

Welcome!

Data Visualisation

DataVis 2020

<http://datavis2020.github.io>

Dr. Benjamin Bach



THE UNIVERSITY
of EDINBURGH

Composition

- Design Informatics?
 - Informatics?
 - Humanities?
 - Design / graphics background?
-
- Who has done a visualization course before?
 - Who has used data visualizations?
 - Who has created data visualizations?

Human Research

Visual Perception

Evaluation

Visualization Representations

Data → Visualization → Information → Action

Interaction

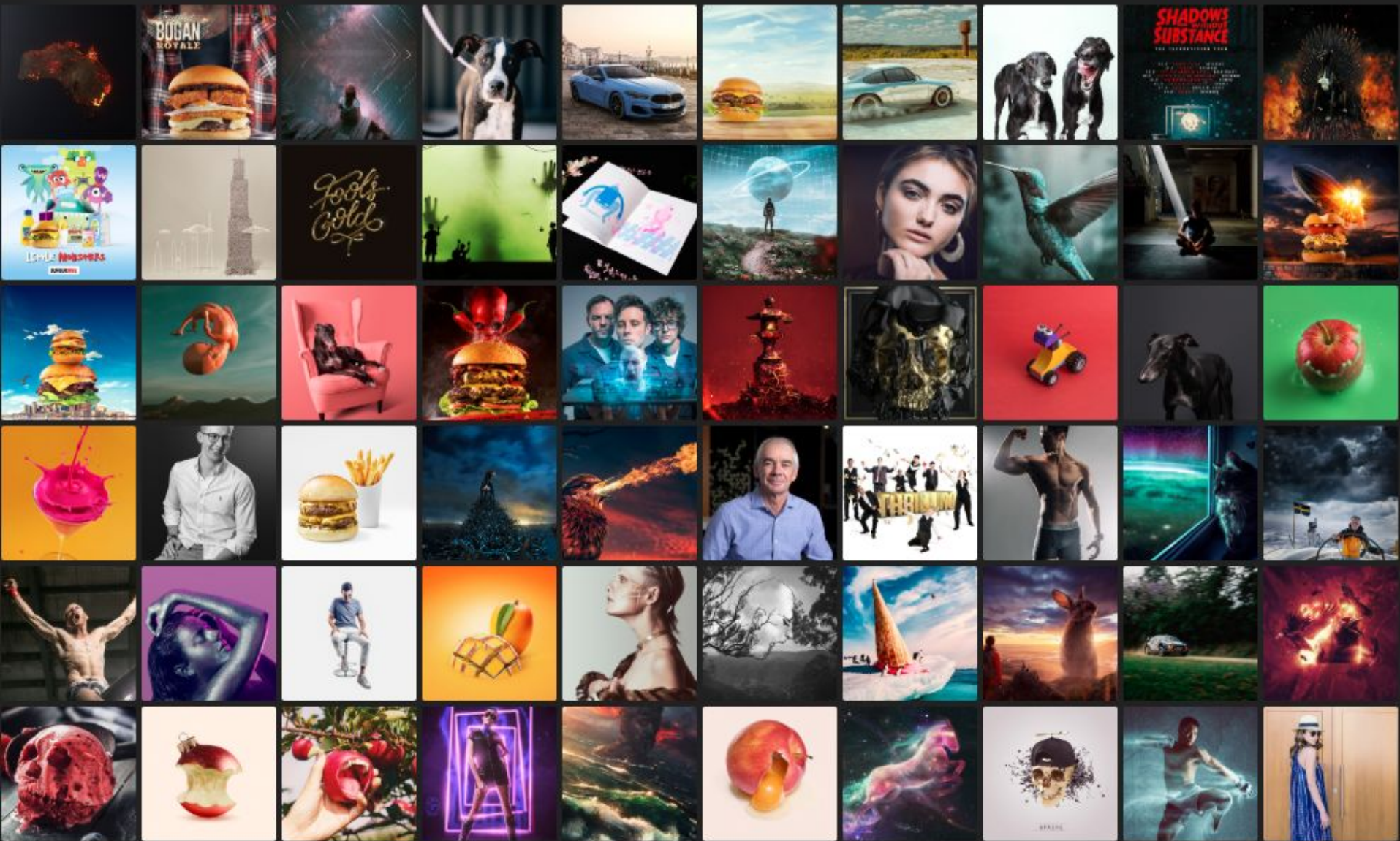
Visualization Literacy

Visual Design

Sketching

Deception



[PROJECTS](#)[JOURNAL](#)[SHOP](#)[ABOUT](#)[CONTACT](#)

