

# G53FIV: Fundamentals of Information Visualization

## Lecture 1: Introduction

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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

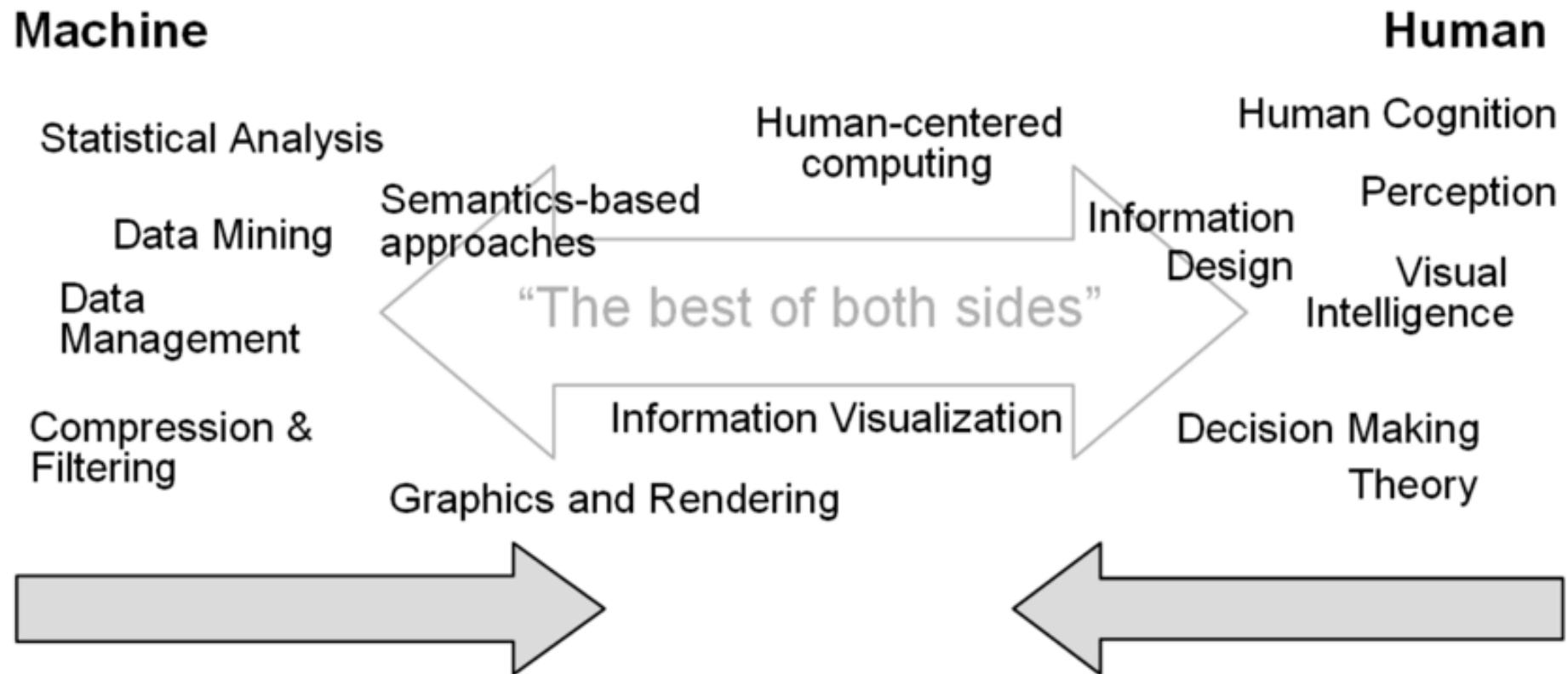
- Transform the data into information (understanding, insight) thus making it useful



