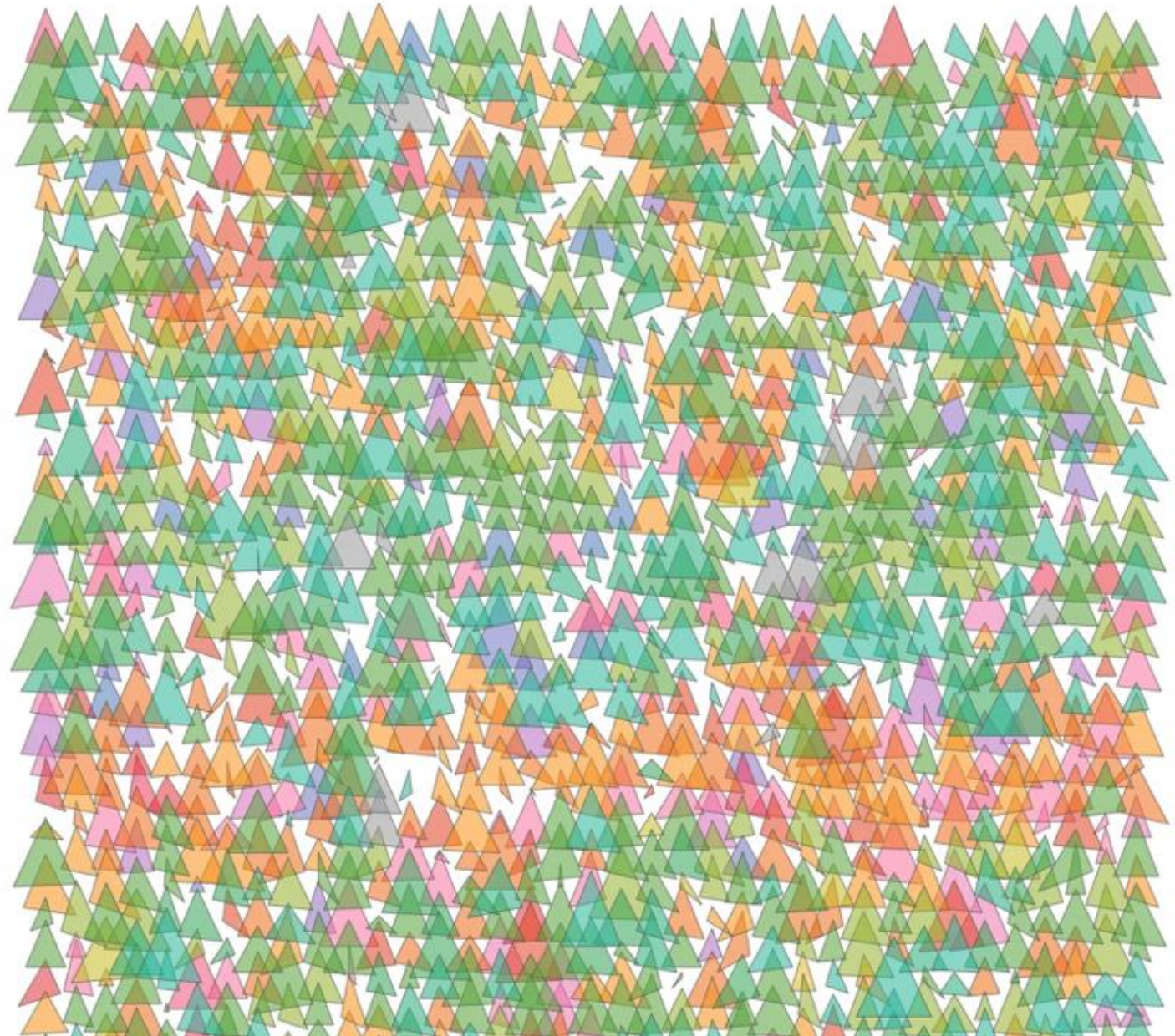
Annual averages calculated from monthly figures. 2019 figures complete to May 2019, with April/May sales numbers estimated from March 2019 figures.

Visualisation: **@theneilrichards**


A
Co
Sn
Ta
$\alpha_{3.2eV}$
0.3
0.2
0.1
$\alpha_{2.3eV}$
0.3
0.2
0.1
$\alpha_{1.5eV}$
0.10
0.05