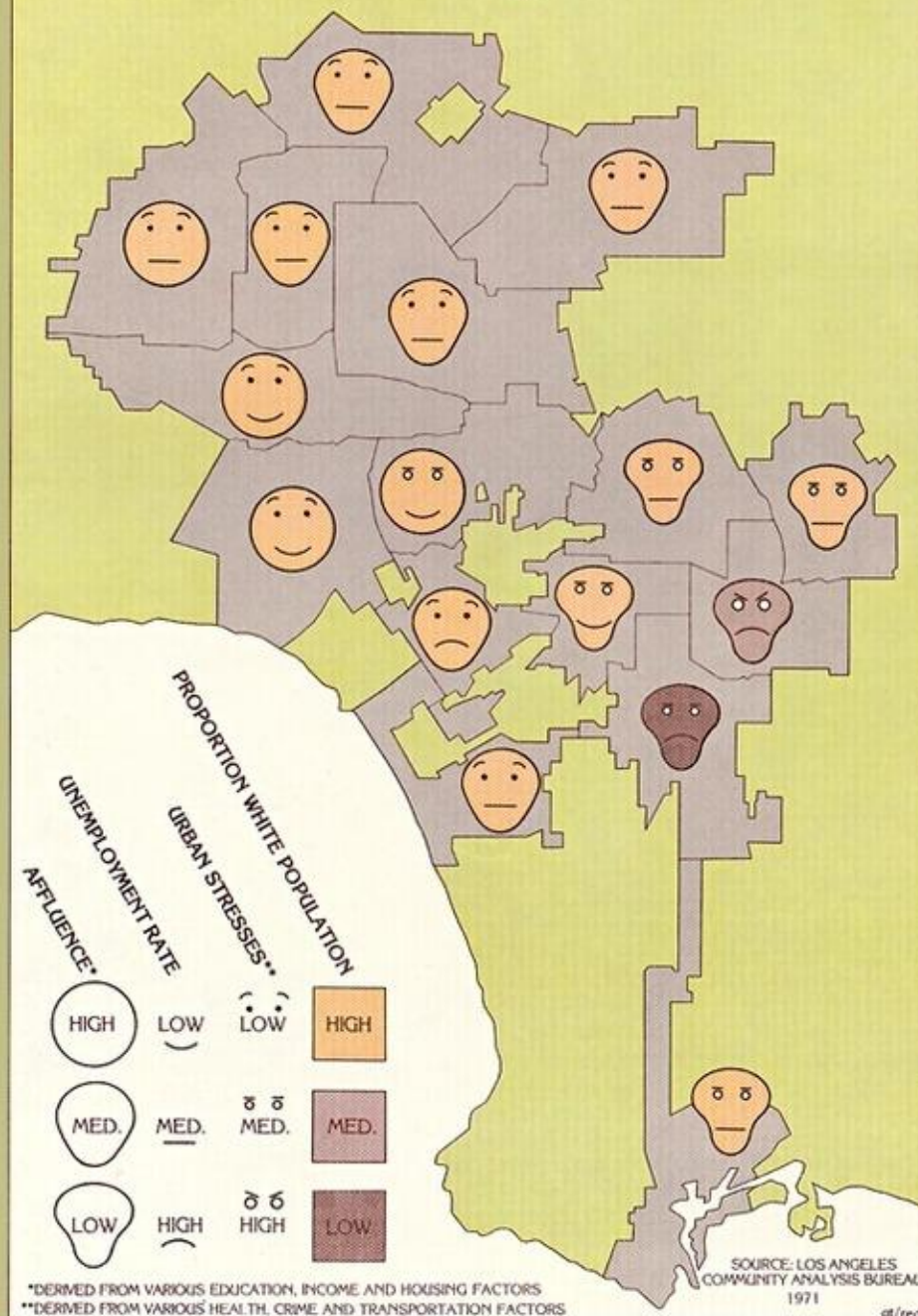
Data

- Geography
- Temporality
- Size
- Causes
- Duration
- Severity
- Urgency
-

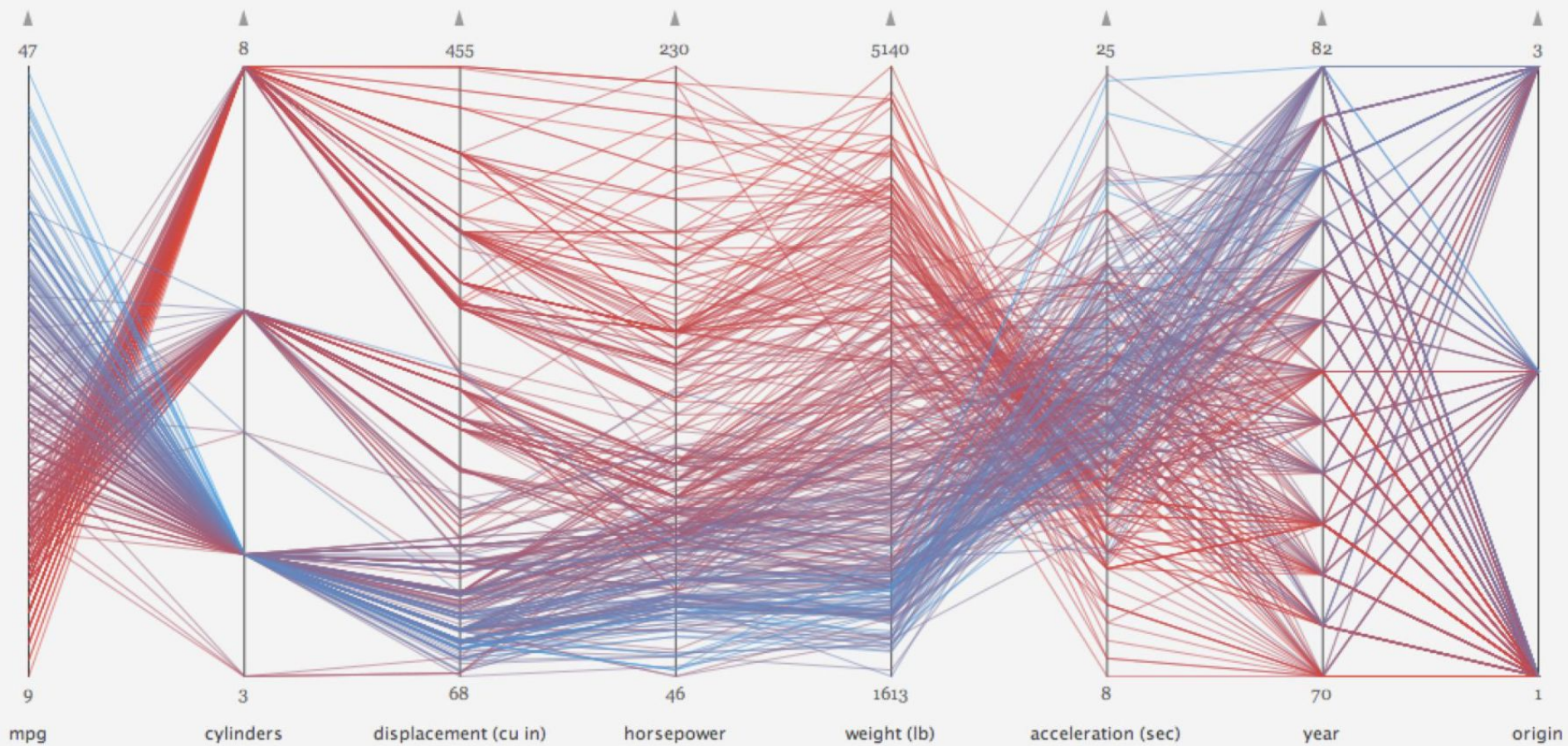


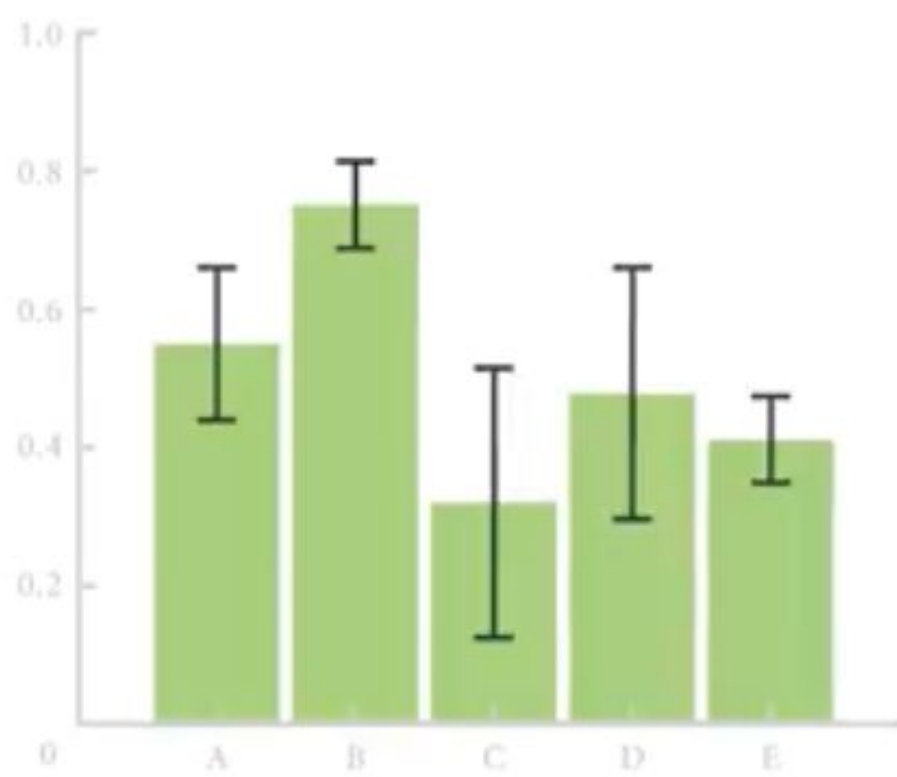
How to visualize **complexity**?