# 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.

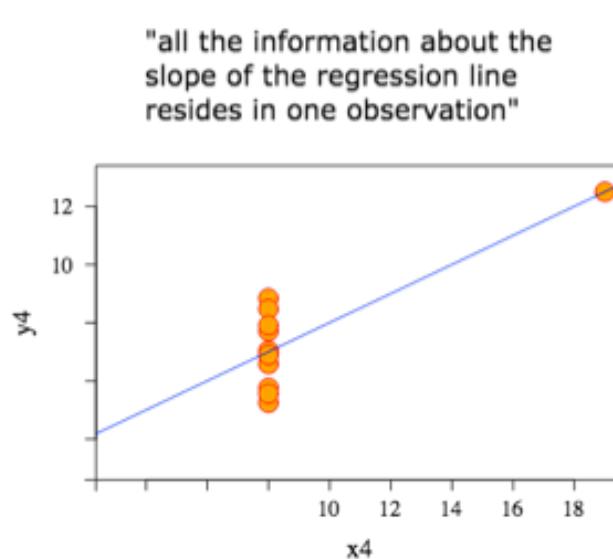
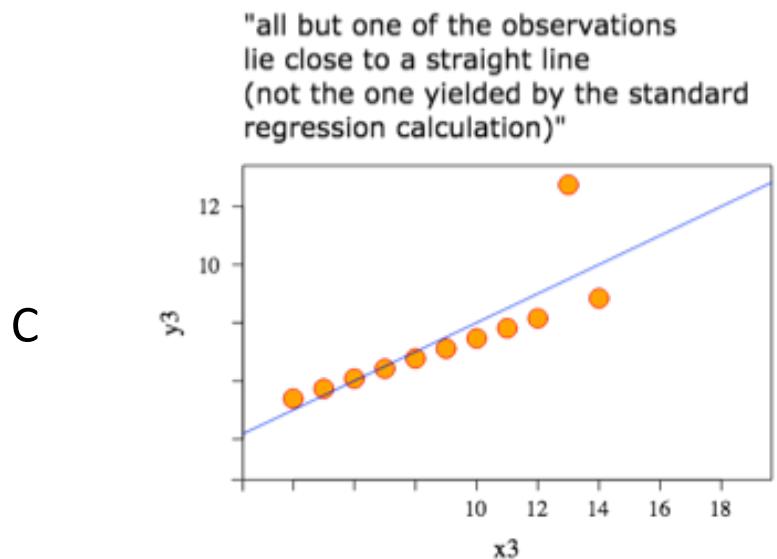
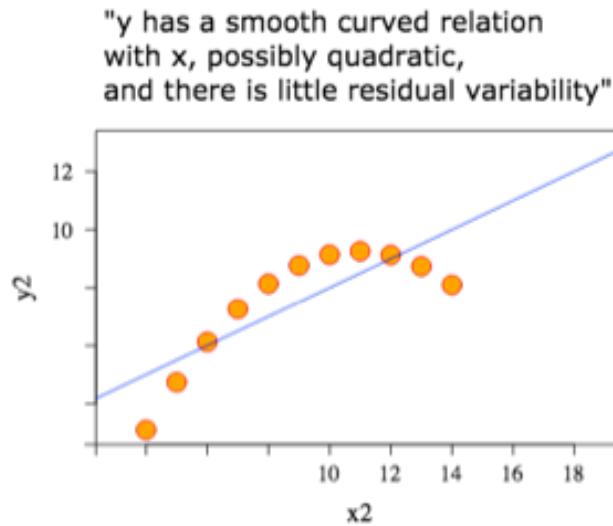
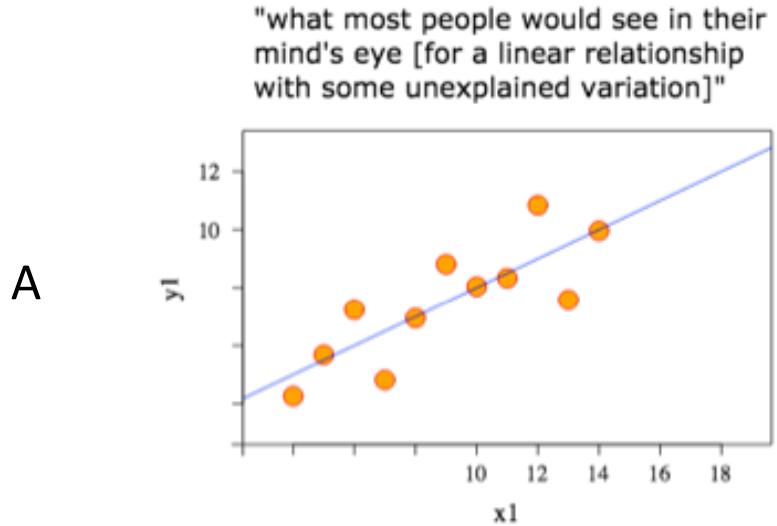
# Anscombe's Quartet

- 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]

