

G53FIV: Fundamentals of Information Visualization

Lecture 1: Introduction

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<https://moodle.nottingham.ac.uk/course/view.php?id=68644>

Contact Information

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Overview

- Motivation for the Module
 - Background
 - Examples
- Module Information (both G53FIV and G53IVP)
 - Objective
 - Structure
 - Schedule

Online in 60 Seconds



Information Overload



The Key Challenge

- How to make use of the data
 - How do we avoid being overwhelmed?
 - How do we make sense of the data?
 - How do we harness this data in decision-making processes?



Objective

- Transform the data into information (understanding, insight) thus making it useful



What is Information Visualization?

- Definitions
 - “... finding the artificial memory that best supports our natural means of perception.” [Bertin 1967]
 - “The use of computer-generated, interactive, visual representations of data to amplify cognition.” [Card, Mackinlay, & Shneiderman 1999]

The Best of Both Sides

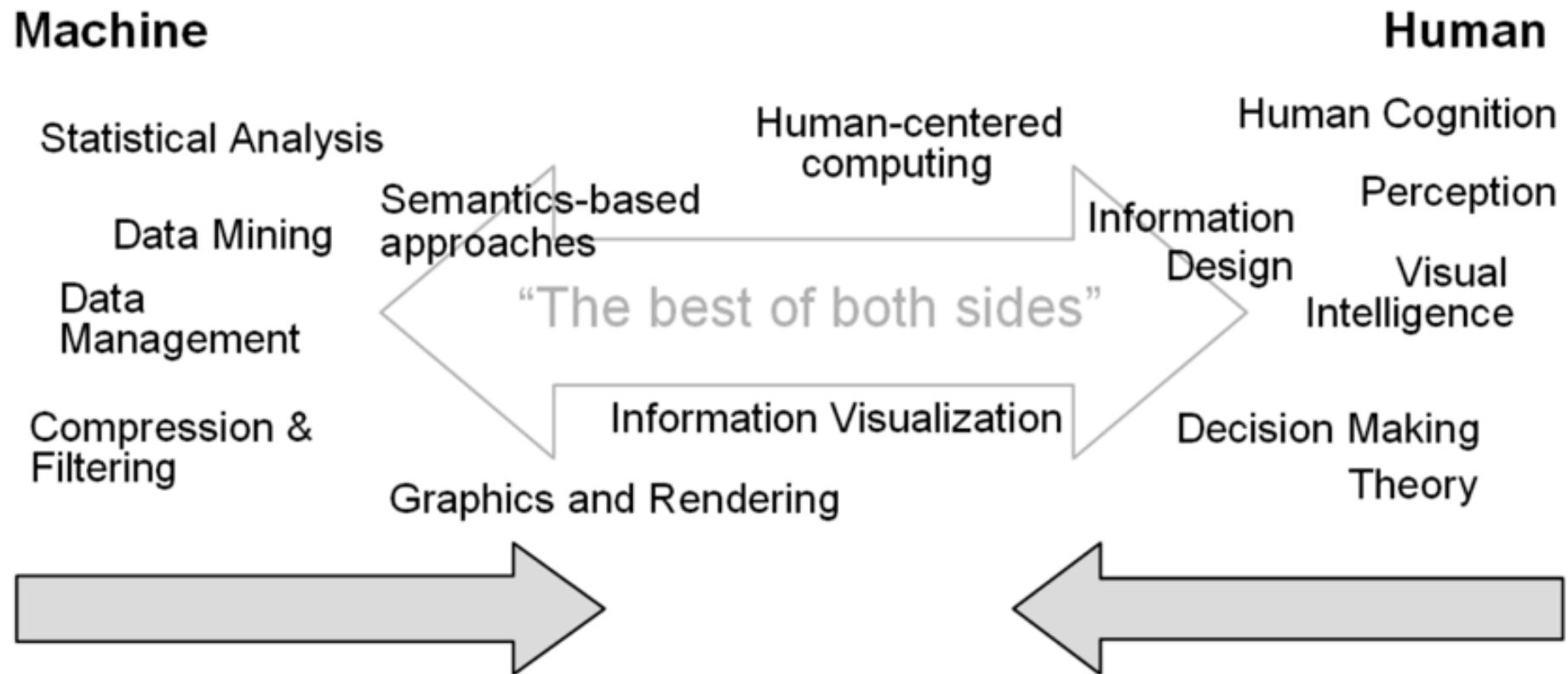


Fig. 2. Visual analytics integrates scientific disciplines to improve the division of labor between human and machine.