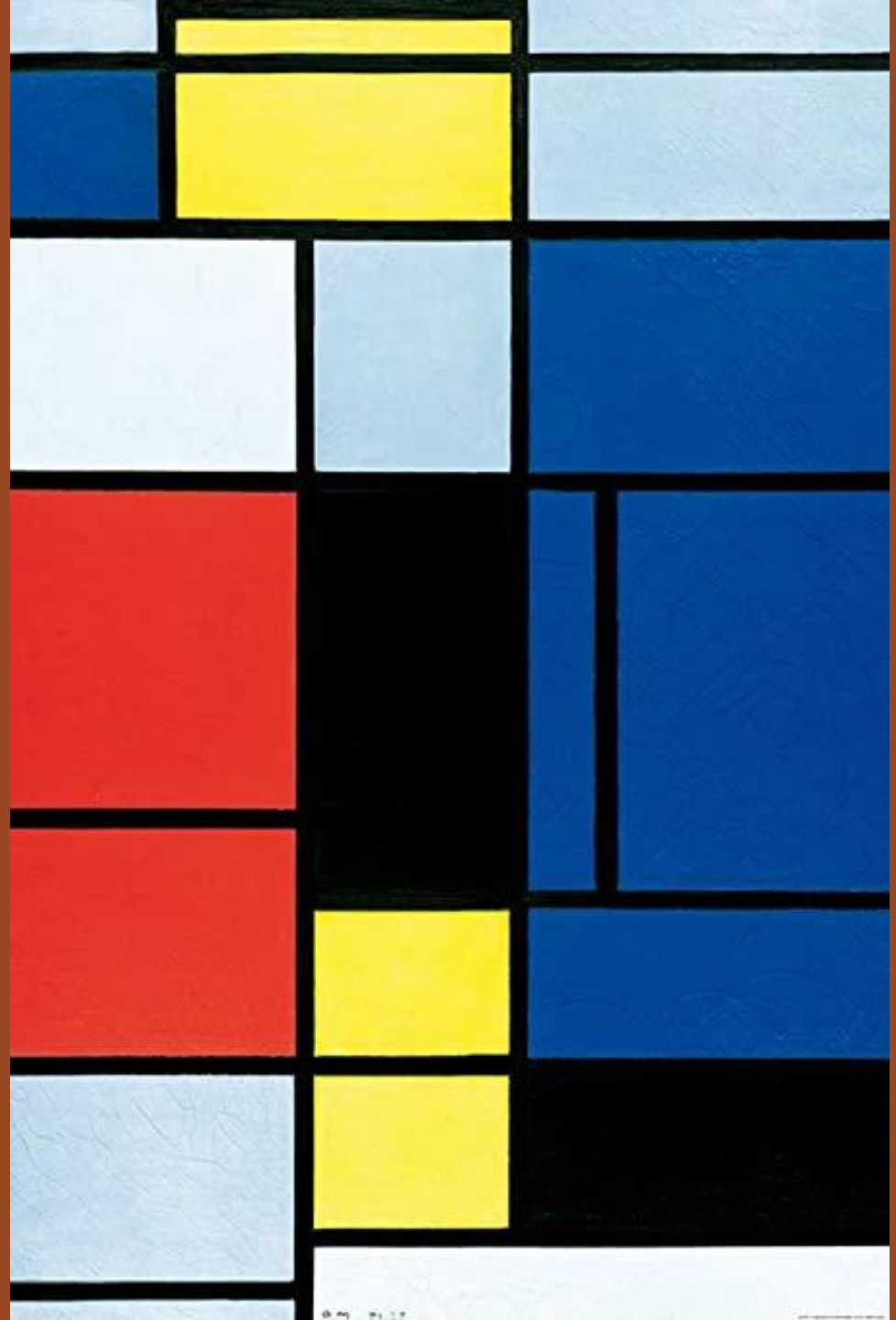
DATA VISUALIZATION SOCIETY



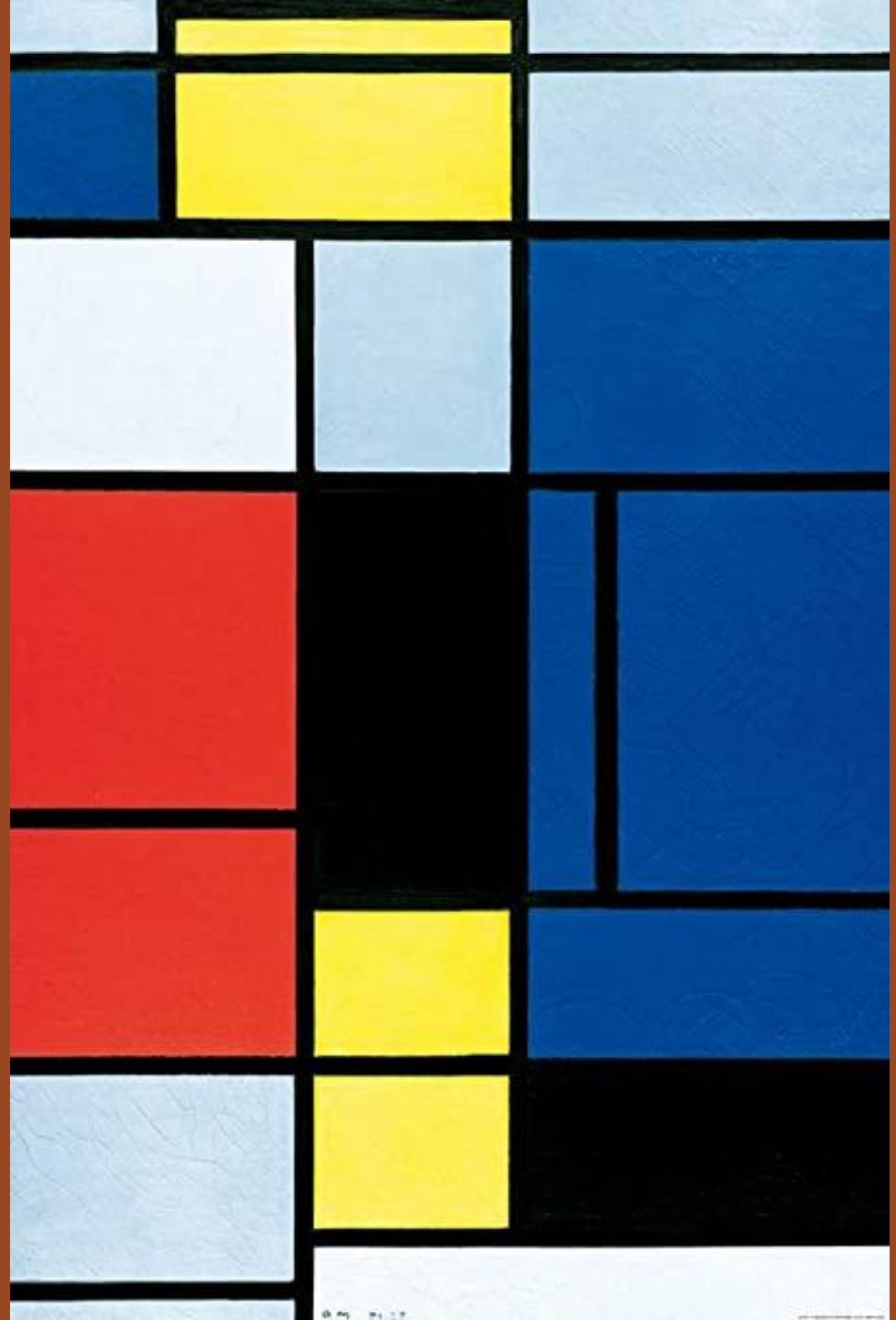


Why visualise using flowers?

- Geometric art
- Resembles data viz
- Piet Mondrian 1921



- Geometric art
- Resembles data viz
- Piet Mondrian 1921
- **Tableau #1**



tableau

[ta-**bloh**, **tab**-loh]

Spell Syllables

Examples Word Origin

See more synonyms on Thesaurus.com

noun, plural **tableaux** [ta-**blohz**, **tab**-lohz] (Show IPA), **tableaus.**

1. a picture, as of a scene.

2. a picturesque grouping of persons or objects; a striking scene.

3. a representation of a picture, statue, scene, etc., by one or more persons suitably costumed and posed.

French

tableau

Edit

English

board

noun

table
table, tableau, liste, classement

picture
image, photo, tableau, portrait, illustration, dessin

board
conseil, bord, pension, commission, planche, tableau

tableau
tableau, tableau vivant

blackboard
tableau noir, tableau

roll
rouleau, roulis, roulement, tableau, petit pain, pellicule

canvas
toile, canevas, tableau, tente

spreadsheet
tableur, tableau

tablet
comprimé, tablette, cachet, tableau, plaque commémorative

drawing
dessin, tirage, étirage, tableau

Gender & ethnic disparities in Tech companies

MALE 80% | 60% | 60% FEMALE

Leadership / Technical

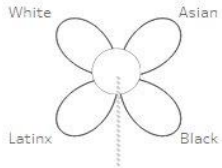
50/50 Gender Split

Dear Tech People is dedicated to unearthing the data behind diversity in tech, starting with a race/gender ranking of 100 top tech companies.

//Select a company on the bar chart to see its flower.
//Click on the center of a flower to look it closer.

HOW TO READ IT

A leaf of a flower means an ethnicity .



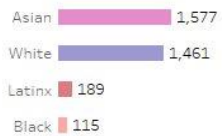
Total #of employees

Size means the #of employees in the specific ethnicity.