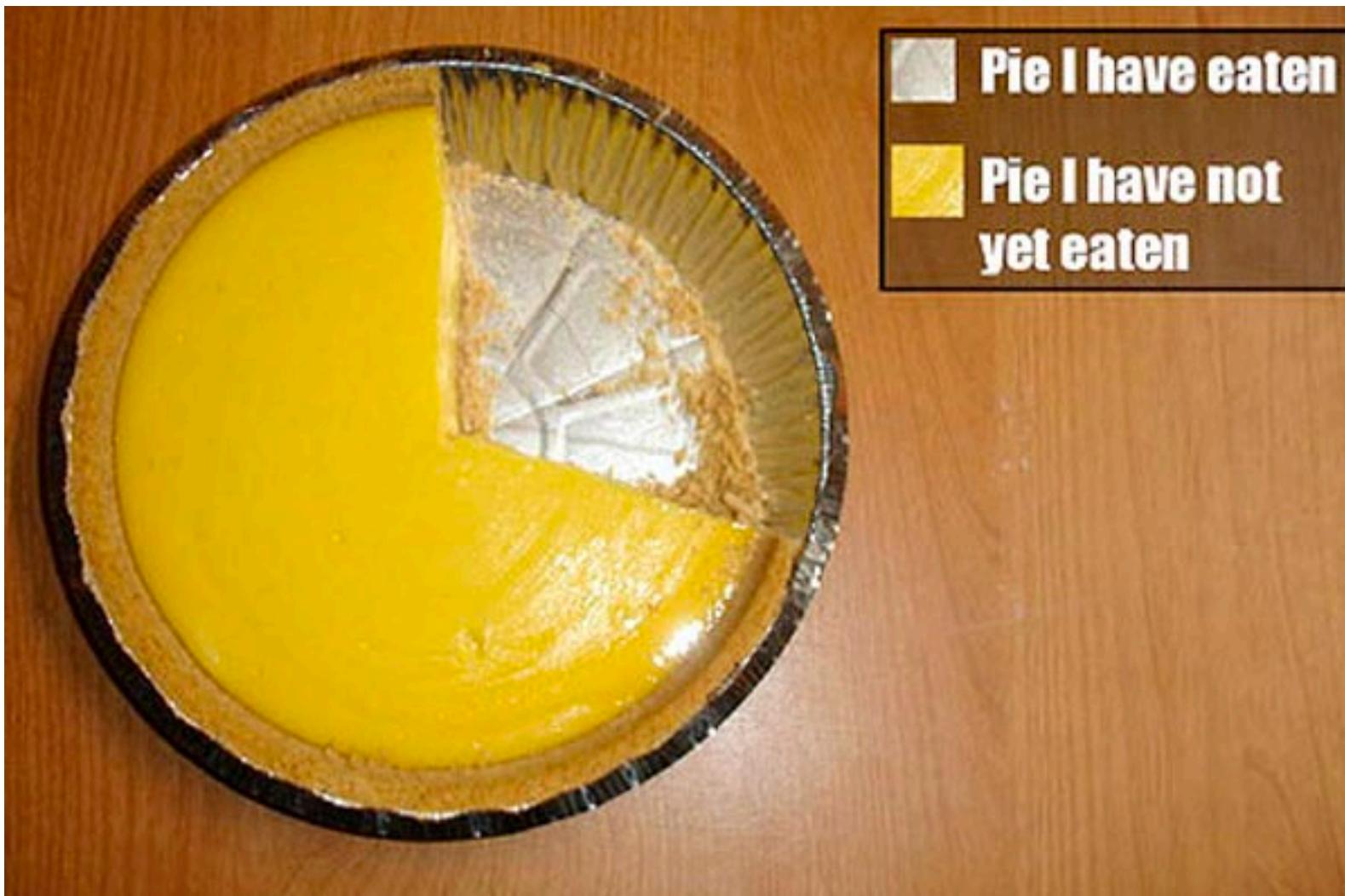
# Visualization of Anscombe's Quartet



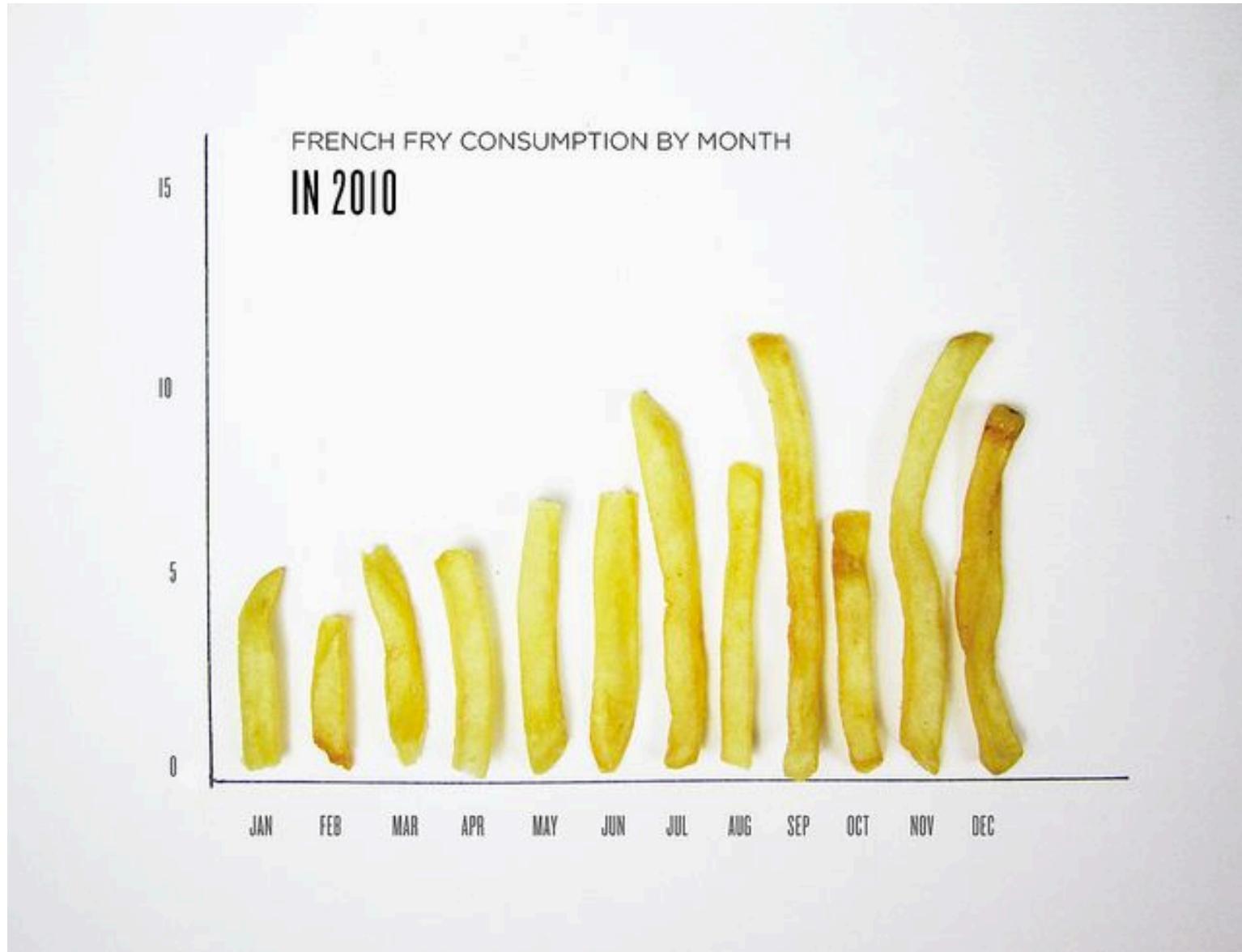
# Common Information Visualizations

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

