

Introduction to visualization

Thomas Torsney-Weir

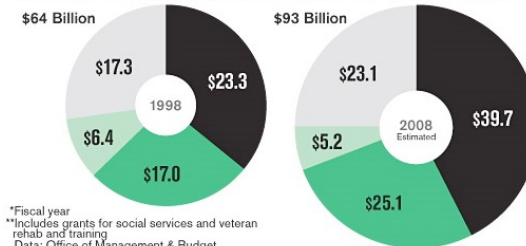
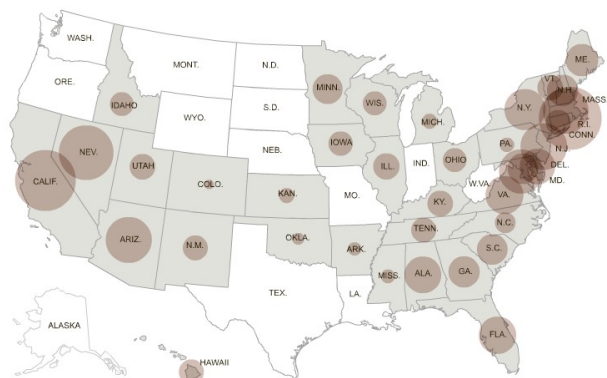
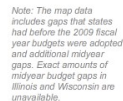
Acknowledgements

Selective contributions from

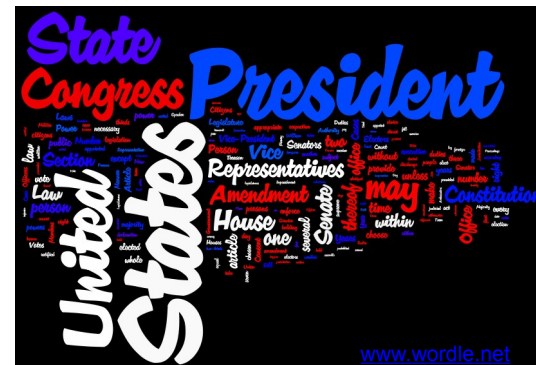
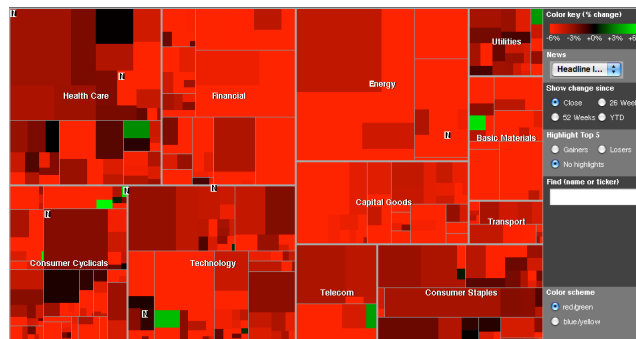
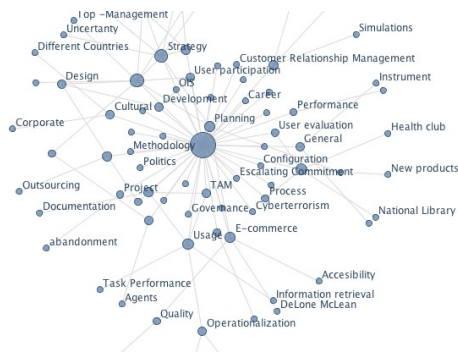
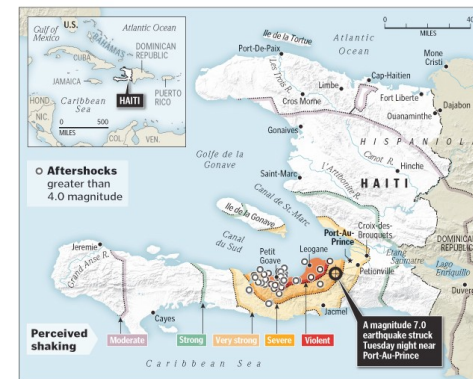
- Robert S. Laramée
- Torsten Möller
- Tamara Munzner
- Raghu Machiraju
- Hanspeter Pfister
- Melanie Tory
- Daniel Weiskopf

What is visualization?

convey information via visual representations



*Fiscal year
**Includes grants for social services and veteran rehab and training
Data: Office of Management & Budget



Definition

Computer-based visualization systems provide visual representations of datasets intended to help people carry out some task more effectively.