Anscombe's Quartet

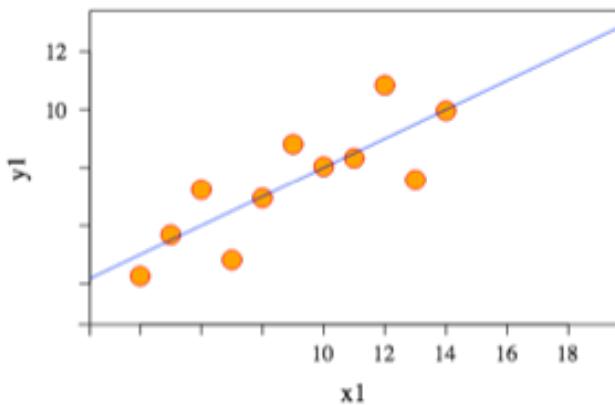
- Four data sets

	Set A		Set B		Set C		Set D	
	X	Y	X	Y	X	Y	X	Y
0	10	8.04	10	9.14	10	7.46	8	6.58
1	8	6.95	8	8.14	8	6.77	8	5.76
2	13	7.58	13	8.74	13	12.74	8	7.71
3	9	8.81	9	8.77	9	7.11	8	8.84
4	11	8.33	11	9.26	11	7.81	8	8.47
5	14	9.96	14	8.10	14	8.84	8	7.04
6	6	7.24	6	6.13	6	6.08	8	5.25
7	4	4.26	4	3.10	4	5.39	19	12.50
8	12	10.84	12	9.13	12	8.15	8	5.56
9	7	4.82	7	7.26	7	6.42	8	7.91
10	5	5.68	5	4.74	5	5.73	8	6.89
mean	9.00	7.50	9.00	7.50	9.00	7.50	9.00	7.50
std	3.32	2.03	3.32	2.03	3.32	2.03	3.32	2.03
corr	0.82		0.82		0.82		0.82	
lin. reg.	$y = 3.00 + 0.500x$		$y = 3.00 + 0.500x$		$y = 3.00 + 0.500x$		$y = 3.00 + 0.500x$	

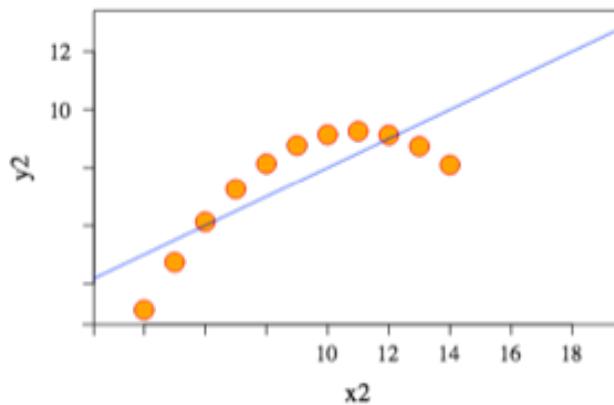
[Anscombe, 1973]

Visualization of Anscombe's Quartet

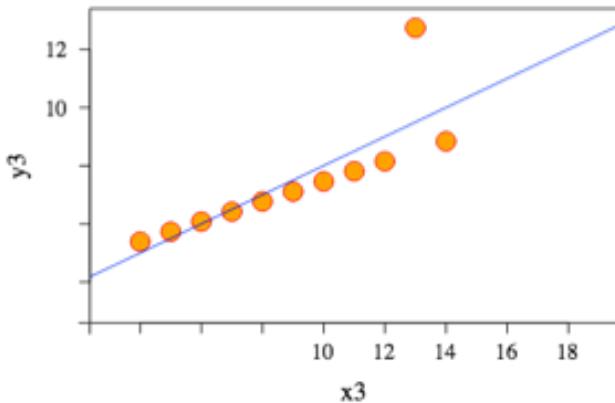
"what most people would see in their mind's eye [for a linear relationship with some unexplained variation]"



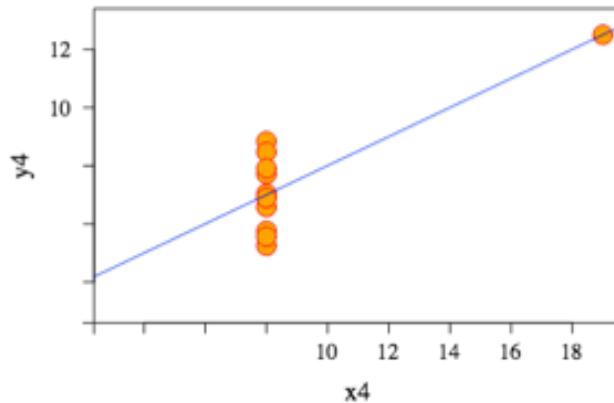
" y has a smooth curved relation with x , possibly quadratic, and there is little residual variability"



"all but one of the observations lie close to a straight line (not the one yielded by the standard regression calculation)"