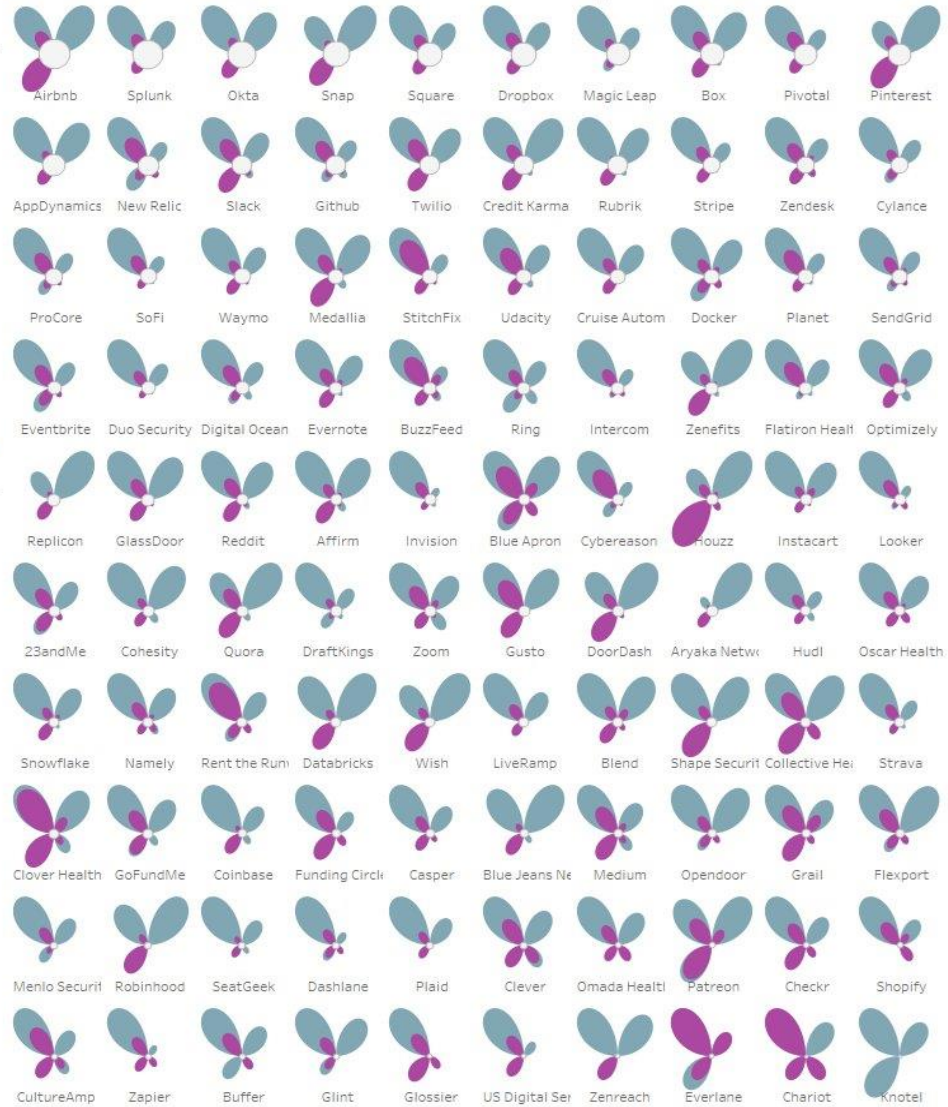
Male Female

3,342

Women work in Technical position

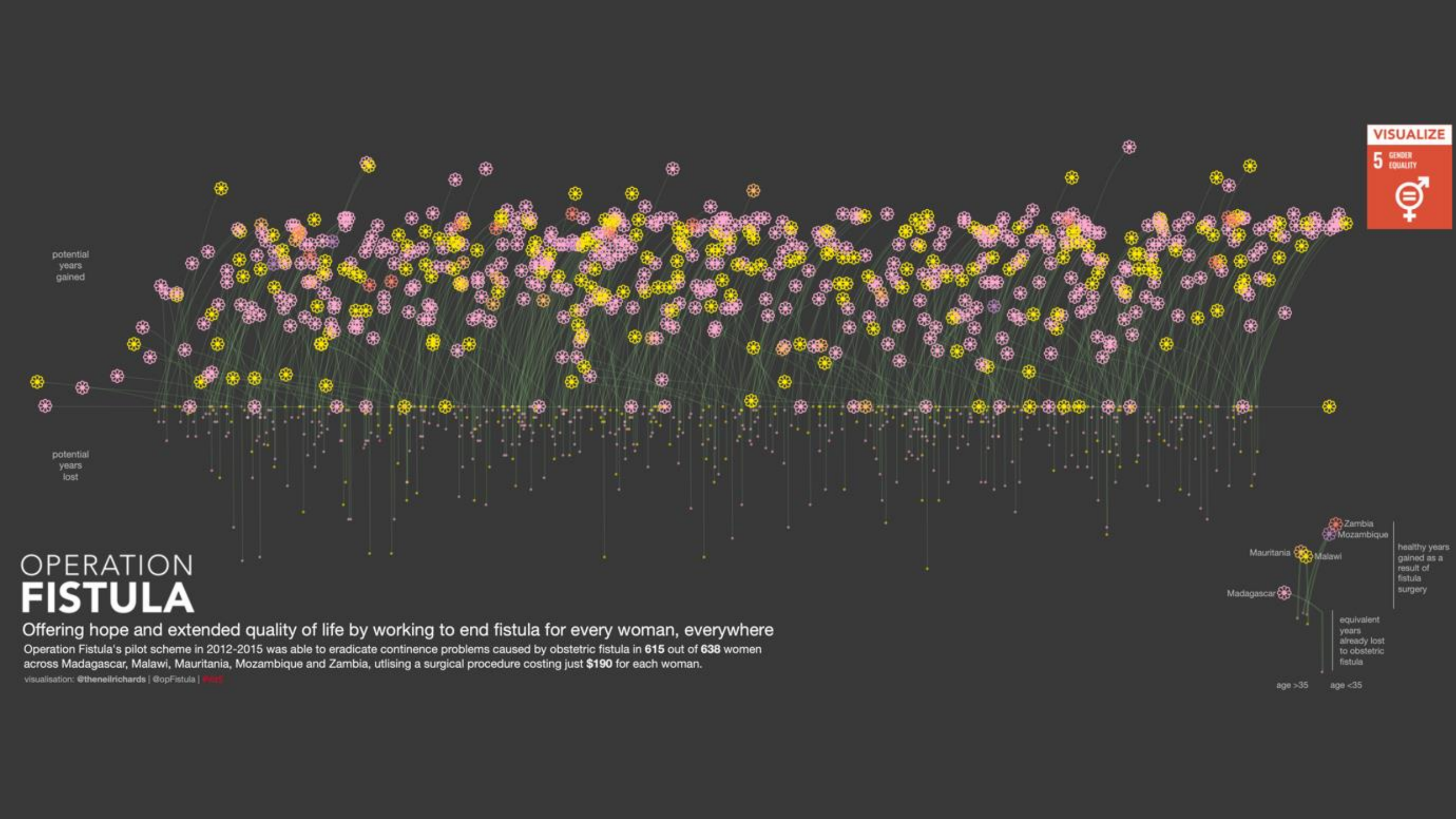


'Most of us agree that tech could be a little more diverse.'
Dear Tech People



Data: Dear Tech People | Viz for Social Good

@IvettAlexa & @korompaiistvan



OPERATION FISTULA

Offering hope and extended quality of life by working to end fistula for every woman, everywhere