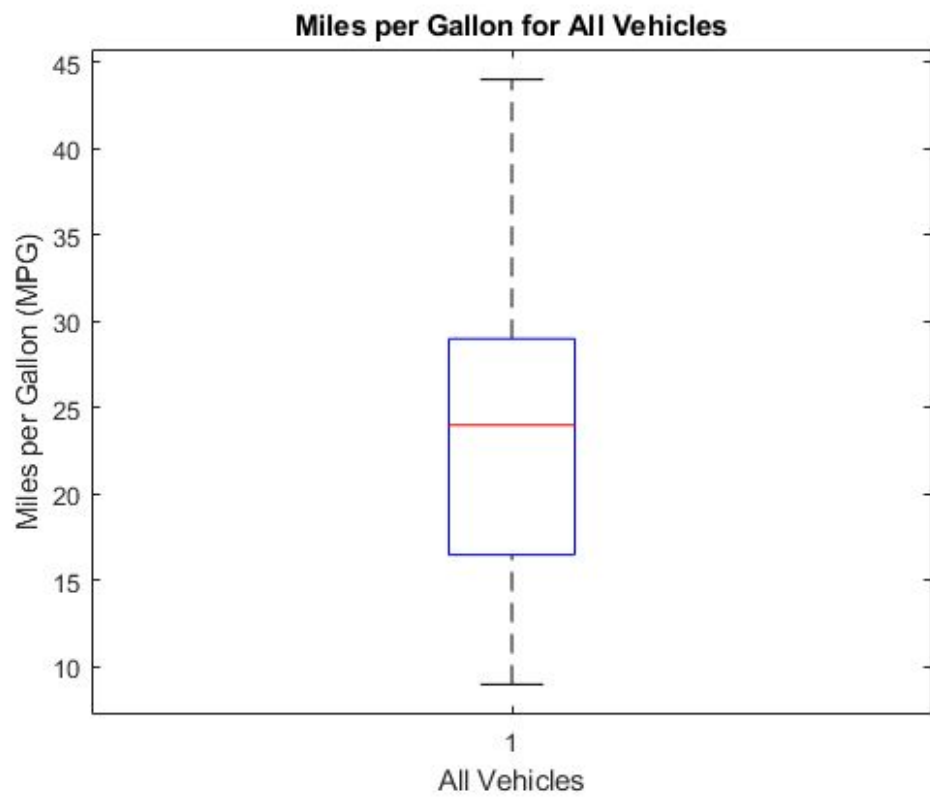
Life in Los Angeles



*DERIVED FROM VARIOUS EDUCATION, INCOME AND HOUSING FACTORS
 **DERIVED FROM VARIOUS HEALTH, CRIME AND TRANSPORTATION FACTORS









Home

Download all (PDF+PNG), 76MB

Download guidelines (PDF), 8MB

Paper

Cheat Sheets for Data Visualization

Techniques: Zezhong Wang, Lovisa Sundin, Dave Murray-Rust, Benjamin Bach, *ACM Conference on Human Factors in Computing Systems (CHI), 2020*

By Type

Anatomy | Introduction | Construction
Visual Pattern | Pitfalls
Well-known Relative | False Friends