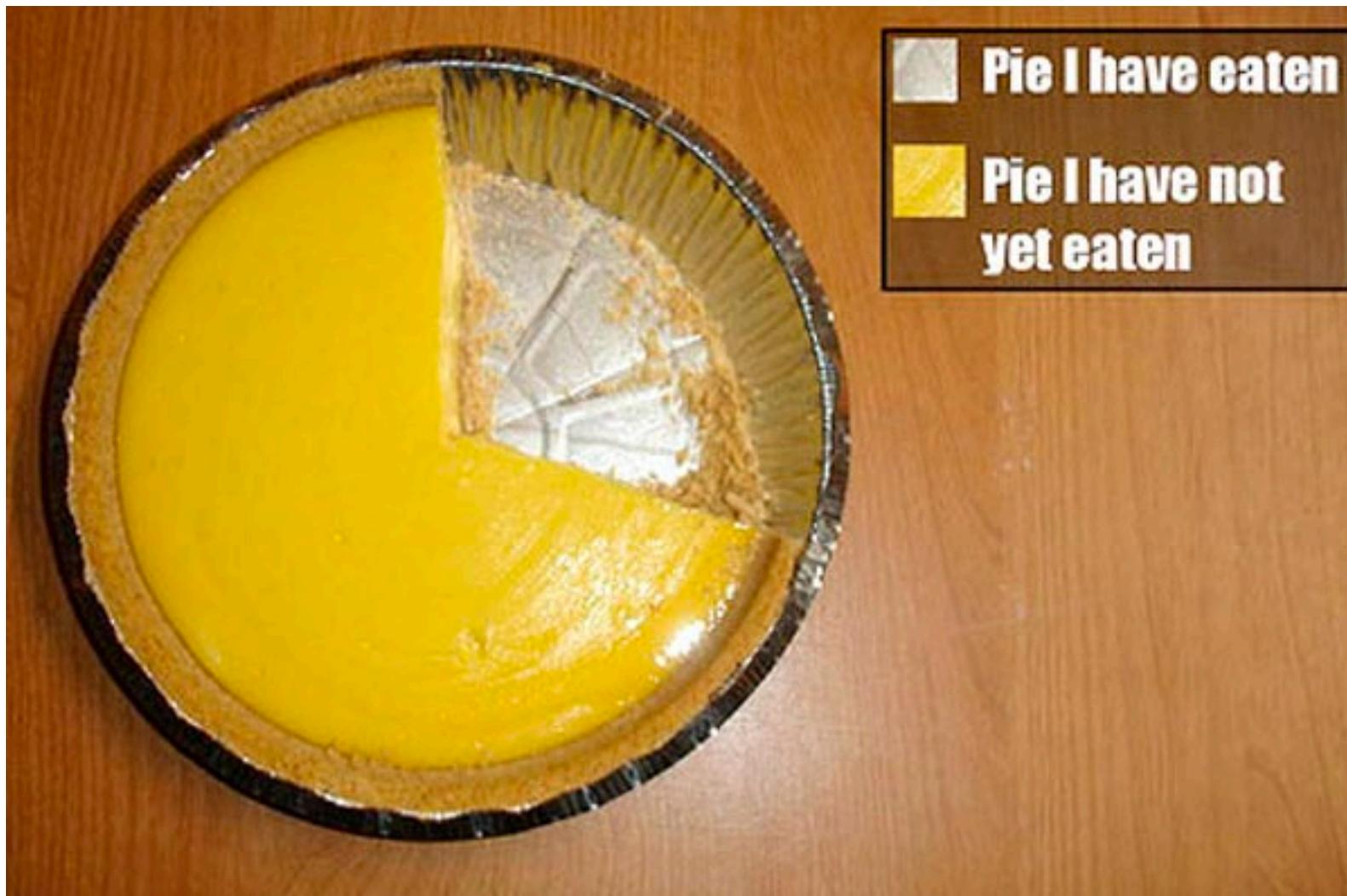
"all the information about the slope of the regression line resides in one observation"