T. Munzner: *Visualization Design and Analysis: Abstractions, Principles, and Methods*, AK Peters, 2014

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What is not visualization?

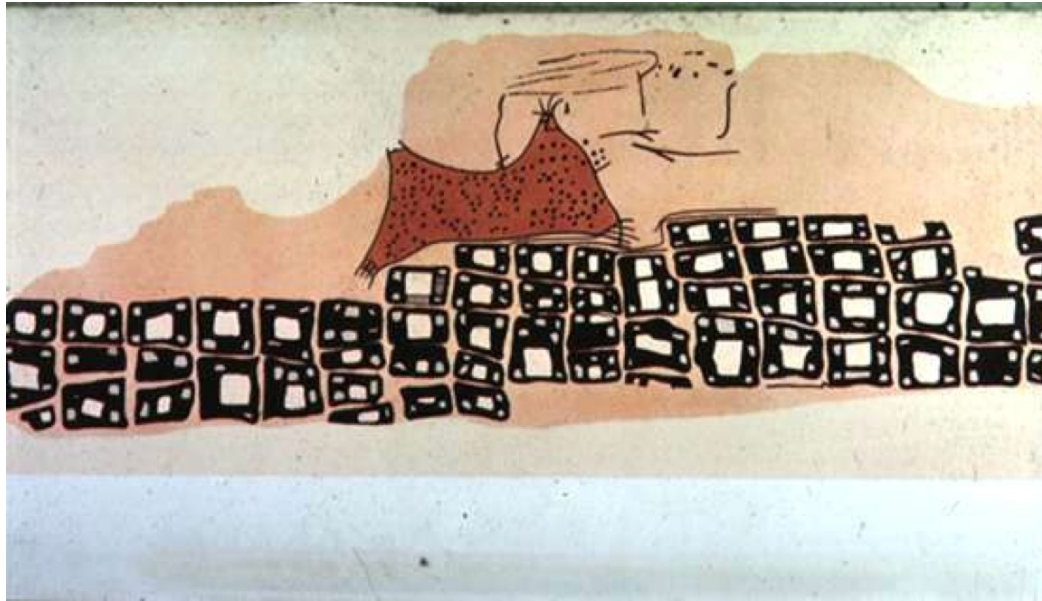
Data-driven art



<https://vimeo.com/4587178>

Beginnings of visualization

Maps



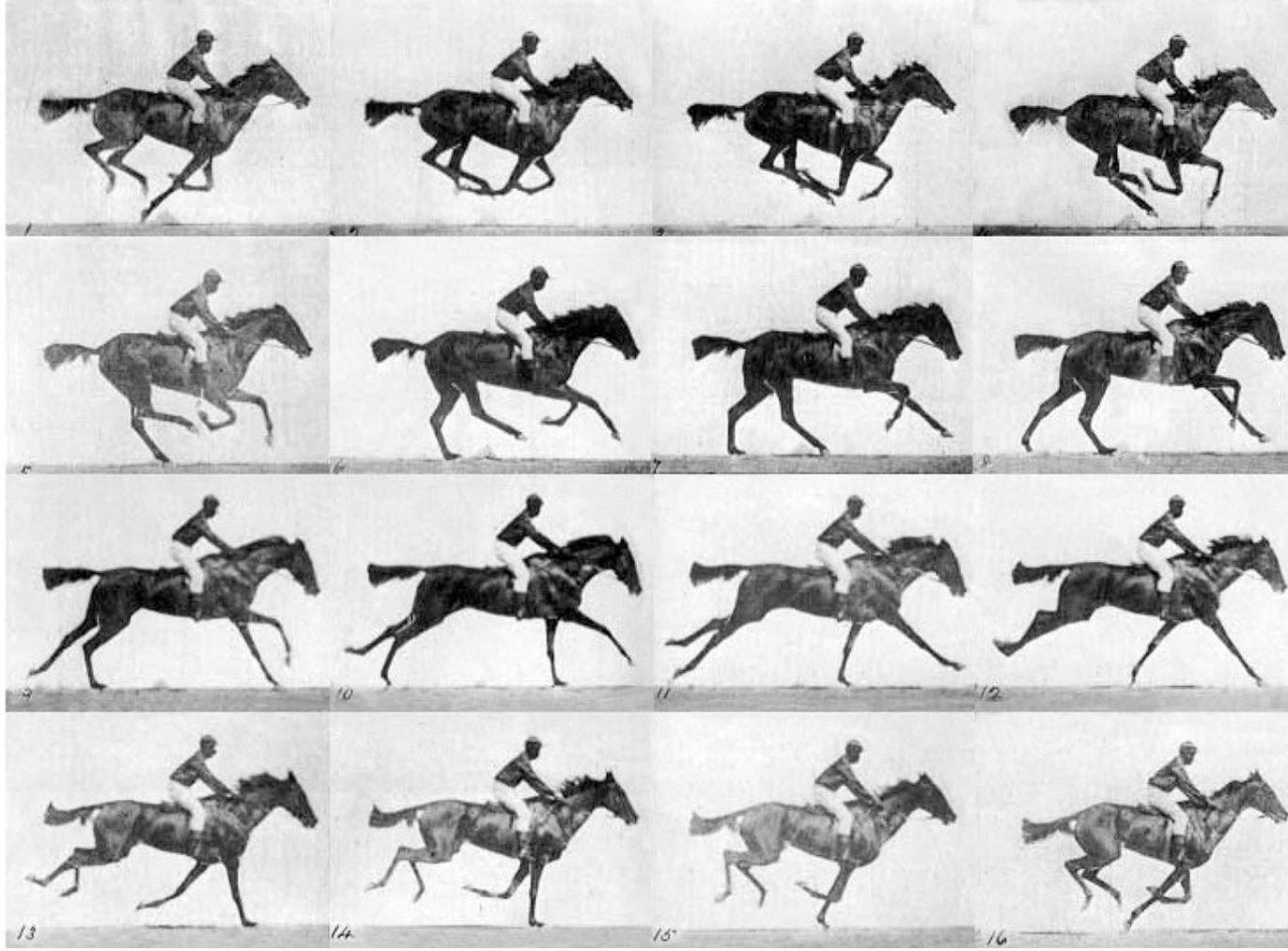
Konya town map, Turkey (~6200 BC)