By Visualization



Boxplots



Confluence Graphs



Adjacency Matrix



Parallel Coordinates



Time Curve

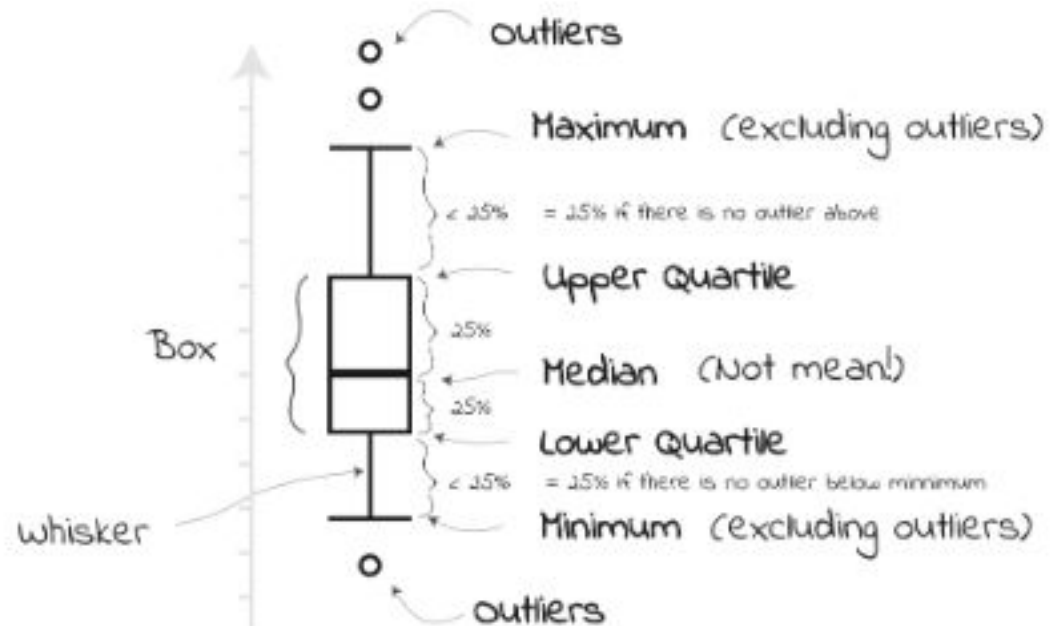


Treemap



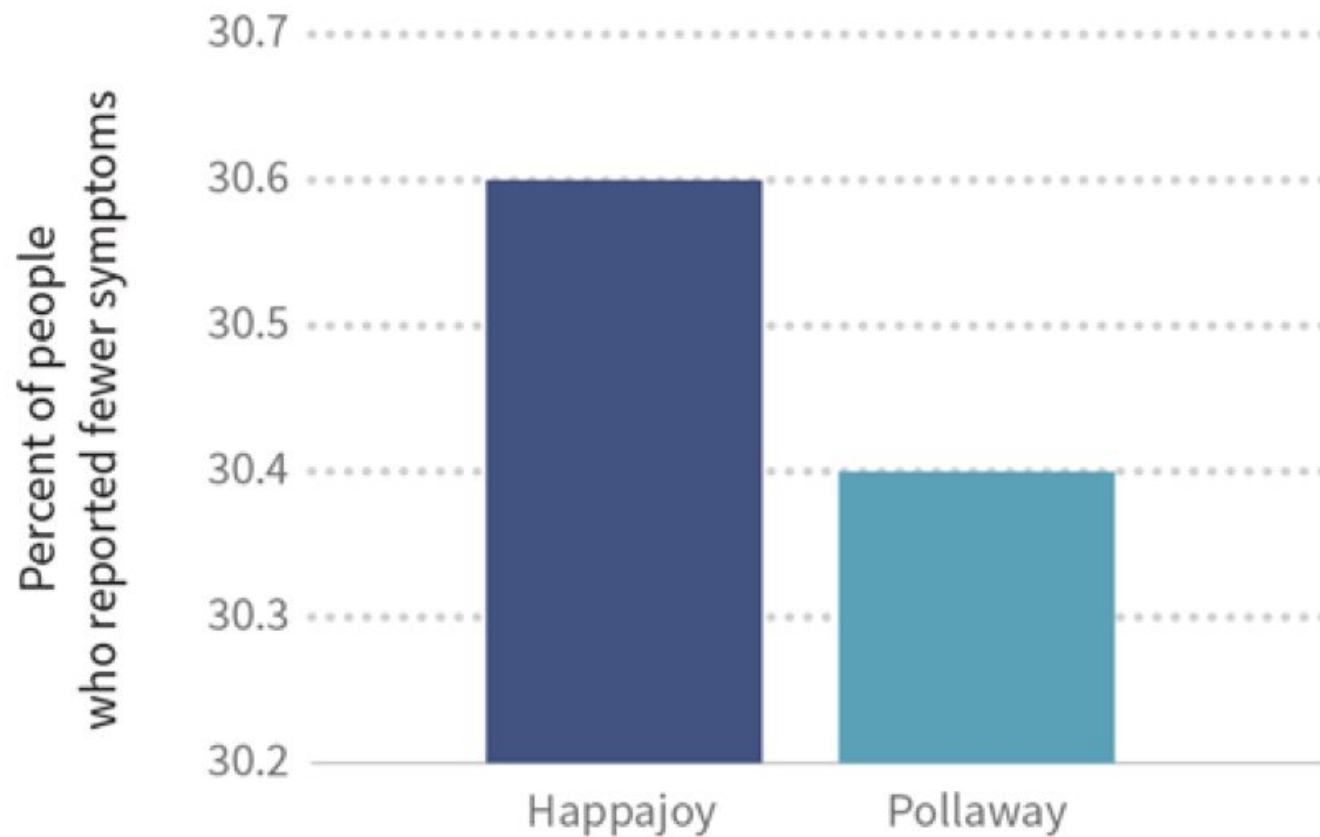
Boxplot

Anatomy



<https://visualizationcheatsheets.github.io>

Effectiveness of Allergy Medicines

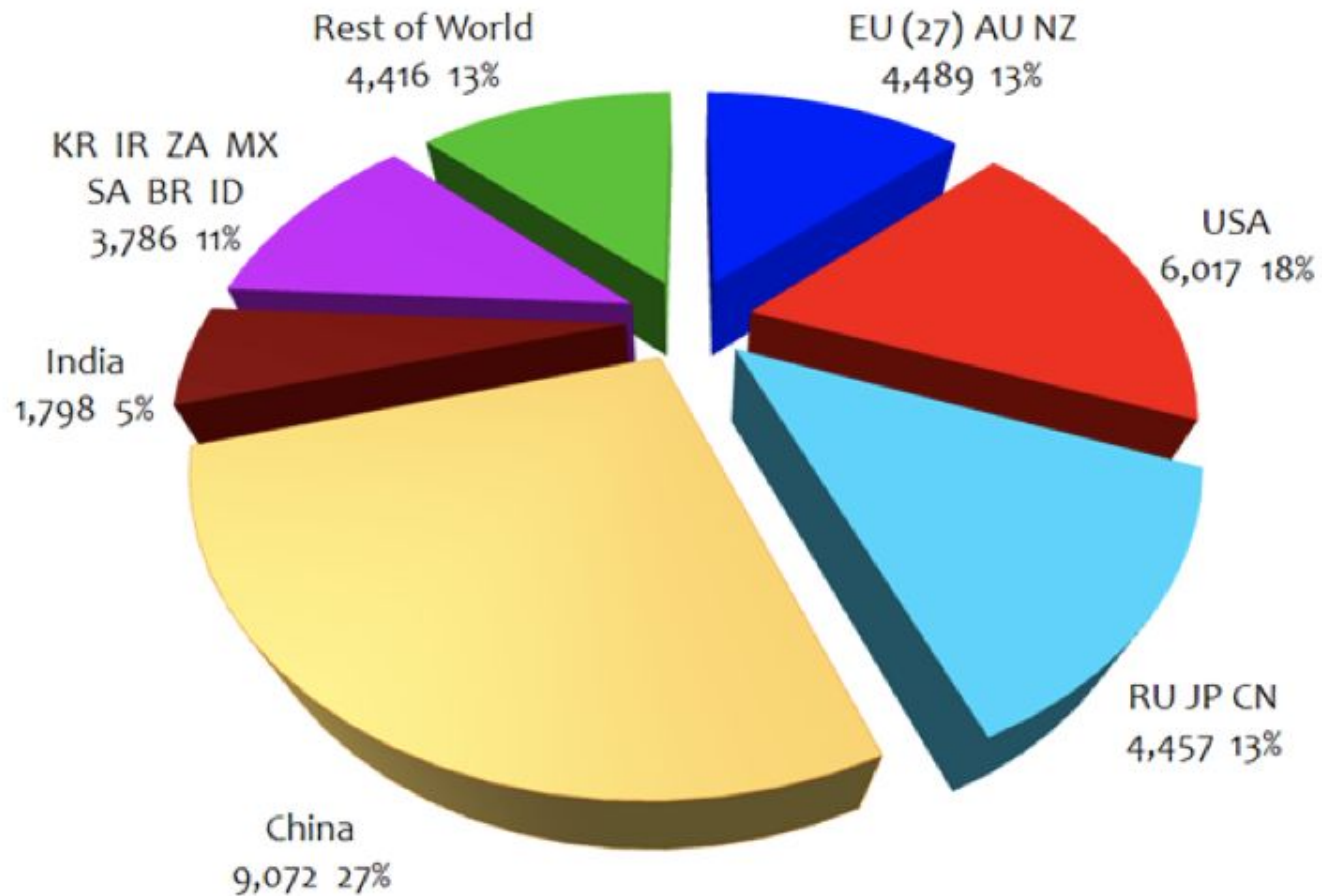


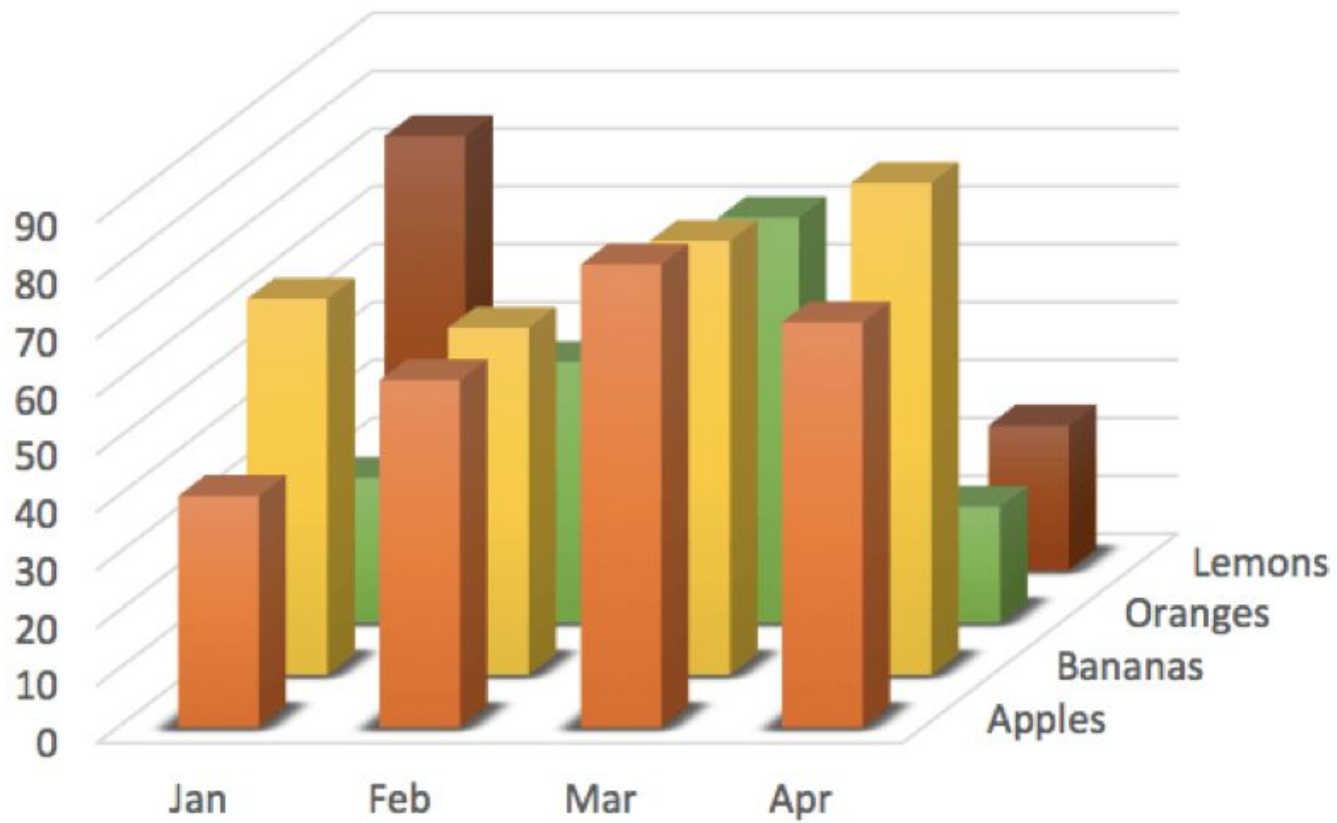
AFFORDABLE CARE ACT ENROLLMENT



IE IN SECOND PLACE WITH \$26.5 MIL, WHILE "MUPP DOW FUT 16,325.00

CO2 emissions 2011: '000,000 tonnes





COLUMBIA THREADNEEDLE RANKINGS AFTER WORLD TRIATHLON LONDON (RACE 6 OF 10)

1	GWEN JORGENSEN	USA	4000
2	KATIE ZAFERES	USA	3645
3	ANDREA HEWITT	NZL	2910
4	SARAH TRUE	USA	2632
5	BARBARA RIVEROS	CHI	2100