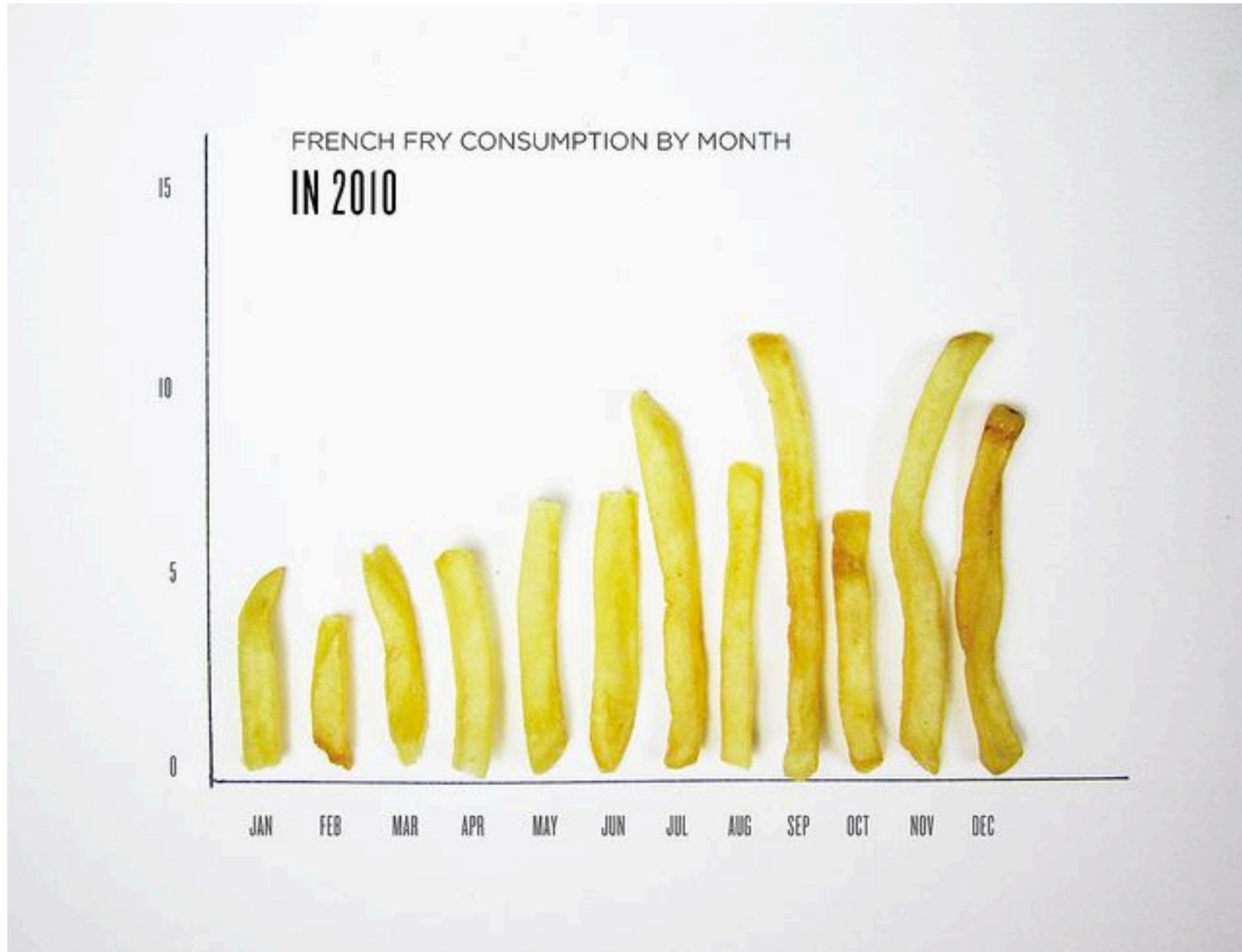
Common Information Visualizations

- What are the common information visualizations that you can think of?