Operation Fistula's pilot scheme in 2012-2015 was able to eradicate continence problems caused by obstetric fistula in **615** out of **638** women across Madagascar, Malawi, Mauritania, Mozambique and Zambia, utlising a surgical procedure costing just **$190** for each woman.

visualisation: **@theneilrichards** | @opFistula | #data

Even better than scatterplots

Scatterplots:

- Size
- Colour
- Position
- Shape

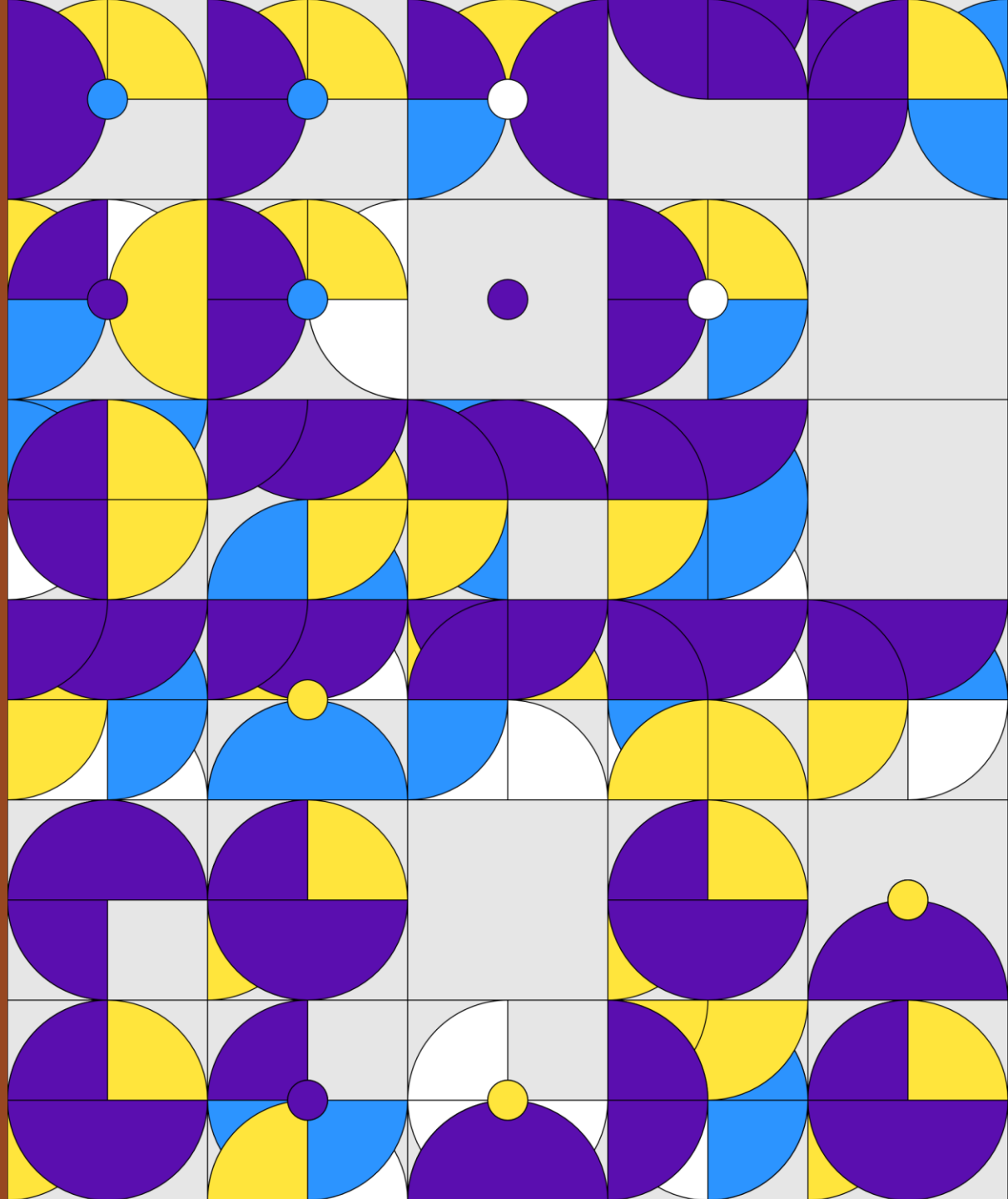
Flowers give you all of these plus

- Petal position
- Petal shape
- Stalk
- Colours of centres and petals
- … etc

Not analytic

Geometric vizzes:

- Designed to be artistic
- Make the reader do work
- Annotations/legends low profile
- Not for clients / board meetings!



Alt Text | Design Ideas | Format Pict...

How would you describe this object and its context to someone who is blind?

(1-2 sentences recommended)