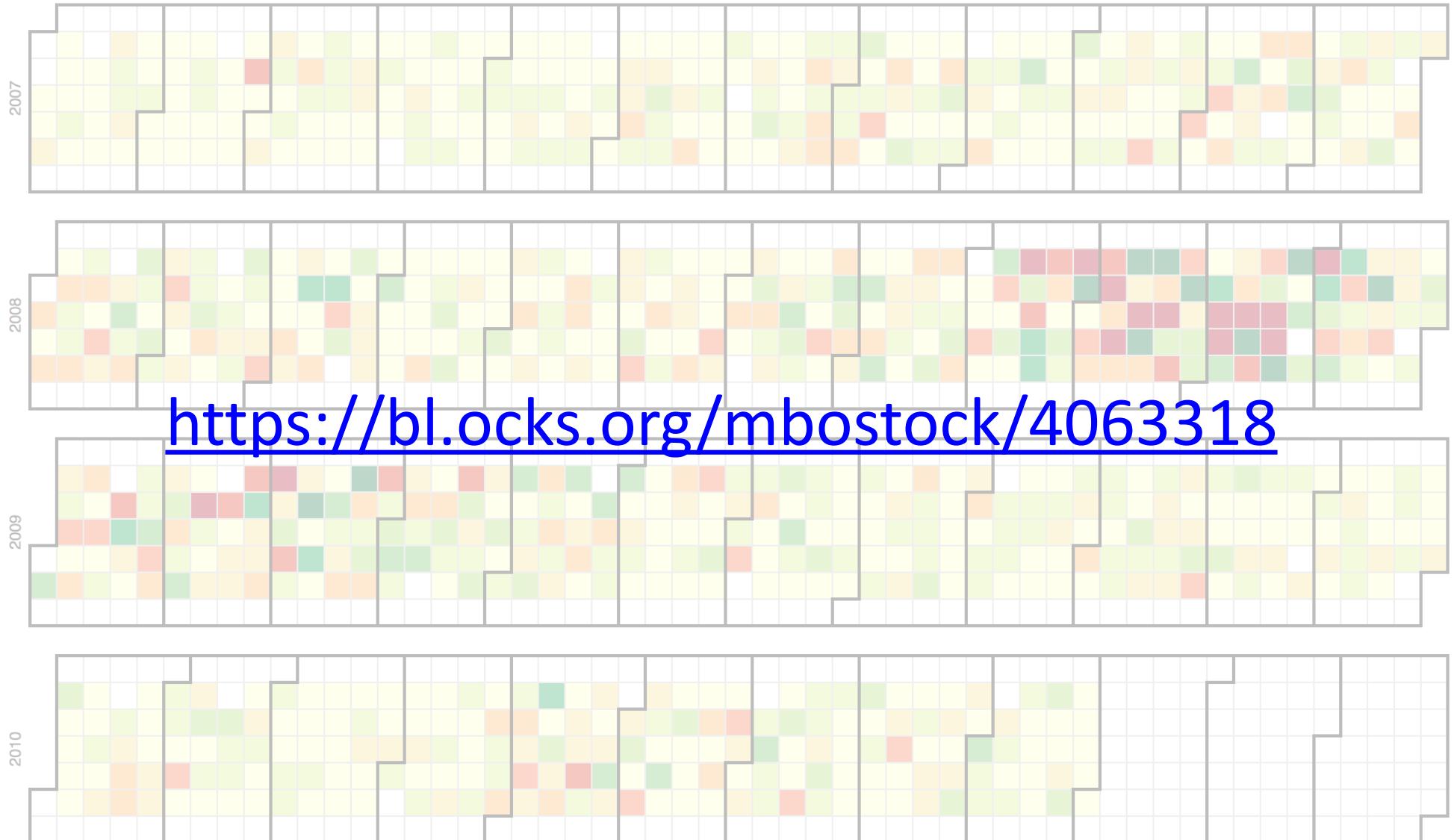
# Pie Chart



# Bar Chart



# Calendar View



# Wikipedia Page



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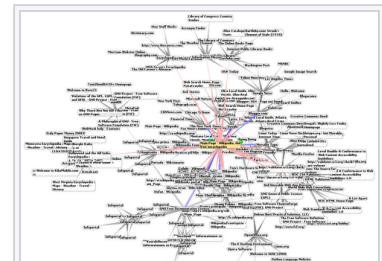
## Information visualization

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".<sup>[1]</sup>

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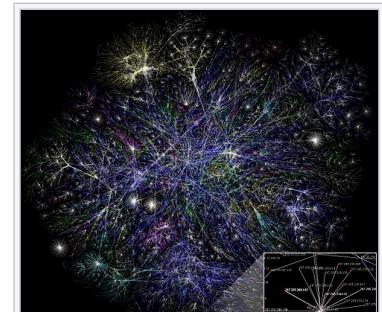
Graphic representation of a minute fraction of the [WWW](#), demonstrating hyperlinks