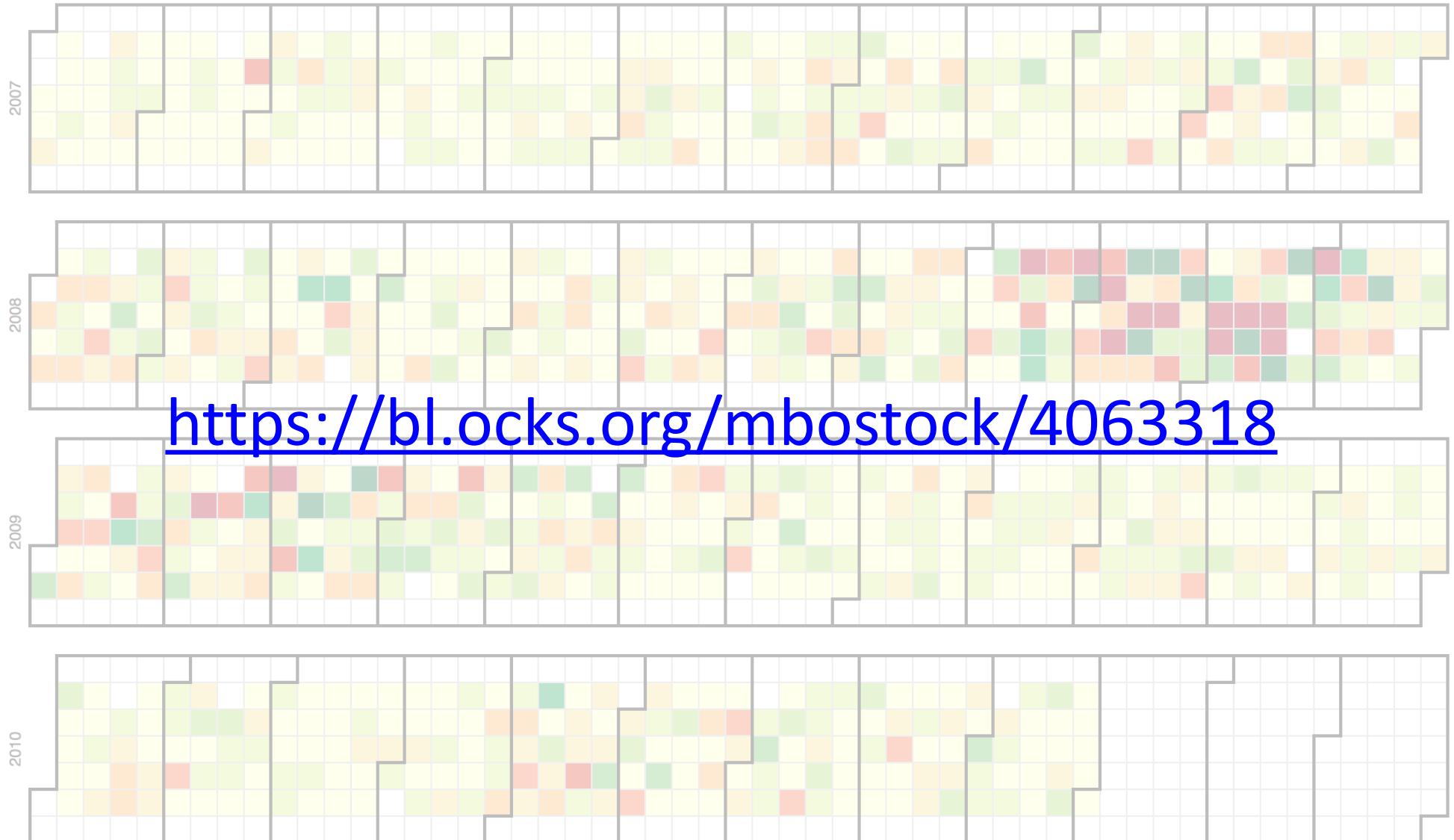
Pie Chart



Bar Chart



Calendar View



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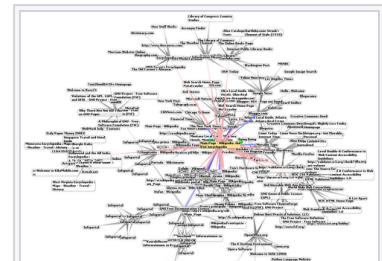
Information visualization

From Wikipedia, the free encyclopedia

Information visualization or **information visualisation** is the study of (interactive) visual representations of abstract data to reinforce human cognition. The abstract data include both numerical and non-numerical data, such as text and geographic information. However, information visualization differs from **scientific visualization**: "it's infovis [information visualization] when the spatial representation is chosen, and it's scivis [scientific visualization] when the spatial representation is given".^[1]

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- [7 References](#)
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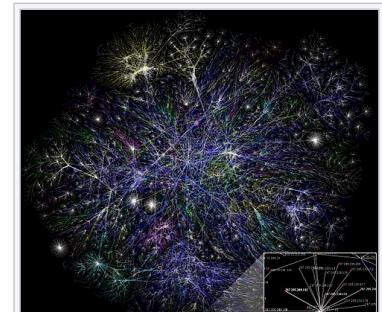
Graphic representation of a minute fraction of the [WWW](#), demonstrating hyperlinks

Overview [edit]

The field of information visualization has emerged "from research in [human-computer interaction](#), [computer science](#), [graphics](#), [visual design](#), [psychology](#), and [business methods](#). It is increasingly applied as a critical component in scientific research, [digital libraries](#), [data mining](#), financial data analysis, market studies, manufacturing [production control](#), and [drug discovery](#)".^[2]

Information visualization presumes that "visual representations and interaction techniques take advantage of the human eye's broad bandwidth pathway into the mind to allow users to see, explore, and understand large amounts of information at once. Information visualization focused on the creation of approaches for conveying abstract information in intuitive ways."^[3]

Data analysis is an indispensable part of all applied research and problem solving in industry. The most fundamental data analysis approaches are visualization (histograms, scatter plots, surface plots, tree maps, parallel coordinate plots, etc.), [statistics](#) ([hypothesis test](#), [regression](#), [PCA](#), etc.), [data mining](#) ([association mining](#), etc.), and [machine learning](#) methods ([clustering](#), [classification](#), [decision trees](#), etc.).