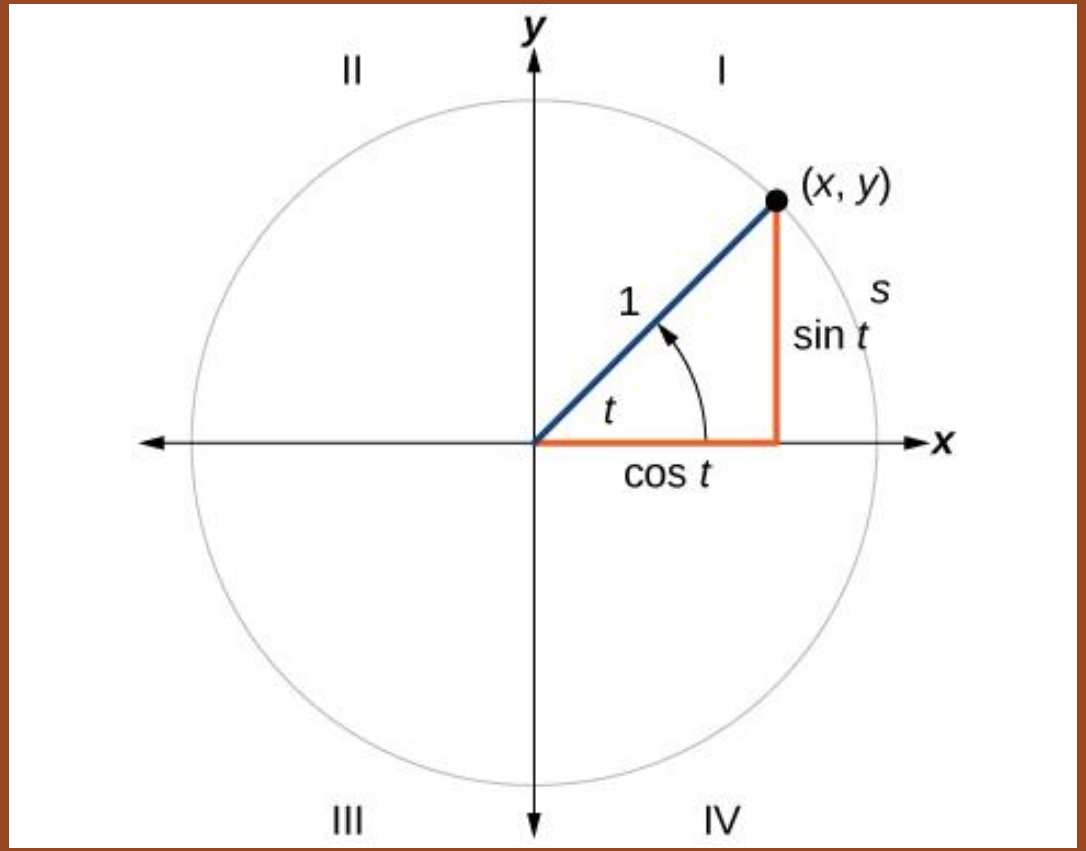
A group of colorful flowers

Description automatically generated with low confidence

Mark as decorative

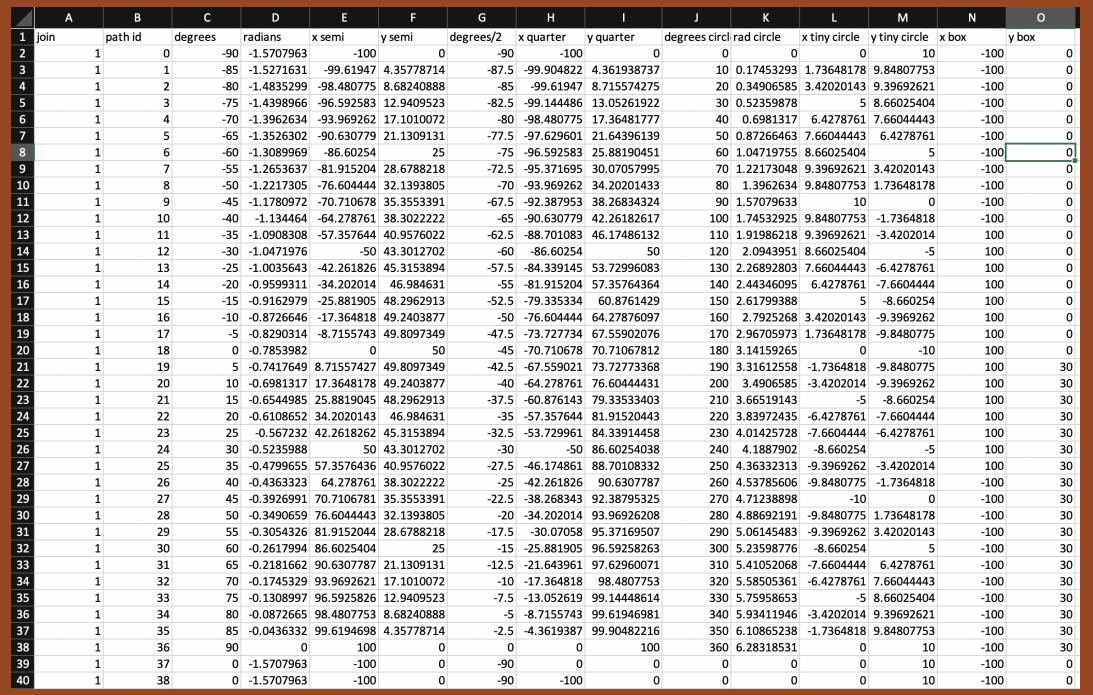
Trigonometry

- Use to calculate points round a circle
- Use unit circle (radius 1) centred at (0,0)
- $x = \cos t$, $y = \sin t$



Shapes file

- All rows have constant col **Join**=1
- Re-use / add columns as often as you like
- Makes several copies of the data with **path id** as identifier (scaffolds)
- Don’t need loads of points for a circle – 30 or so will do