### 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](#)".<sup>[2]</sup>

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."<sup>[3]</sup>

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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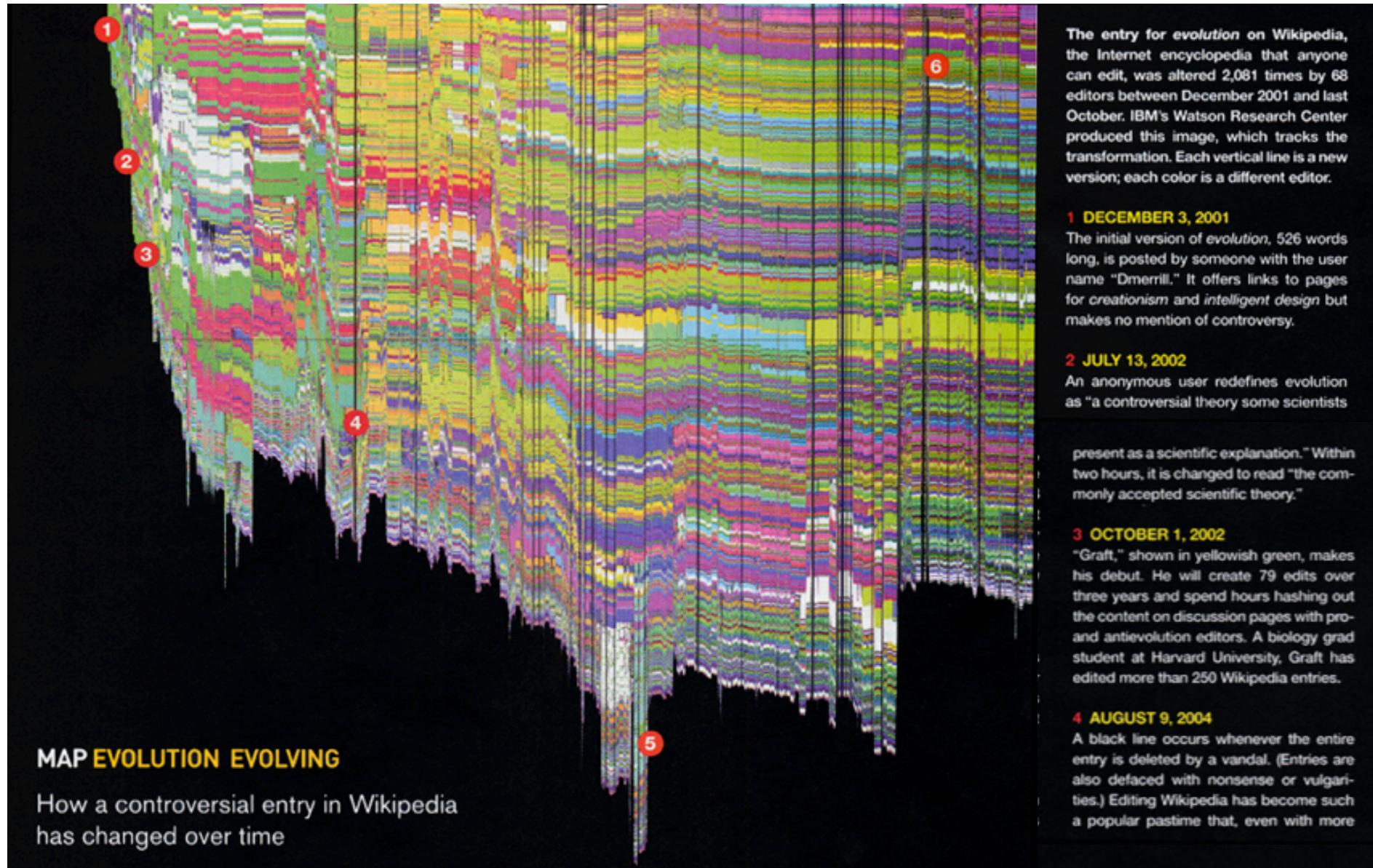
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- (cur | prev)  09:14, 19 December 2017 Billhpike (talk | contribs) . . (9,942 bytes) (-17) . . (→See also) ([undo](#))
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- (cur | prev)  16:33, 5 November 2017 14.139.157.209 (talk) . . (9,848 bytes) (+16) . . (→Specific methods and techniques) ([undo](#))
- (cur | prev)  04:25, 1 September 2017 KolbertBot (talk | contribs) m . . (9,832 bytes) (+3) . . (Bot: [HTTP→HTTPS](#)) ([undo](#))
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- (cur | prev)  17:49, 16 June 2017 Magic links bot (talk | contribs) m . . (9,825 bytes) (+8) . . (Replace [magic links](#) with templates per [local RfC](#) and [MediaWiki RfC](#)) ([undo](#))
- (cur | prev)  22:39, 5 June 2017 Blueclaw (talk | contribs) . . (9,817 bytes) (+694) . . (→Organization: reorganized section) ([undo](#))
- (cur | prev)  22:27, 5 June 2017 Blueclaw (talk | contribs) . . (9,123 bytes) (-2) . . (→Organization: removed defunct and irrelevant pages, added more organizations) ([undo](#))
- (cur | prev)  04:12, 27 May 2017 Dhjnavy (talk | contribs) m . . (9,125 bytes) (+39) . . (add this page into the category - [Information Visualization.](#)) ([undo](#))
- (cur | prev)  01:29, 10 February 2017 Omnipaedista (talk | contribs) . . (9,086 bytes) (+2) . . (→References) ([undo](#))
- (cur | prev)  20:50, 2 February 2017 178.4.223.168 (talk) . . (9,084 bytes) (+20) . . ([undo](#))
- (cur | prev)  20:40, 2 February 2017 178.4.223.168 (talk) . . (9,064 bytes) (+22) . . ([undo](#))
- (cur | prev)  14:58, 29 January 2017 MrOllie (talk | contribs) . . (9,042 bytes) (-387) . . (→External links: [WP:EL](#)) ([undo](#))
- (cur | prev)  14:02, 8 January 2017 45.247.69.160 (talk) . . (9,429 bytes) (+3) . . (→History) ([undo](#))
- (cur | prev)  15:58, 19 November 2016 174.118.59.81 (talk) . . (9,426 bytes) (-31) . . (→Specific methods and techniques) ([undo](#))