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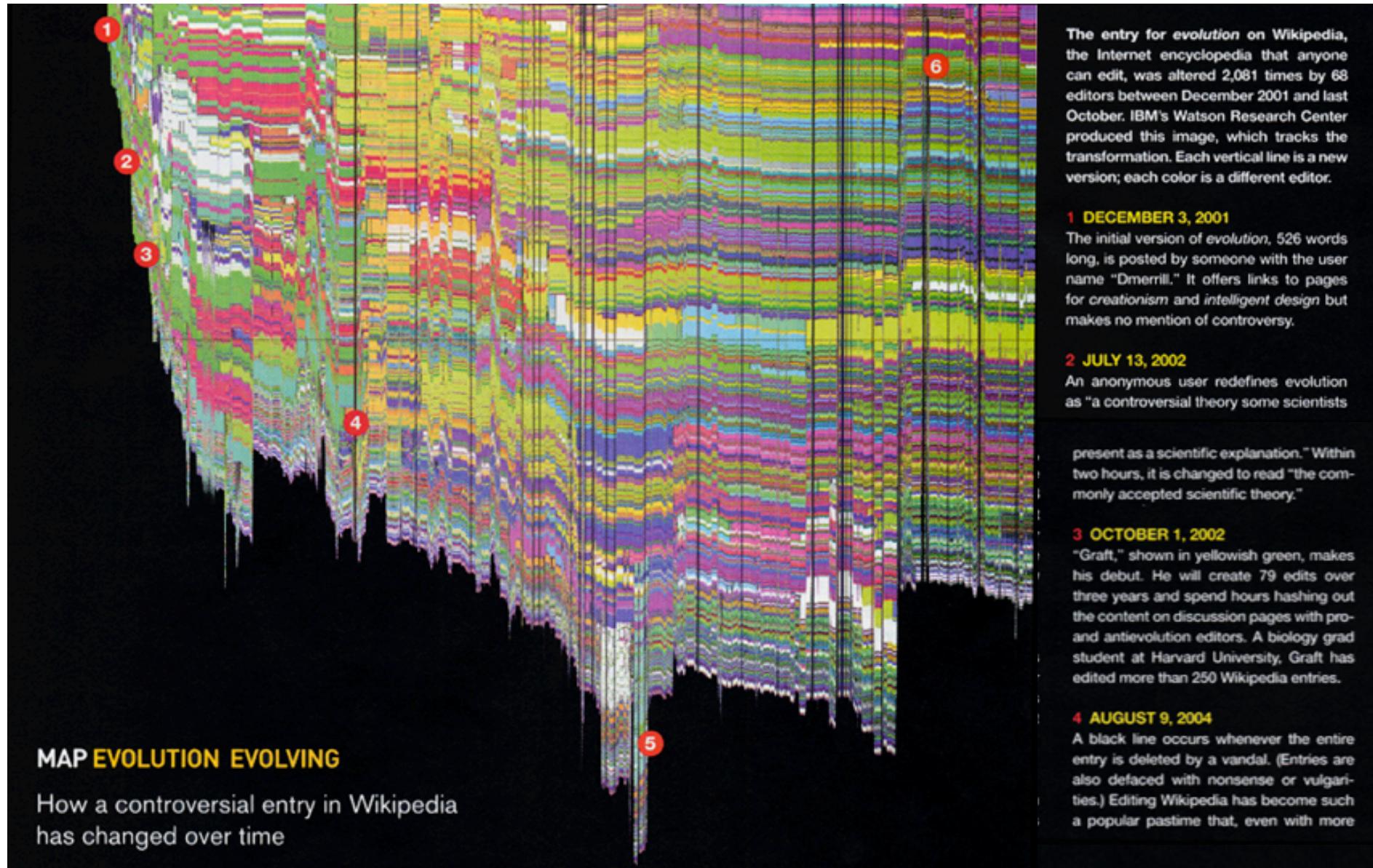
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- (cur | prev) 22:27, 5 June 2017 Blueclaw (talk | contribs) . . (9,123 bytes) (-2) . . (→Organization: removed defunct and irrelevant pages, added more organizations) ([undo](#))
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- (cur | prev) 20:50, 2 February 2017 178.4.223.168 (talk) . . (9,084 bytes) (+20) . . ([undo](#))
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- (cur | prev) 15:58, 19 November 2016 174.118.59.81 (talk) . . (9,426 bytes) (-31) . . (→Specific methods and techniques) ([undo](#))