Anaximander's Map of the World

Anaximander of Miletus, (~550 BC)

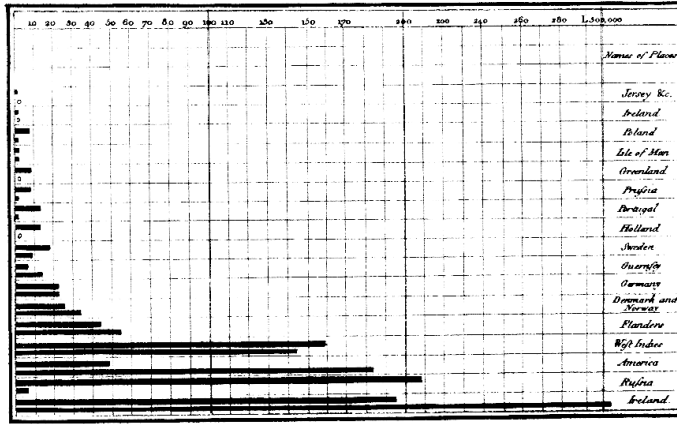
Solving arguments



E. J. Muybridge (1878)

Abstract data

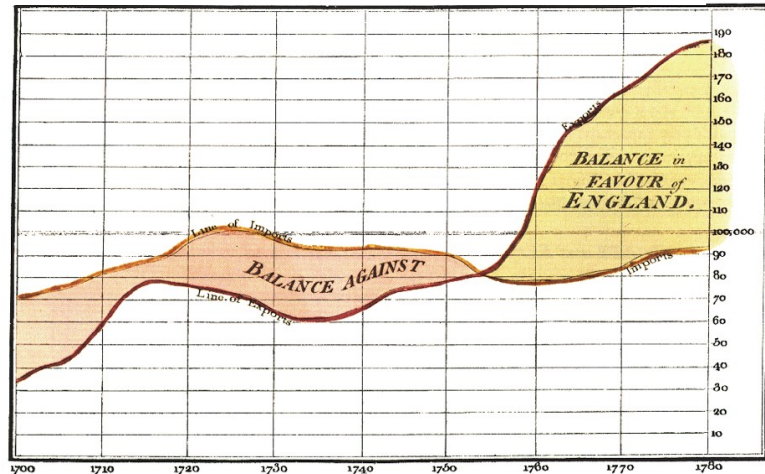
Exports and imports of SCOTLAND to and from different parts for one Year from Christmas 1780 to Christmas 1781.