1	JAVIER GOMEZ NOYA	ESP	3507
2	MARIO MOLA	ESP	2979
3	FERNANDO ALARZA	ESP	2961
4	RICHARD MURRAY	RSA	2490
5	ALISTAIR BROWNLEE	GBR	2340



MIXED RELAY WORLD CHAMPIONSHIP MEDALLISTS



386,250km

THE TOTAL DISTANCE EXPECTED TO BE COVERED BY ATHLETES TAKING PART AT THE WORLD TRIATHLON HAMBURG. EQUIVALENT DISTANCE FROM EARTH TO THE MOON



€15 MILLION

ESTIMATED VALUE OF BIKES IN THE WORLD TRIATHLON HAMBURG TRANSITION AREA

10,000

AGE-GROUP ATHLETES HAVE SIGNED UP TO RACE THE OLYMPIC AND SPRINT DISTANCE EVENTS OVER THE WORLD TRIATHLON HAMBURG WEEKEND



FOOD/DRINK CONSUMED 9,200 BANANAS, 6,700 ORANGES, 8,000 ENERGY BARS, 8,250 LITRES OF ENERGY DRINK, 10,000 LITRES OF WATER, 2,900 PIECES OF CAKE

@CTInvest_tri #CT_Rankings

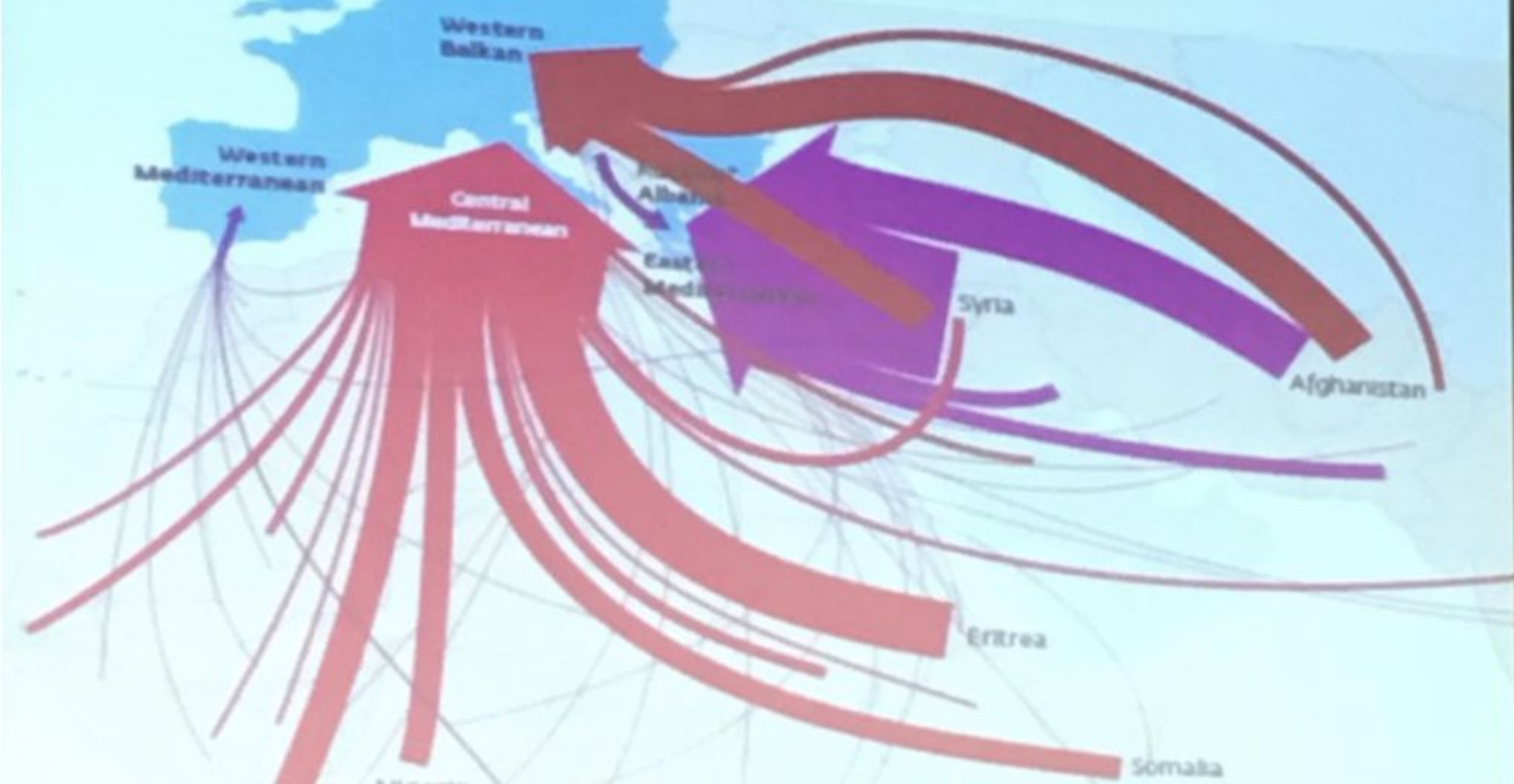
COLUMBIA THREADNEEDLE RANKINGS 2015 WORLD TRIATHLON HAMBURG PREVIEW



Nationalities

"Risk analysis" Frontex, 2015

Main nationalities
of illegal border-crossers, April-June 2015





Visualization Literacy

Literacies

Literacy: the ability to read and write.

Numeracy: ability to understand and work with numbers.

Information Literacy: abilities [...] to recognize when information is needed [,] to locate, evaluate, and use effectively the needed information.

Statistical Literacy: [ability] to count or measure, [...] assemble [...] measurements into summary statistics, [compare] statistics and [...] communicate.

Literacies

Visual literacy: ability to read, evaluate, use, and create images

Graphicacy: ability to understand and present information in the form of sketches, photographs, diagrams, maps, plans, charts, graphs and other non-textual, two-dimensional formats

Data Literacy: understand a wide variety of tools for accessing, converting and manipulating data.

Visualization Literacy

- 1) the ability to **confidently use** a given data visualization,
- 2) to translate questions specified in the data domain into **visual queries** in the visual domain,
- 3) **interpreting visual patterns** in the visual domain as properties in the data domain

This course

Learning goals

Analysis: identify + describe a visualization challenge

Design: Create + implement a visualizations

Read: understand and interpret visualizations

Evaluation: Show a visualization works

Questions

What is visualization?

What is **good** visualization?

Why to visualize?

How to visualize?

Which visualizations exist?

Which **tools**?

How to create **new** visualizations?

Activities

See

Discuss

Sketch (+ re-sketch!)

Criticize

Evaluate

Explain

...

Theory ↔ Practise

- Visual perception
- Design principles
- Visual variables
- Data structures
- Task taxonomies
- Visualization tax.
- Presentation
- Tools
- ...

- Understanding problems
- Communicating problems
- Sketching ideas
- Creating visuals
- Seeing
- Storytelling
- ...

Assignment 1: Individual

- two different visualizations
- describe three faults and why they are problematic.
- propose (sketch) one or two visualizations that solve the identified faults.
- For each solution you find, argue with a more general visualization guideline.

Weight: **50%**

Hand-in: **Feb 15**

Assignment 2: Group

"Create visualization to help people understand issues related to climate change."

› You chose data and challenge

- 1) **Challenge description:** data, context, audience...
- 2) **Design Exploration:** designs and explorations
- 3) **Final Design:**

Are We in the Midst Of a Sixth Mass Extinction?

A Tally of Life Under Threat

The International Union for Conservation of Nature has evaluated 52,205 species, depicted here, for their ability to survive. [Related Article »](#)

Each symbol represents 100 species assessed:



Stark Indicators Of Extinction Risks

Because most known species of birds, mammals and amphibians have been evaluated, scientists are confident about the percentage of each group that is threatened.

Other Threatened Life: The Tip of a Vast Unknown

Only fractions of known species in these nine groups have been evaluated. Because assessments have focused on species likely to be in danger, the proportion of each group that is threatened may be overstated.