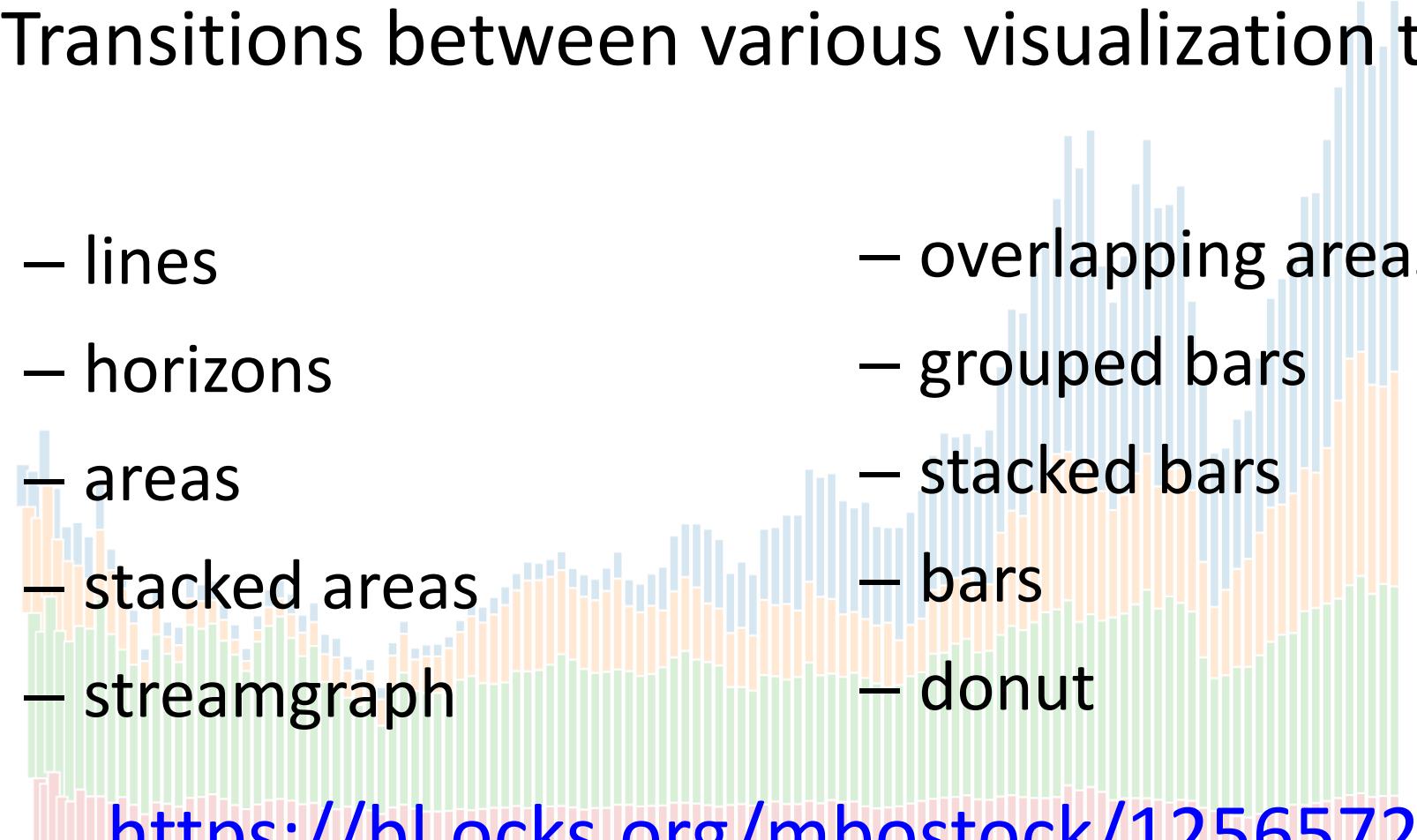
Visualizing Wikipedia Edit Evolution



D3's Show Reel

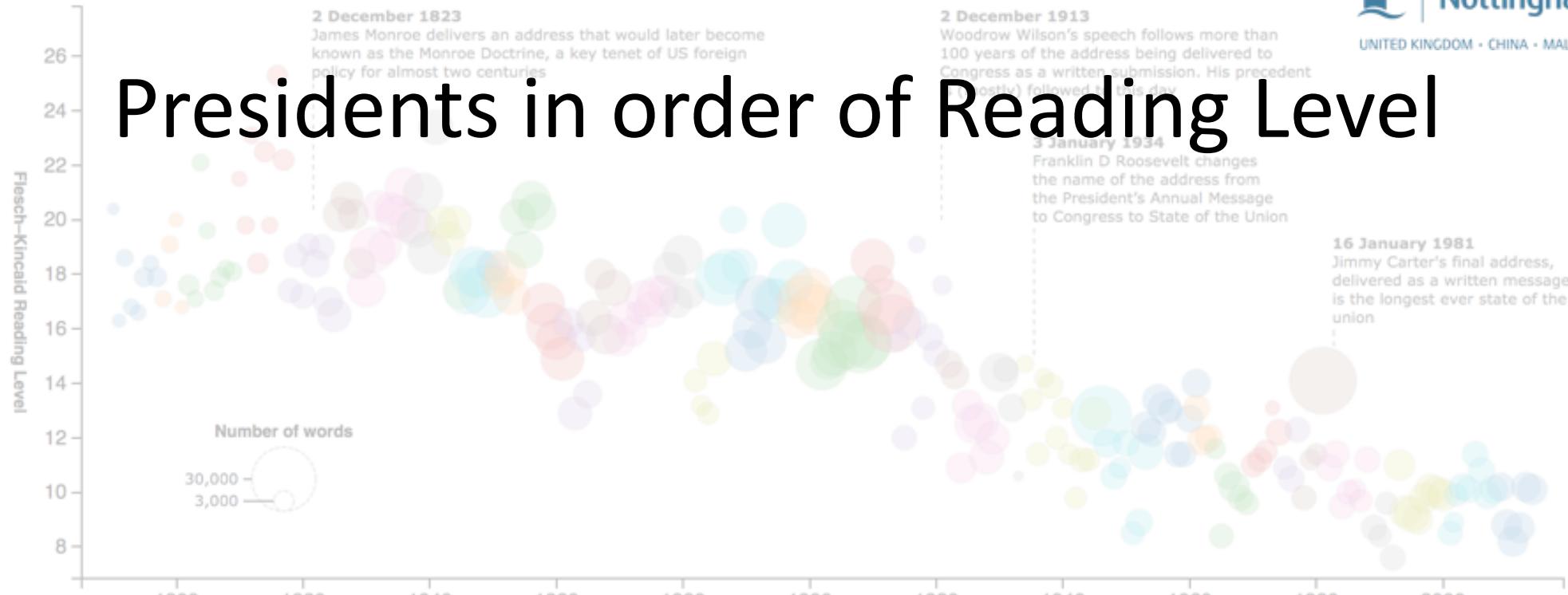
- Transitions between various visualization types

- lines
- horizons
- areas
- stacked areas
- streamgraph
- overlapping areas
- grouped bars
- stacked bars
- bars
- donut



<https://bl.ocks.org/mbostock/1256572>

Presidents in order of Reading Level



<https://www.theguardian.com/world/interactive/2013/feb/12/state-of-the-union-reading-level>



Information Visualization Examples



<https://d3js.org/>

Module Objectives

- Fundamental understanding on how visualizations convey information and how humans perceive
- Master an essential set of visualization techniques
- Practical experience in visualizing real-world data

Module Structure

- Lectures (8 weeks)
 - 2 x 1 hours / week
 - Monday 12:00 - 14:00
 - Business South A25, Jubilee Campus
- Assessment
 - 75% written examination
 - Contents from all lectures, core texts and paper handouts examinable.
 - 25% course work
 - Implementing a simple visualization
 - A written report, due on April 8, 2019

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 - Personal homepage: <http://cs.nott.ac.uk/~pszkz/>

Course Materials

- Core text:
 - [The Visual Display of Quantitative Information](#) (2nd Edition). E. Tufte. Graphics Press, 2001 [available in the library].
 - [R Graphics Cookbook](#), Winston Chang, O'Reilly Media, 2013 [you can find it online by googling].