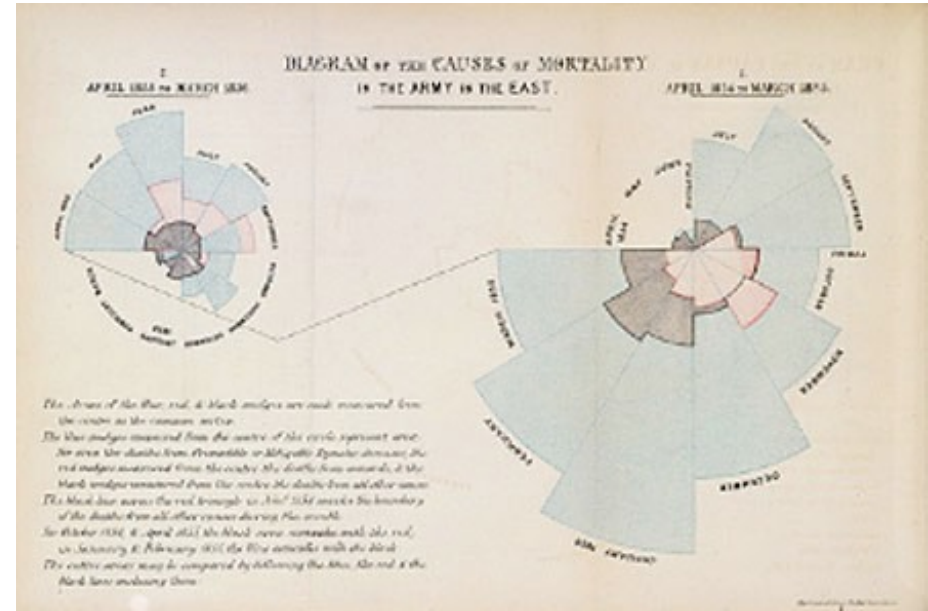
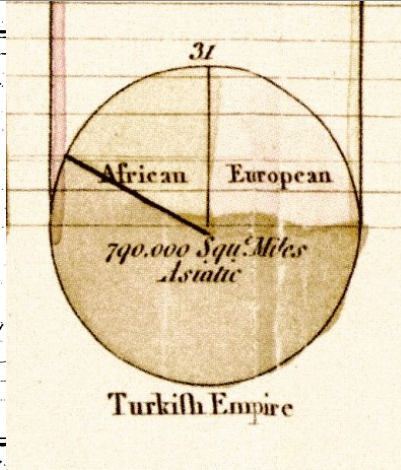
The Upright divisions are Ten Thousand Pounds each. The Black Lines are Exports the Red Lines Imports.