	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
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3	1	1	-85	-1.5271631	-99.61947	4.35778714	-87.5	-99.904822	4.361938737	10	0.17453293	1.73648178	9.84807753	-100	0
4	1	2	-80	-1.4835299	-98.480775	8.68240888	-85	-99.61947	8.715574275	20	0.34906585	3.42020143	9.39692621	-100	0
5	1	3	-75	-1.4398966	-96.592583	12.9409523	-82.5	-99.144486	13.05261922	30	0.52359878	5	8.66025404	-100	0
6	1	4	-70	-1.3962634	-93.969262	17.1010072	-80	-98.480775	17.36481777	40	0.6981317	6.4278761	7.66044443	-100	0
7	1	5	-65	-1.3526302	-90.630779	21.1309131	-77.5	-97.629601	21.64396139	50	0.87266463	7.66044443	6.4278761	-100	0
8	1	6	-60	-1.3089969	-86.60254	25	-75	-96.592583	25.88190451	60	1.04719755	8.66025404	5	-100	0
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10	1	8	-50	-1.2217305	-76.604444	32.1393805	-70	-93.969262	34.20201433	80	1.3962634	9.84807753	1.73648178	-100	0
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12	1	10	-40	-1.134464	-64.278761	38.3022222	-65	-90.630779	42.26182617	100	1.74532925	9.84807753	-1.7364818	-100	0
13	1	11	-35	-1.0908308	-57.357644	40.9576022	-62.5	-88.701083	46.17486132	110	1.91986218	9.39692621	-3.4202014	100	0
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22	1	20	10	-0.6981317	17.3648178	49.2403877	-40	-64.278761	76.60444431	200	3.4906585	-3.4202014	-9.3969262	100	30
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	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
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4	1	2	-80	-1.4835299	-98.480775	8.68240888	-85	-99.61947	8.715574275	20	0.34906585	3.42020143	9.39692621	-100	0
5	1	3	-75	-1.4398966	-96.592583	12.9409523	-82.5	-99.144486	13.05261922	30	0.52359878	5	8.66025404	-100	0
6	1	4	-70	-1.3962634	-93.969262	17.1010072	-80	-98.480775	17.36481777	40	0.6981317	6.4278761	7.66044443	-100	0
7	1	5	-65	-1.3526302	-90.630779	21.1309131	-77.5	-97.629601	21.64396139	50	0.87266463	7.66044443	6.4278761	-100	0
8	1	6	-60	-1.3089969	-86.60254	25	-75	-96.592583	25.88190451	60	1.04719755	8.66025404	5	-100	0
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11	1	9	-45	-1.1780972	-70.710678	35.3553391	-67.5	-92.387953	38.26834324	90	1.57079633	10	0	-100	0
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17	1	15	-15	-0.9162979	-25.881905	48.2962913	-52.5	-79.335334	60.8761429	150	2.61799388	5	-8.660254	100	0
18	1	16	-10	-0.8726646	-17.364818	49.2403877	-50	-76.604444	64.27876097	160	2.7925268	3.42020143	-9.3969262	100	0
19	1	17	-5	-0.8290314	-8.7155743	49.8097349	-47.5	-73.727734	67.55902076	170	2.96705973	1.73648178	-9.8480775	100	0
20	1	18	0	-0.7853982	0	50	-45	-70.710678	70.71067812	180	3.14159265	0	-10	100	0
21	1	19	5	-0.7417649	8.71557427	49.8097349	-42.5	-67.559021	73.72773368	190	3.31612558	-1.7364818	-9.8480775	100	30
22	1	20	10	-0.6981317	17.3648178	49.2403877	-40	-64.278761	76.60444431	200	3.4906585	-3.4202014	-9.3969262	100	30
23	1	21	15	-0.6544985	25.8819045	48.2962913	-37.5	-60.876143	79.33533403	210	3.66519143	-5	-8.660254	100	30
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25	1	23	25	-0.567232	42.2618262	45.3153894	-32.5	-53.729961	84.33914458	230	4.01425728	-7.6604444	-6.4278761	100	30
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28	1	26	40	-0.4363323	64.278761	38.3022222	-25	-42.261826	90.6307787	260	4.53785606	-9.8480775	-1.7364818	-100	30
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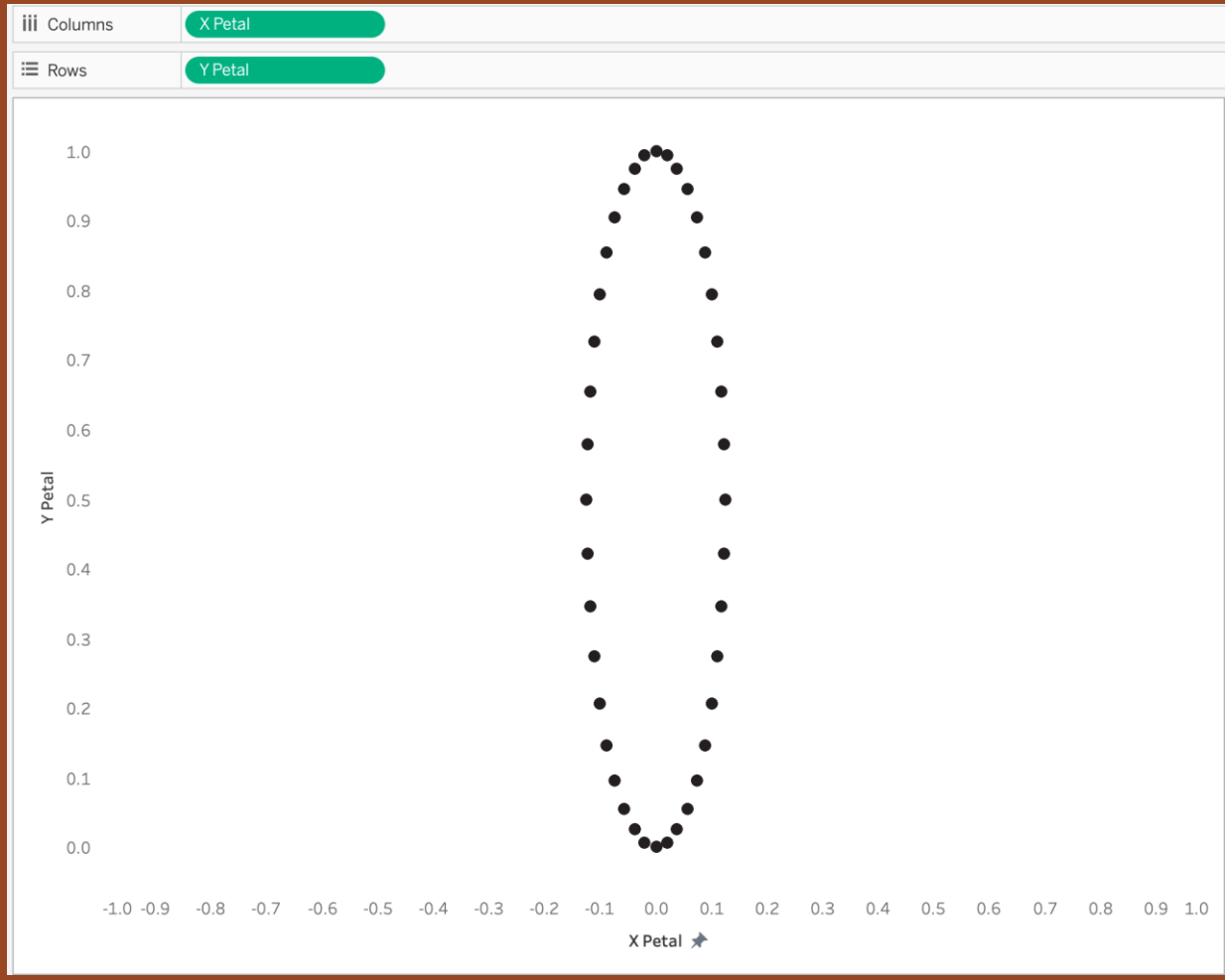
31	1	29	55	-0.3054326	81.9152044	28.6788218	-17.5	-30.07058	95.37169507	290	5.06145483	-9.3969262	3.42020143	-100	30
32	1	30	60	-0.2617994	86.6025404	25	-15	-25.881905	96.59258263	300	5.23598776	-8.660254	5	-100	30
33	1	31	65	-0.2181662	90.6307787	21.1309131	-12.5	-21.643961	97.62960071	310	5.41052068	-7.6604444	6.4278761	-100	30
34	1	32	70	-0.1745329	93.9692621	17.1010072	-10	-17.364818	98.4807753	320	5.58505361	-6.4278761	7.66044443	-100	30
35	1	33	75	-0.1308997	96.5925826	12.9409523	-7.5	-13.052619	99.14448614	330	5.75958653	-5	8.66025404	-100	30
36	1	34	80	-0.0872665	98.4807753	8.68240888	-5	-8.7155743	99.61946981	340	5.93411946	-3.4202014	9.39692621	-100	30
37	1	35	85	-0.0436332	99.6194698	4.35778714	-2.5	-4.3619387	99.90482216	350	6.10865238	-1.7364818	9.84807753	-100	30
38	1	36	90	0	100	0	0	0	100	360	6.28318531	0	10	-100	30
39	1	37	0	-1.5707963	-100	0	-90	0	0	0	0	0	10	-100	0
40	1	38	0	-1.5707963	-100	0	-90	-100	0	0	0	0	10	-100	0

Petals

- Include in shapes file
- Design your own shape
- This is an elongated circle
  - Y values translated so range from 0 to 1 (not -1 to 1)
- Gives a long, thin, vertical petal
- Petals need to rotate depending on where they start around the flower
- Deliberately chose (0,0) at bottom



Positioning of Petals

- Use trigonometry to determine start
- Central circle radius proportional to team score
- Position based on player number
- Petals will all be vertical pointing up

X Petal Start — Sheet2 (premier league

```
[X1 circle centre]
+ ([Total Team Score] * [centre slider]
* sin(radians(9 * [Player Number numeric])))
```