Meanwhile, the number of **unknown species** may be in the millions, or tens of millions — many times that of what has been discovered.

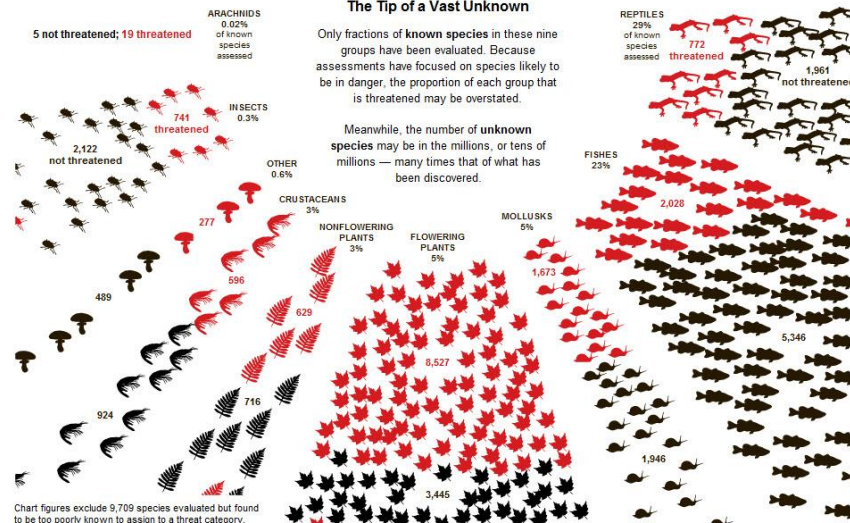


Chart figures exclude 9,709 species evaluated but found to be too poorly known to assign to a threat category.

Already Gone

Species known to be extinct, or extinct in the wild, since 1500:

Mollusks	Birds	Flowering plants	Mammals	Fishes	Insects	Amphibians	Reptiles	Crustaceans	Nonflowering plants	Others	No known arachnid extinctions.
327	136	110	79	68	60	39	22	12	10	2	

GUYS LET'S JUST HAVE A CHAT ABOUT MASS EXTINCTIONS.

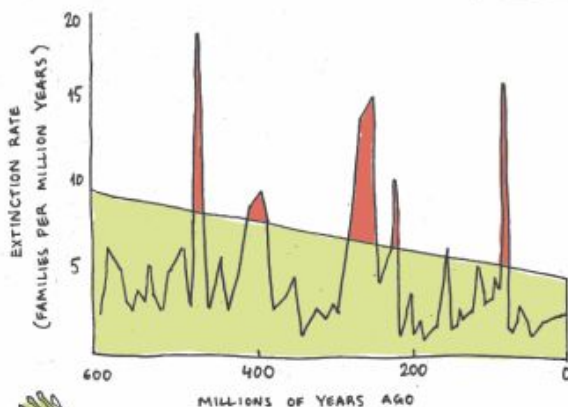
THERE'S GONNA BE A LOT OF GRAPHS AND TEXT AND SHIT SO JUST BE PREPARED TO FEEL LIKE THIS.

SERIOUSLY IF YOU DON'T NEED THIS IN YOUR LIFE YOU CAN SKIP TO PAGE 3.

LET'S START WITH A HISTORY LESSON.

HERE COMES THE FIRST GRAPH.

Source: University of California Museum of Paleontology's Understanding Evolution (<http://evolution.berkeley.edu>)



IT'S A BIT HARD TO READ BUT I'M GONNA TRY AND BREAK IT DOWN TO YOU. IT'S ABOUT MASS EXTINCTIONS IN THE PAST 600 MILLION YEARS.

THE Y-AXIS SHOWS THE AMOUNT OF DEATH BASICALLY.

THE X-AXIS IS THE TIMELINE.

WE'RE TALKING LONG TIME PERIODS. 600 000 000 - 0 YEARS AGO.

THE GREEN AREA IS BACKGROUND EXTINCTION. IT'S THE RATE AT WHICH SPECIES DIE OFF NORMALLY, LIKE IT'S NO BIG DEAL.

THIS IS FINE.

DON'T WORRY

THE BIG DEALS ARE THE SPIKES. I'VE MADE THEM RED SO YOU CAN FIND THEM MORE EASILY. THOSE ARE THE MASS EXTINCTION EVENTS.

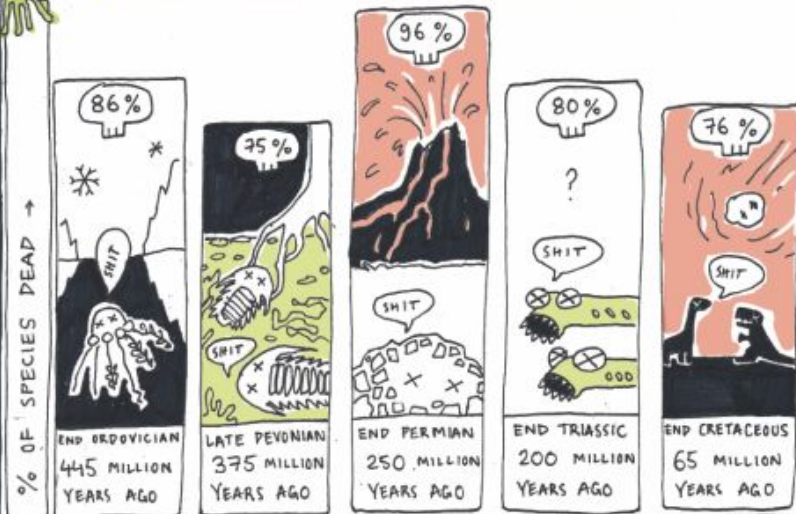
THAT'S WHEN MORE THAN 75% OF ALL SPECIES ON EARTH HAVE DIED OFF.

SO THAT'S HAPPENED 5 TIMES HERE.



LOOK HERE'S MY ATTEMPT TO VISUALISE THE BIG EXTINCTION EVENTS. YES I MADE IT MYSELF. AND I'M A FROG.

THERE ARE NUMBERS HERE THAT AREN'T FROM THE PREVIOUS GRAPH. DON'T FREAK OUT. I USED A DIFFERENT SOURCE: Viviane Richier: "The Big Five Mass Extinctions" <https://cosmosmagazine.com/paleontology/big-five-extinctions> ESSENTIALLY IT'S THE SAME THING THOUGH.



IT'S A DATA COMIC INSIDE A DATA COMIC! HAHAHA

I'M VERY EXCITED ABOUT DATA COMICS

ANYWAY

IMAGINE IF THIS PORTION



OF LIFE ON EARTH JUST DIED OFF.