Published in the Edinburgh Review, June 7th 1788 by W. Playfair

W. Playfair 1788, London



W. Playfair (1786)

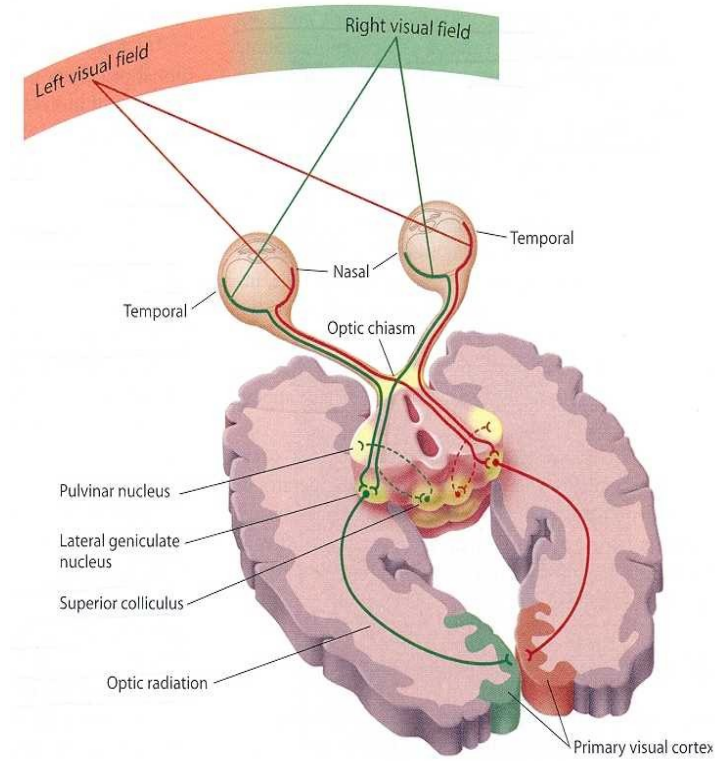


F. Nightingale (1856)

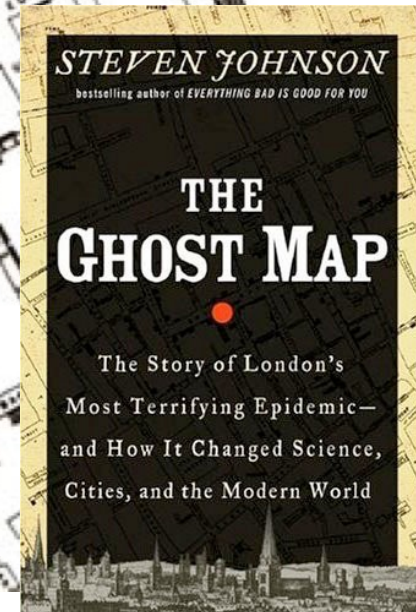
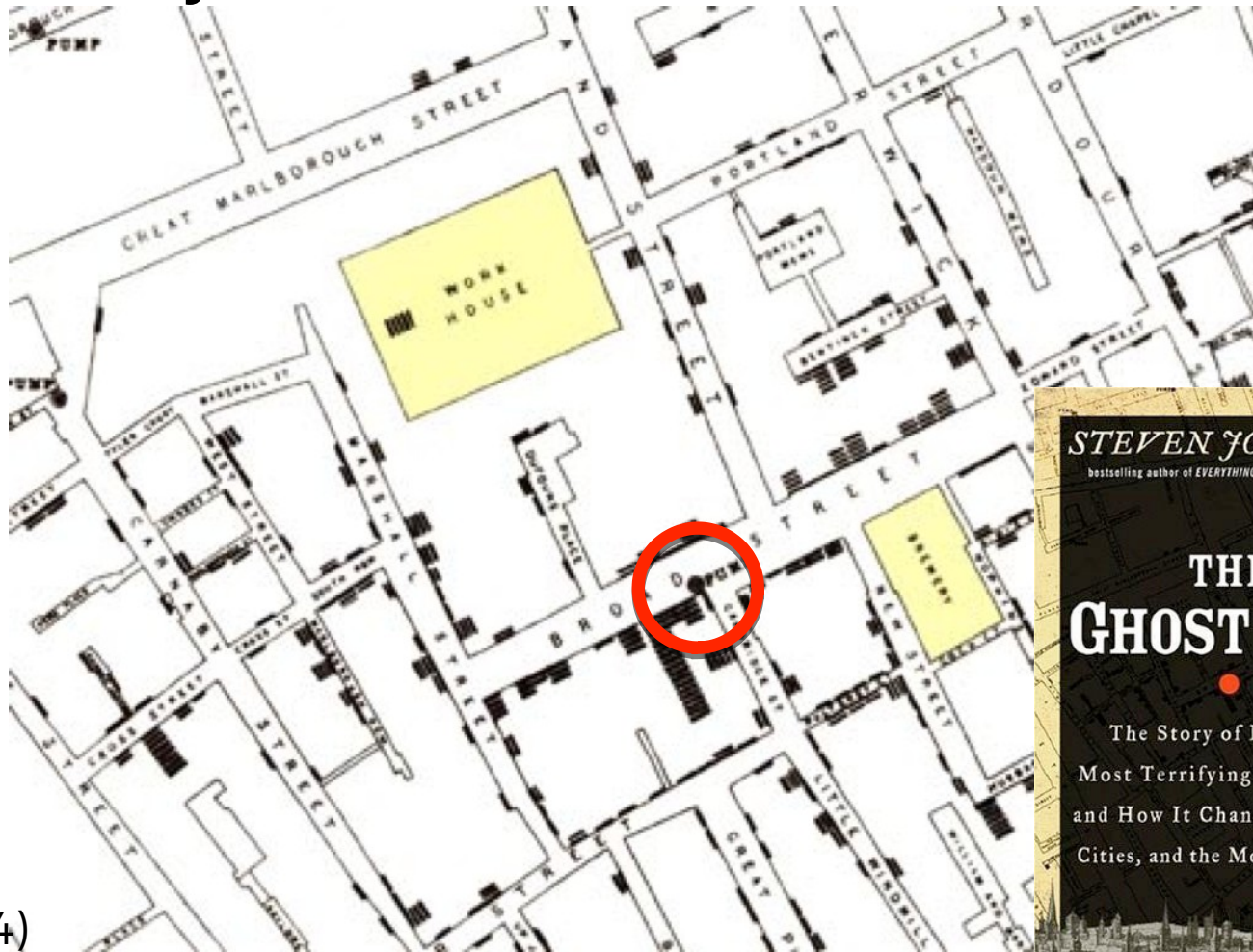
Why visualization?