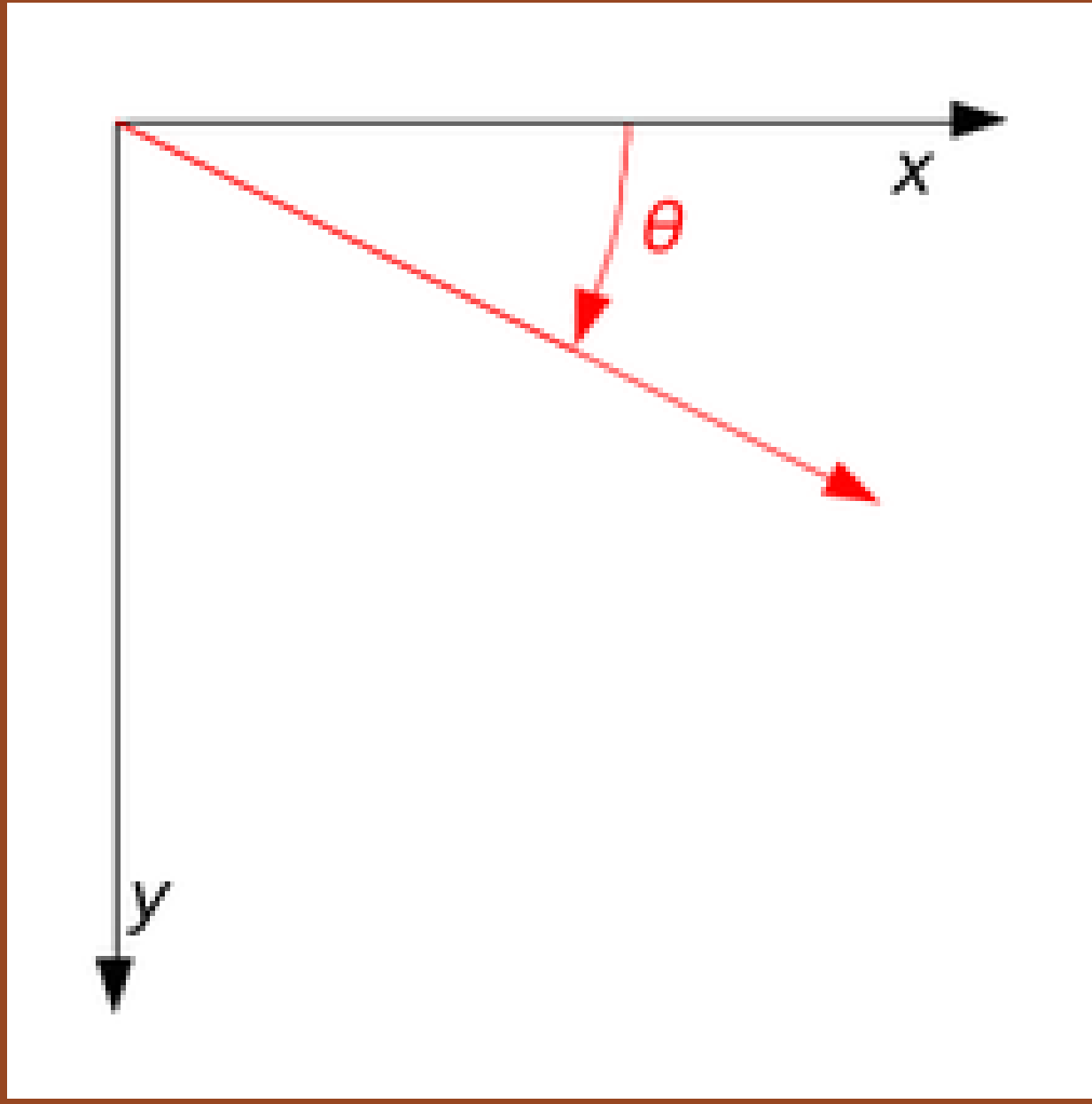
X — She

```
[X Petal Start] +
([X Petal]*3*[Matches Played])
```

Formula to rotate

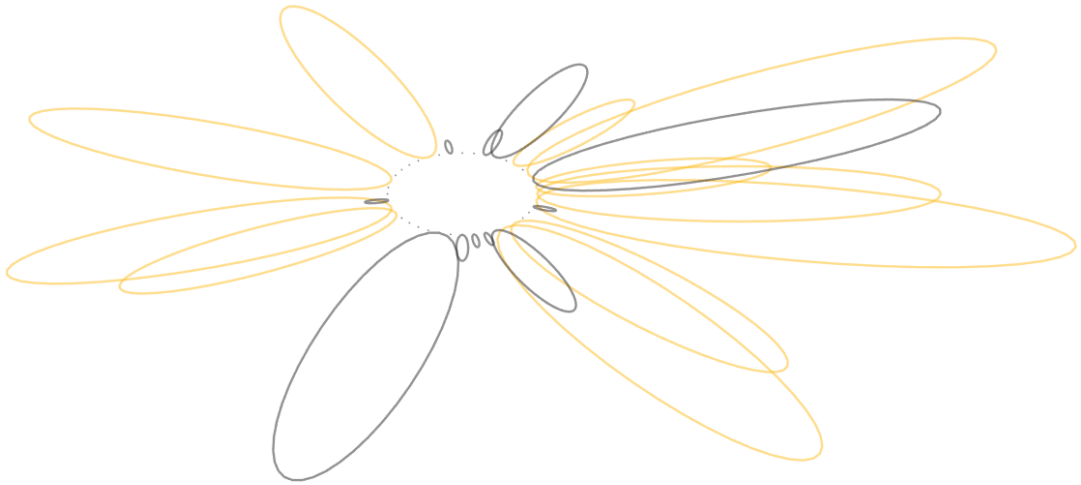
- Rotate point (x,y) through angle θ
- Rotation is relative to (0,0)
- Easy to google!

$$x' = x\cos\theta - y\sin\theta$$
$$y' = x\sin\theta + y\cos\theta.$$



Rotating petals

- Use formula to rotate
- Create X rotated / Y rotated
- Then add *rotated* petals to your petal start points



X petal rotated — Sheet2 (premier league lineups)

```
-([X Petal] * cos(RADIANS([Player Number numeric]*9)))
+ ([Y Petal] * sin(RADIANS([Player Number numeric]*9)))
```

Y petal rotated — Sheet2 (premier league lineups)

```
([X Petal] * sin(RADIANS([Player Number numeric]*9)))
 + ([Y Petal] * cos(RADIANS([Player Number numeric]*9)))
```

X — Sheet2 (premier league lineups)