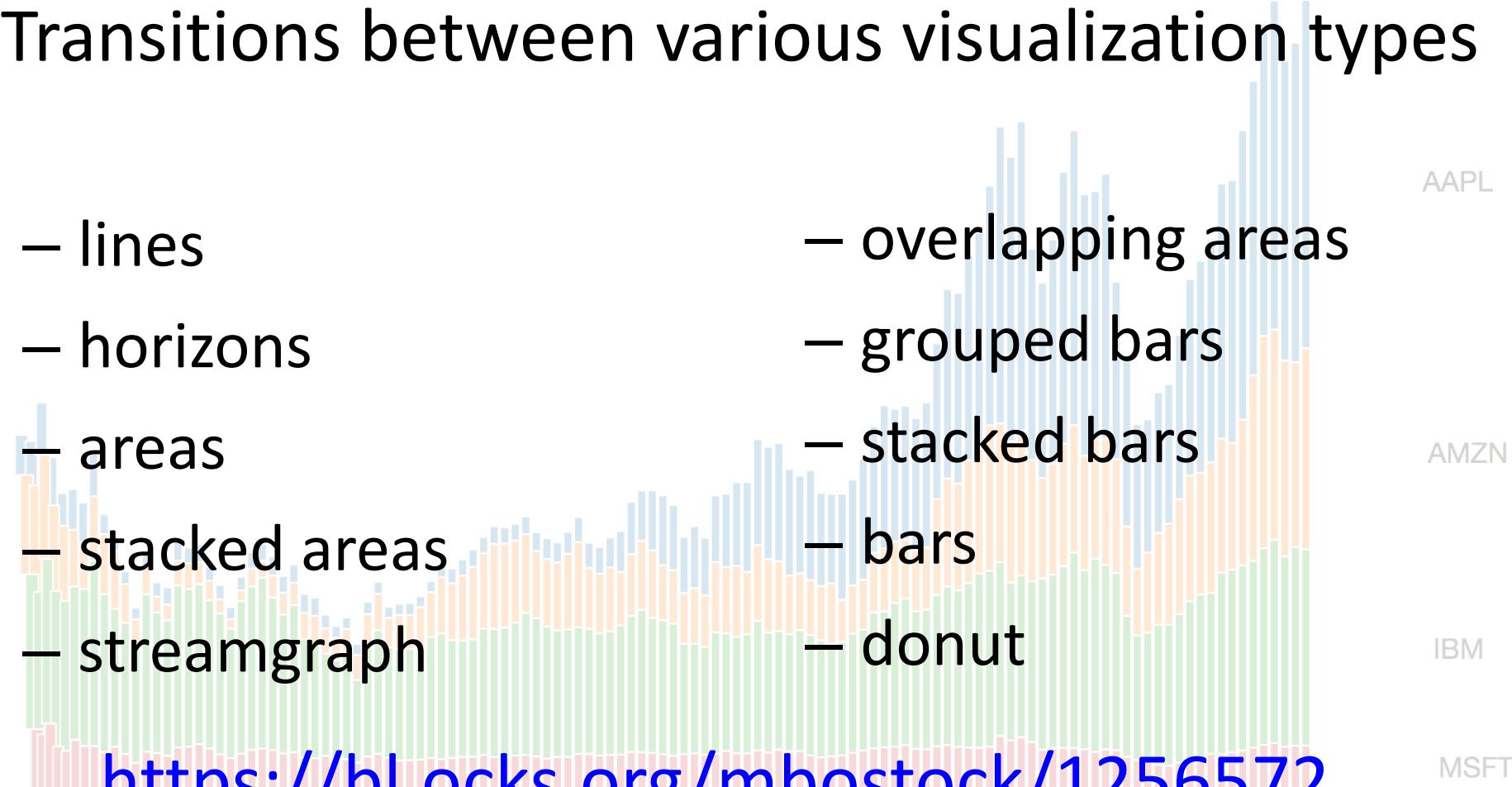
# Visualizing Wikipedia Edit Evolution



# D3's Show Reel

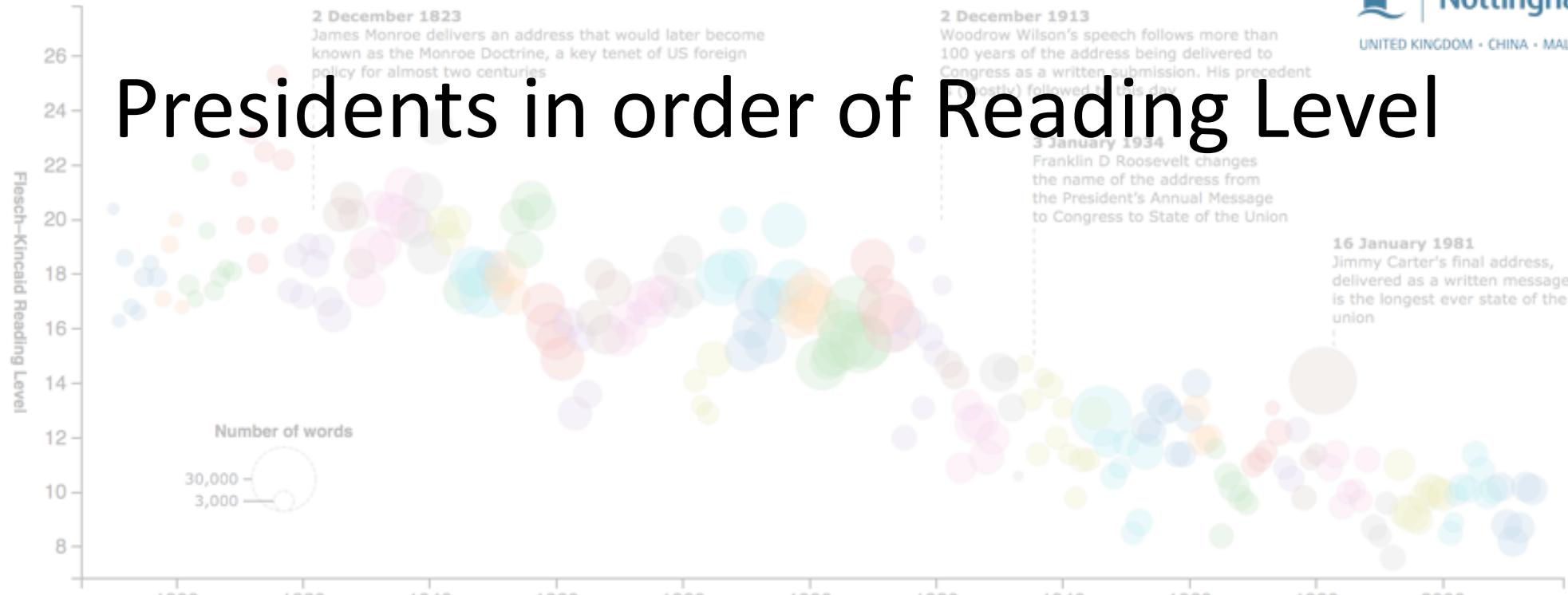
- Transitions between various visualization types

- 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
- Assessment
  - 75% written examination
    - Contents from all lectures, core texts and paper handouts examinable.
  - 25% course work
    - Implementing a simple visualization
    - A written report

# 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

- 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

# Break

- Next:
- Topic: The Value of Visualization