Visual cortex

- Visualization exploits our powerful visual system
- Several billion neurons devoted to analyzing visual information (30% cortex)
- 8% for touch, 3% for hearing (Discover, 1993, Ware, 2013)
- Enables massively parallel processing of the visual field, i.e., incoming color, motion, texture, shapes etc.



Discovery



John Snow (1854)

Interaction

A Peek Into Netflix Queues

Examine Netflix rental patterns, neighborhood by neighborhood, in a dozen cities. Some titles with distinct patterns are *Mad Men*, *Obsessed* and *Last Chance Harvey*. [Comments \(131\)](#)

100 titles that were frequently rented from Netflix in 2009

[Previous](#) [Next](#) Most rented Least rented

Change how movies are sorted

Most rented Alphabetical By metacore

Paul Blart: Mall Cop



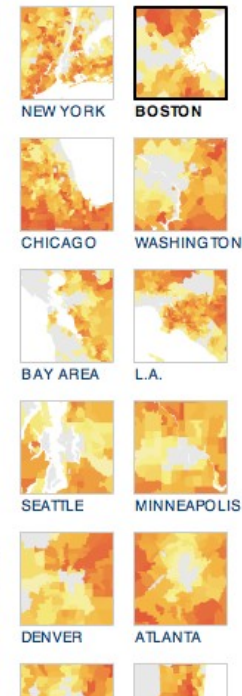
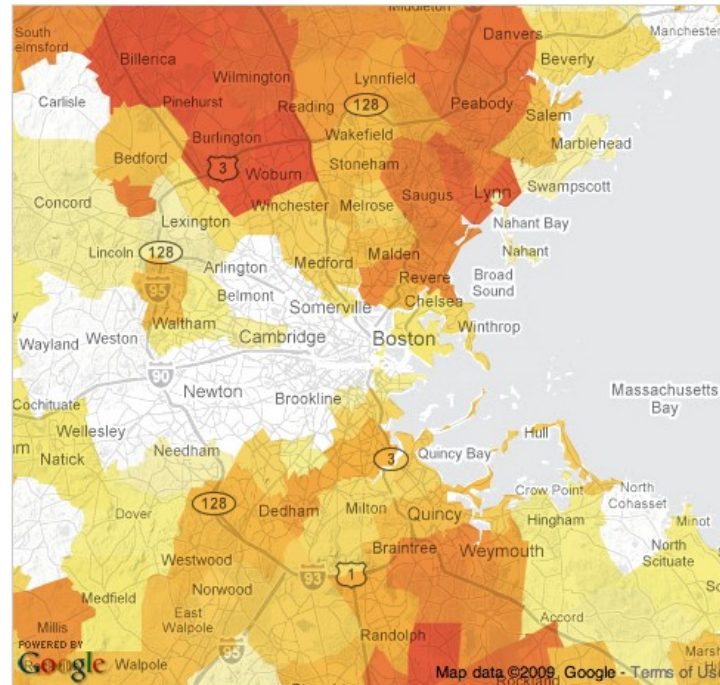
39

Metacritic
score
100=loved by
critics, 0=hated

Fat people are funny. Fat people who fall over are funnier. Fat people who fall over and have humiliating working-class jobs? Stop, you're killing me!