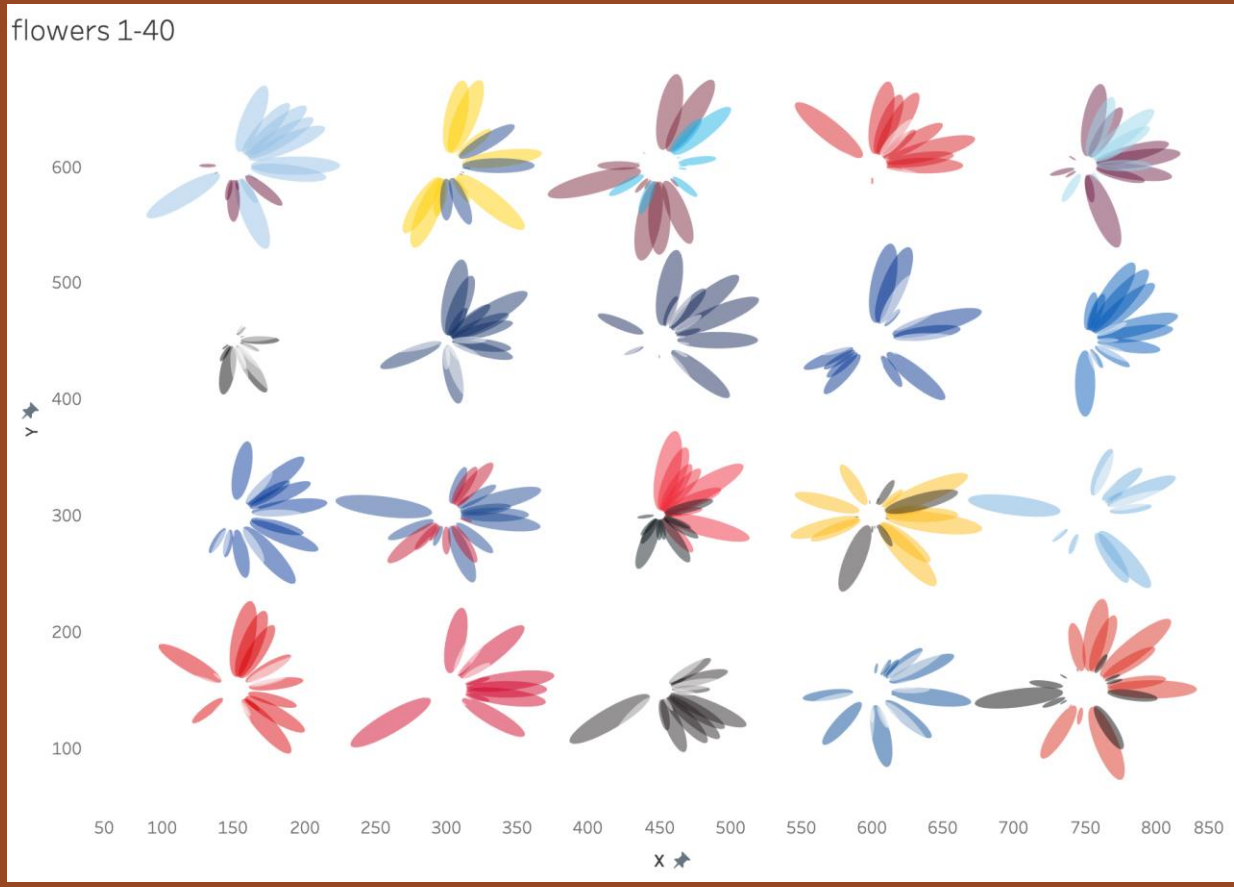
```
[X Petal Start] +
([X petal rotated]*3*[Matches Played])
```

Y — Sheet2 (premier league lineups)

```
[Y Petal Start ] +
([Y petal rotated]*3*[Matches Played])
```

Worksheet

- **Fix your axes!**
- Squares:
  - Use **exact** ratio of rows/cols
  - Example (before stalks):
    - X 50 – 850 (800 wide)
    - Y 50 – 690 (640 tall)
    - Ratio 5:4
- Other shapes:
  - Multiply ratio above by width/height ratio of shape …



Summary

- Question your basic principles
  - Which do you need to apply, and which could you bend/break?
  - Which are more complex than they might seem?

- Think about questions you might not have thought of before
  - Does it suggest a technique you haven’t used?
  - Do it make you consider things differently / widen your scope

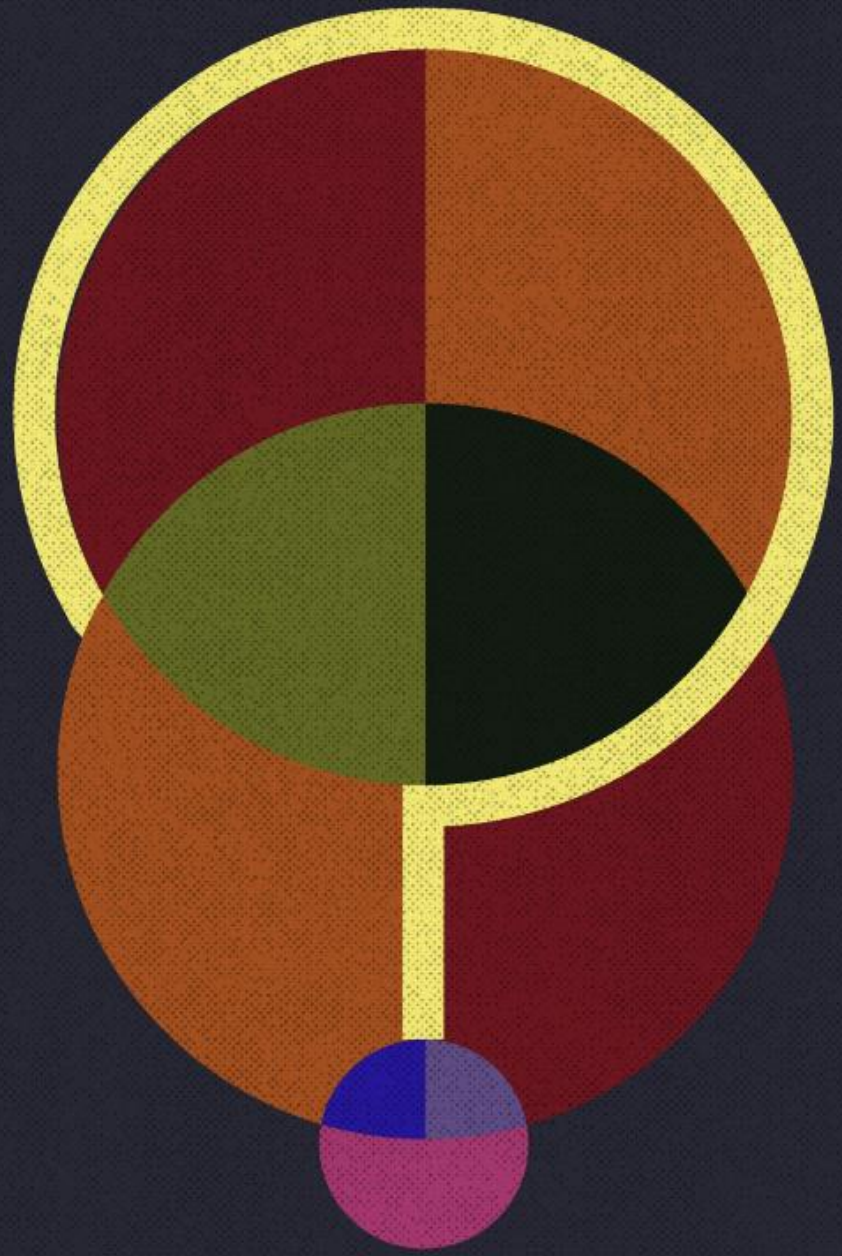
- Think of a brand new idea in data visualisation
  - What are the pros and cons of this idea?
  - Will you enjoy the process and flex your creative muscle?
  - Will it suit an audience disposed to creative/artistic output?

- Tableau is your blank canvas … of graph paper.
  - Questions lead to ideas, improving creativity and skills, increasing fun

QUESTIONS IN DATAVIZ

NEIL RICHARDS

ANY QUESTIONS?



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