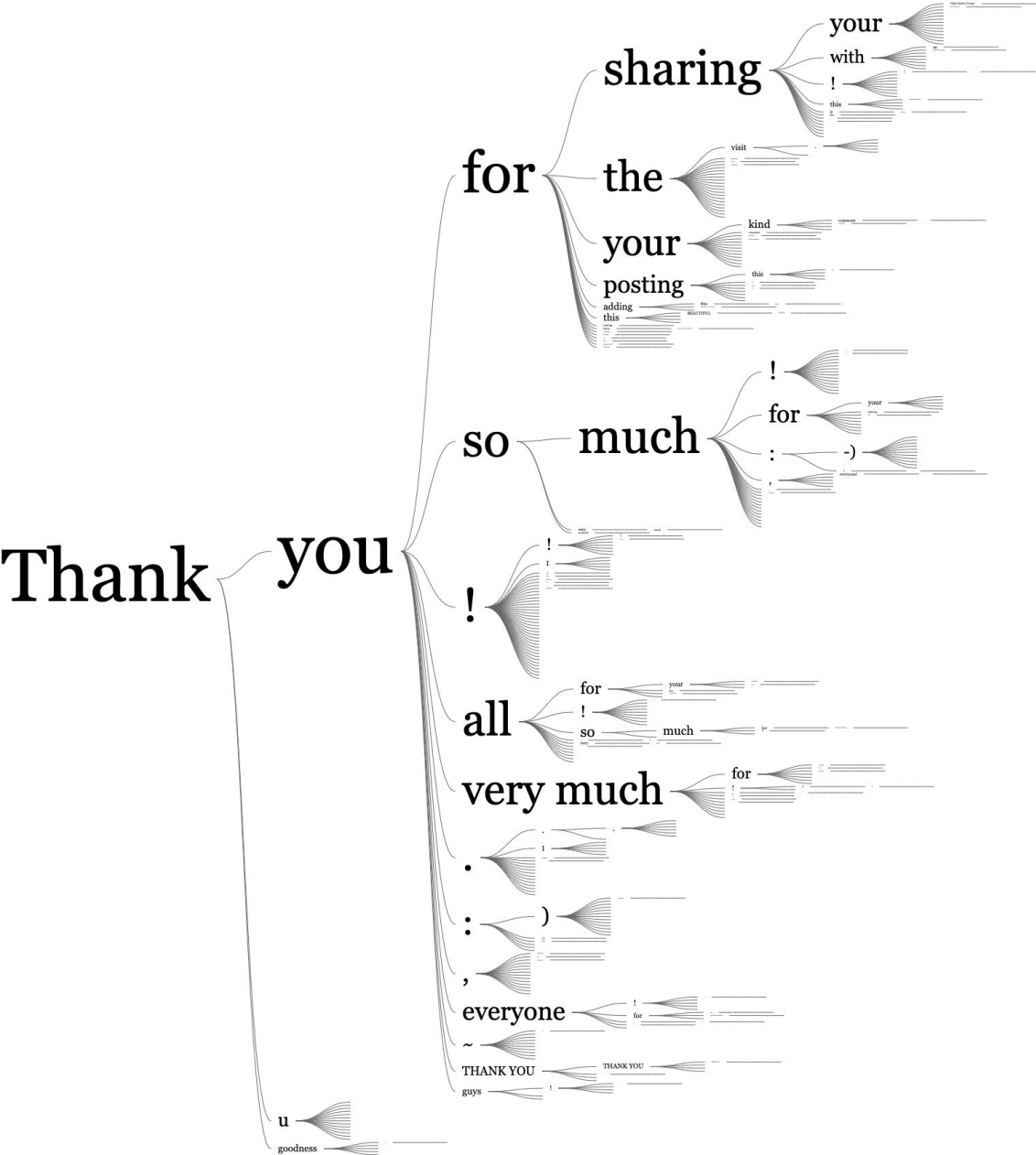
THAT'S BAD, RIGHT???

WELL, A LOT OF SCIENTISTS SAY THAT WE'RE NOW ENTERING THE 6TH MASS EXTINCTION.

SEE THAT OMINOUS PANEL THERE? THAT'S WHERE WE ARE.

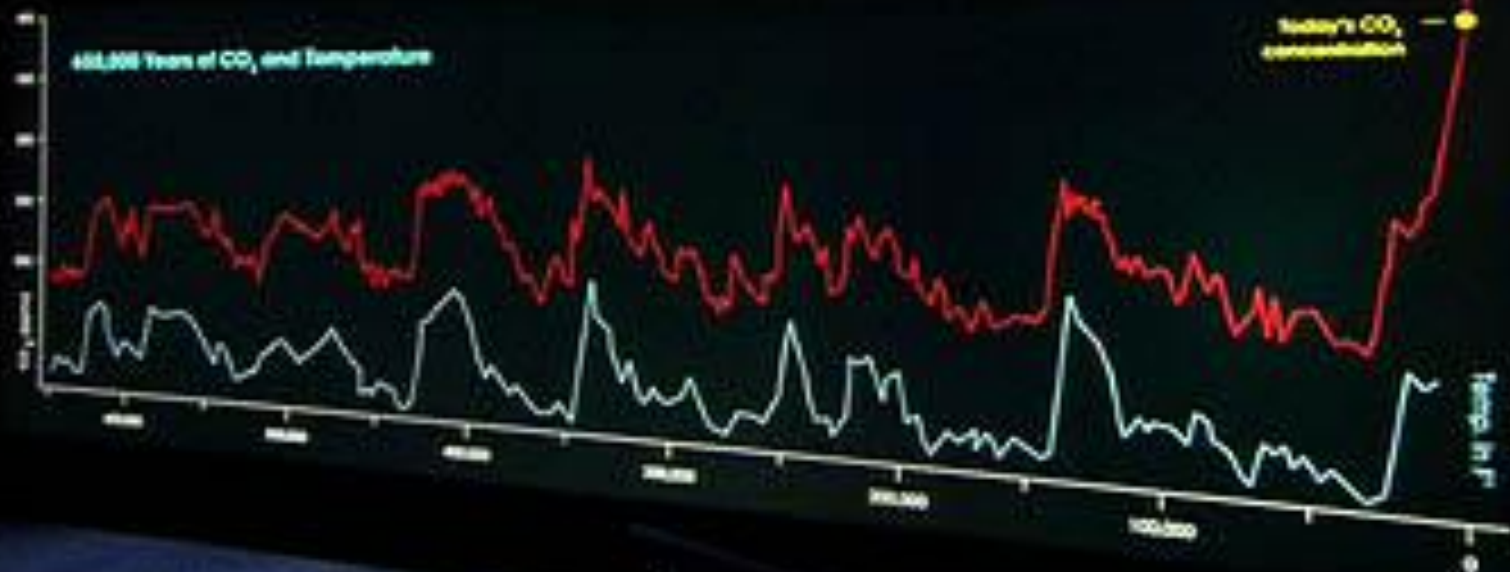
AND GUESS WHAT'S CAUSING IT THIS TIME? (TURN THE PAGE TO FIND OUT)

Shift-click to make that word the root.



Challenge!

How to understand
climate change?

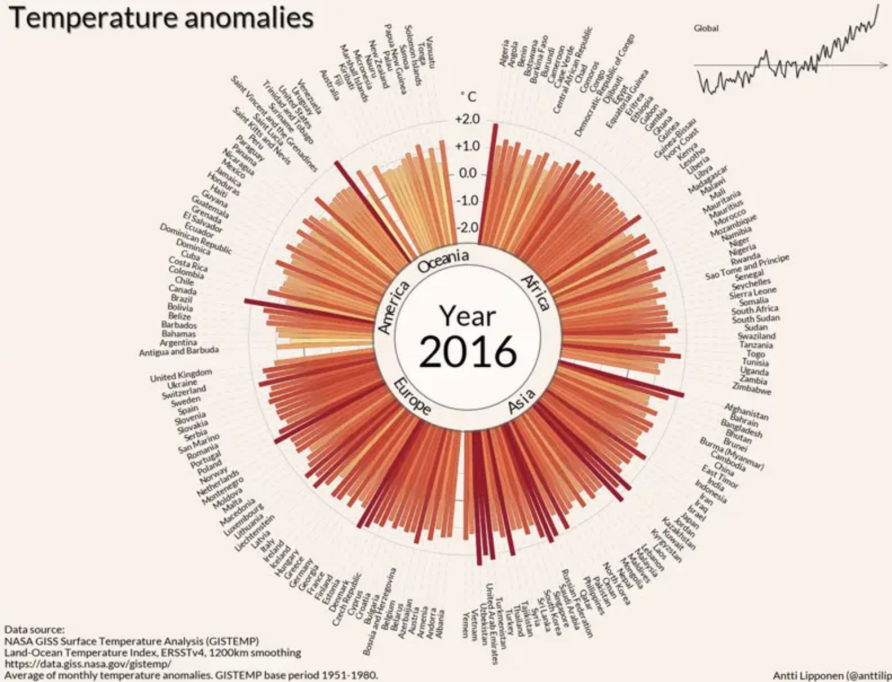


Pre-Industrial
Industrial
Modern
Future

Data

- Collect yourself
 - Gather from the internet
 - Obtain from agency..
-
- Waste / weather / climate
 - Deforestation
 - News events
 - Personal usage
 - Positive action