[Read Rest of NYT Review »](#)

The ZIP codes are shaded according to each movie's rank. **Ranked No. 1** **No. 50**



NY times

Communication

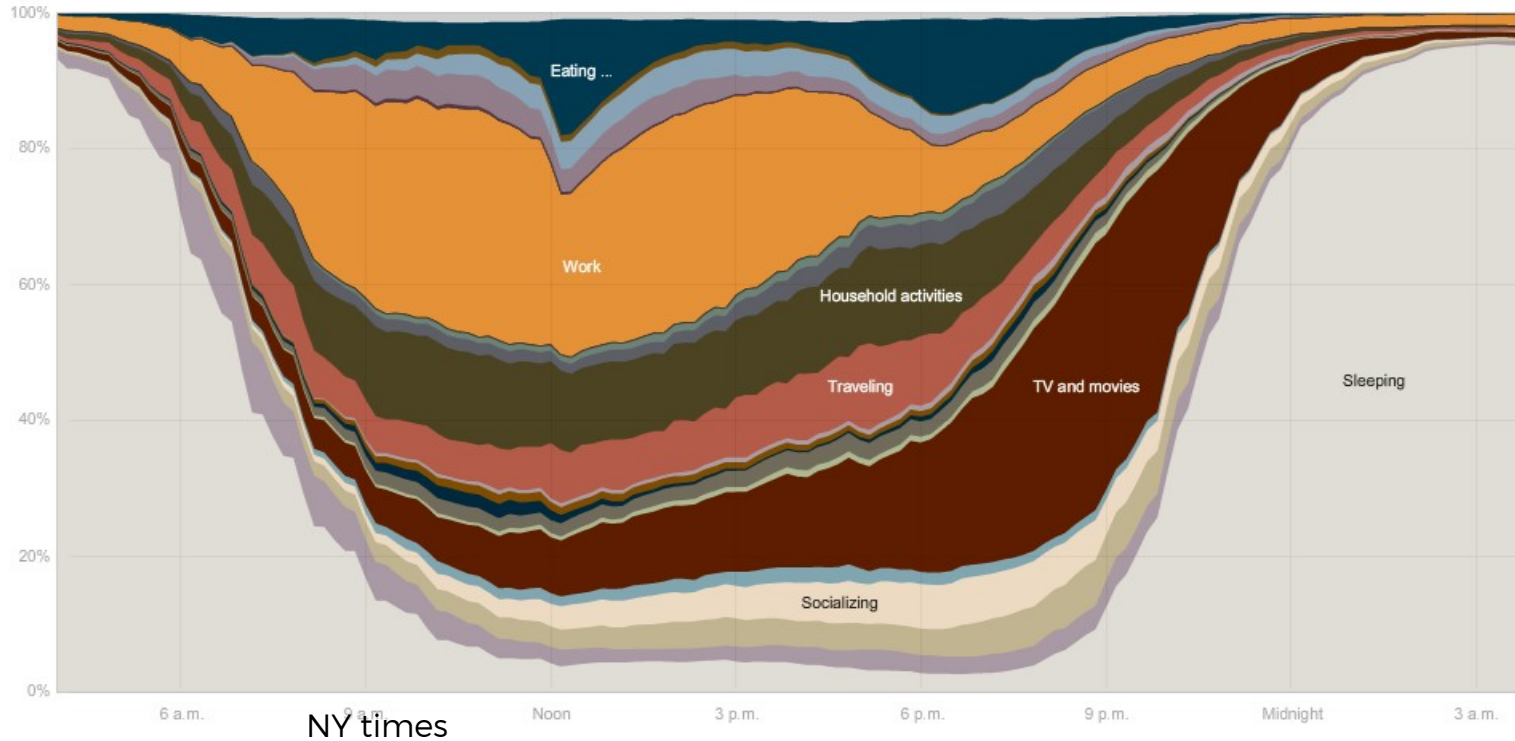
How Different Groups Spend Their Day

The American Time Use Survey asks thousands of American residents to recall every minute of a day. Here is how people over age 15 spent their time in 2008. [Related article](#)

Everyone

Sleeping, eating, working and watching television take up about two-thirds of the average day.

Everyone	Employed	White	Age 15-24	H.S. grads	No children
Men	Unemployed	Black	Age 25-64	Bachelor's	One child
Women	Not in lab...	Hispanic	Age 65+	Advanced	Two+ children



Why visualization

- Helps us think
- Reduces load on working memory
- Offloads cognition
- Leverages power of human perception

Conclusion

Related fields

Analysis

- Machine learning
- Statistics
- Signal/image processing
- Geometry
- Numerics

Human

- Psychology
- Cognition
- UI/UX
- Graphic design

Graphics

- Computer graphics
- Animation
- Geometry processing
- Virtual reality

Summary

- factors for effective visualization
 - data
 - tasks
 - users
- People have been using visualization for centuries
- Human visual perception is extremely powerful