 - [Paper Handouts](#) (available on moodle in additional materials session per week)
- Other resources:
 - Moodle (Optional)

Lecture Schedule

Week	Topic (A25, Bus-South)	Topic (A25, Bus-South)	Lab (Optional, CS-A32)
1 (w19)	Introduction	The Value of Visualization	NONE
2 (w20)	Data and Image Models	Graphs and Charts	NONE
3 (w21)	Multivariate Data Visualization	Visualization with R	NONE
4 (w22)	Advanced R and Visualization Tools	Visual Perception	Course Work Case Study (Optional)
5 (w23)	Interaction	Evaluation	Lab (Optional)
6 (w24)	Text and Document	Time Series Data Visualization	Lab (Optional)
7 (w25)	Trees and Graphs	Recap of Fundamentals	Lab (Optional)
8 (w34)	Review	Demo	NONE

G53IVP

- <https://moodle.nottingham.ac.uk/course/view.php?id=68656>
- You will gain practical experience of how to **design, implement** and **evaluate** a distinctive interactive visualization which presents information gathered from a complex and interesting data source.
- Assessments
 - 80%: written report, documentation and code repositories
 - 20%: presentation

G53IVP

- Initial meeting
 - Feb 11th 15:00, 17:00 (third week of G53FIV)
 - B50, School of Computer Science
 - Discuss the general format and available resources
- Proposal development
 - Feb 25th 11:00 (fifth week of G53FIV)
- Report, documentation, code due
 - May 10th 11:00
- Presentation
 - May 13th 10:00

Break

- Next:
- Topic: The Value of Visualization