Temperature anomalies

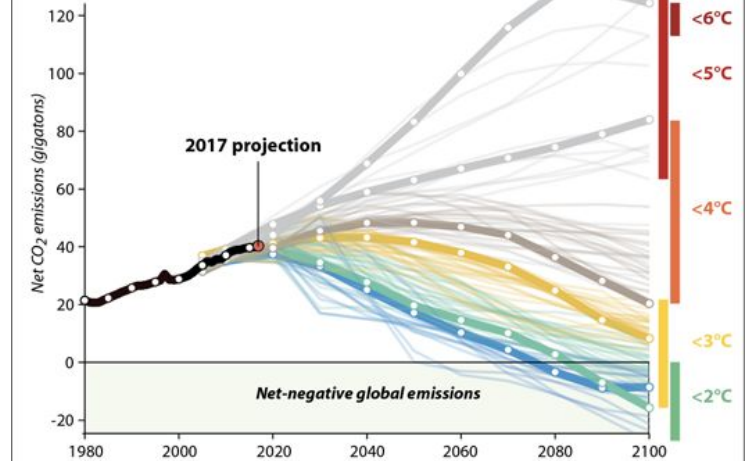


CO₂ Emissions Are Still Rising

Human-caused greenhouse gas emissions had appeared to be leveling off, but new research shows 2017 is headed for a new high. The future projections show how emissions levels translate to temperature rise.

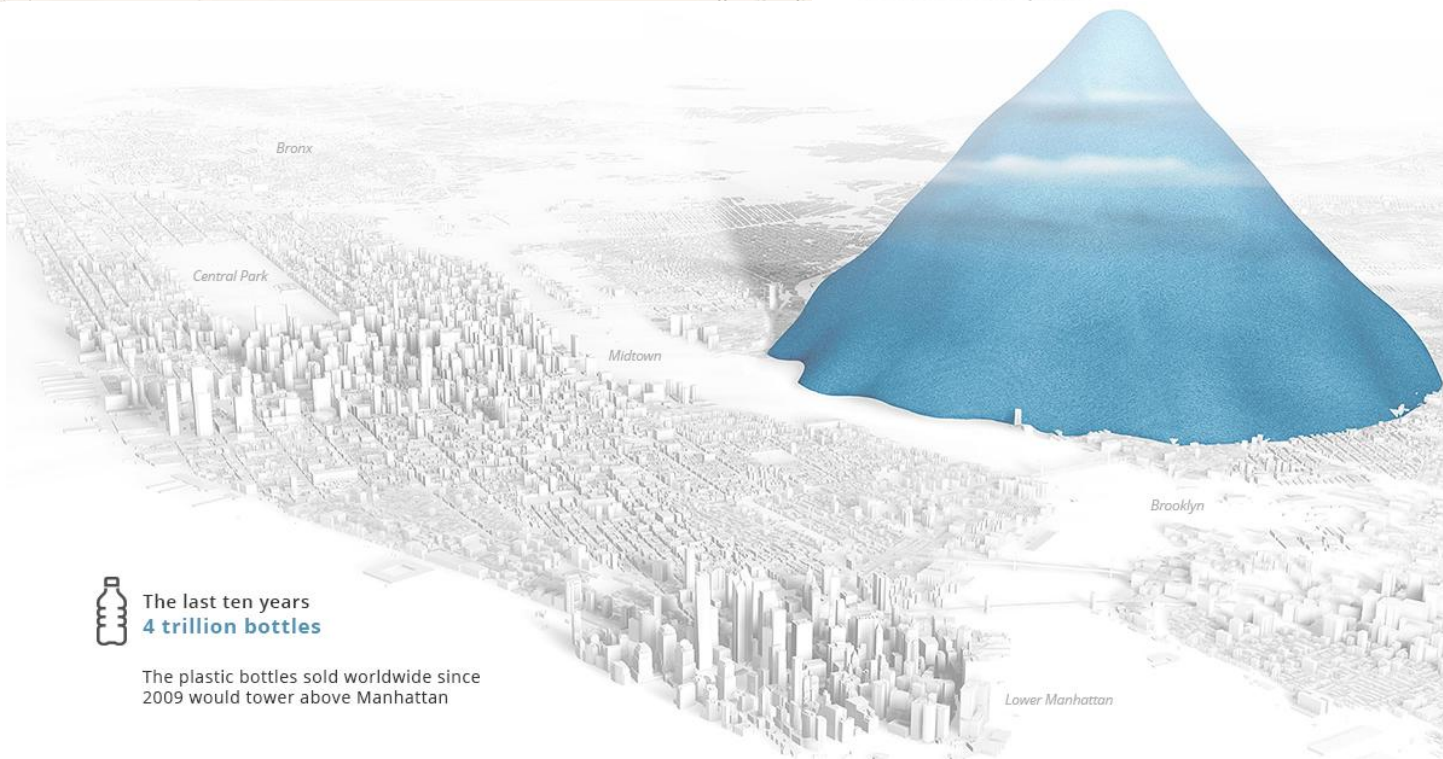
FOSSIL FUEL AND LAND-USE CO₂ EMISSIONS

In gigatons, with corresponding temperature rise, projected to 2100



SOURCE: Global Carbon Project 2017

InsideClimate News



Schedule

Day	Session	Lectures	Tutorials (2h) 5x	Assignments
13/01/20	1	Foundations I: Introduction to Data Visualization		
20/01/20	2	Foundations II: Visualization Design	T1: Critique + redesign	
27/01/20	3	Foundations III: Tools for data visualization		
03/02/20	4	Techniques I: Visualizing Statistical and Multivariate	T2: challenge + sketching	
10/02/20	5	Techniques II: Trees, Networks, and Sets		#A1: Individual assignment
17/02/20		Week of creative learning		
24/02/20	6	Techniques III: Geographic and Temporal	T3: guidelines	
02/03/20	7	Advanced I: Storytelling and Communication		
09/03/20	8	Advanced II: Evaluation	T4: atelier -1	
16/03/20	9	<i>guest lecture</i>		
23/03/20	10	Topic lecture	T5: atelier - 2	
30/03/20	11	PRESENTATIONS		#A2: Group assignment

	9:00	10:00	11:10	12:10	13:10	14:10	15:10	16:10
Monday		<div> <div>Data Visualisation</div> <div>LECTURE DATA VISUALISATION ></div> <div>Sem2 Week 1 - Sem2 Week 5, Sem2 Week 6 - Vac2 Week 1</div> <div>S.1, 7 George Square, Central</div> <div>1 2 3 4 5 6 7 8 9 10 11</div> </div>			<div> <div>Data Visualisation</div> <div>OPT A1</div> <div>TUTORIAL DATA VISUALISATION - TUTORIAL/01 ></div> <div>Sem2 Week 2, Sem2 Week 4, Sem2 Week 6, Sem2 Week 8, Sem2 Week 10</div> <div>3.01 - Robotics Lab, Appleton Tower, Central</div> <div>1 2 3 4 5 6 7 8 9 10 11</div> </div>			
Tuesday			<div> <div>Data Visualisation</div> <div>OPT B1</div> <div>WORKSHOP DATA VISUALISATION - COMPUTER LAB/01 ></div> <div>Sem2 Week 2 - Sem2 Week 5, Sem2 Week 6 - Sem2 Week 11</div> <div>3.09 - Workroom, Appleton Tower, Central</div> <div>1 2 3 4 5 6 7 8 9 10 11</div> </div>					
Wednesday								
Thursday		<div> <div>Data Visualisation</div> <div>OPT B2</div> </div>						
Friday	<div> <div>Data Visualisation</div> <div>OPT A2</div> </div>							

<https://datavis2020.github.io>

Time estimates

Type	h per unit	number	total
Lectures	1.5	11	16.5
tutorials	1.5	5	7.5
Lecture prep	2	11	22
Assignment 1	25	1	25
Assignment 2	25	1	25
		Total:	96

Questions?