Introduction to visualization

Thomas Torsney-Weir

Acknowledgements

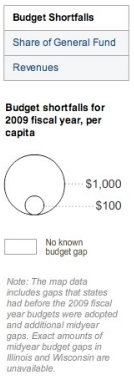
Selective contributions from

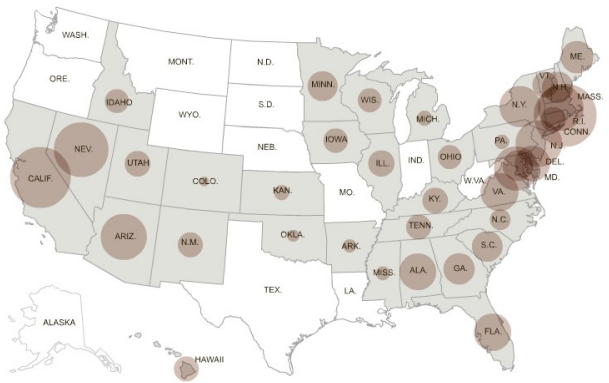
- Robert S. Laramee
- Torsten Möller
- Tamara Munzner
- Raghu Machiraju
- Hanspeter Pfister
- Melanie Tory
- Daniel Weiskopf

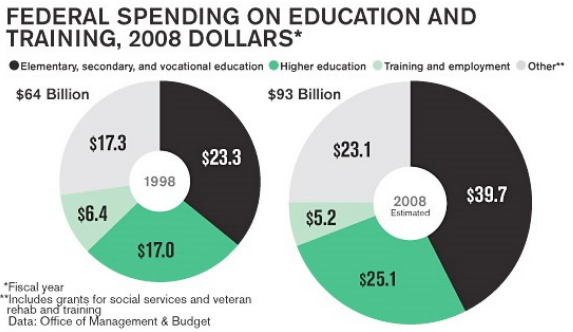
What is visualization?

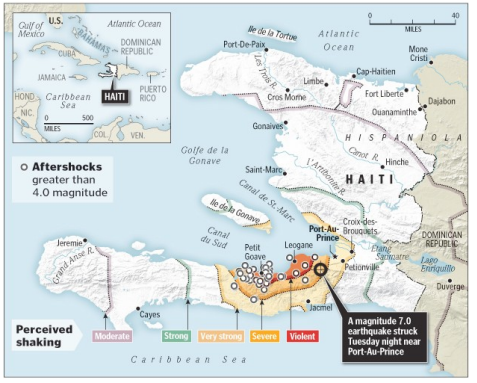
What is visualization?

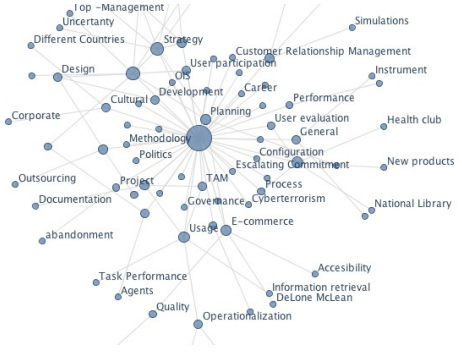
convey information via visual representations

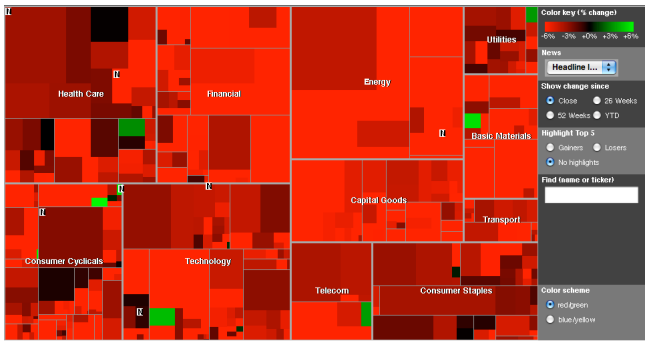


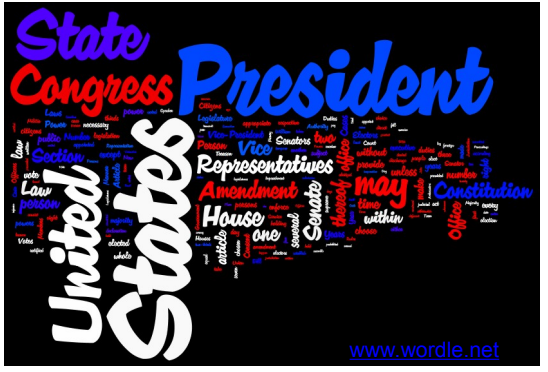












Definition

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

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

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

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

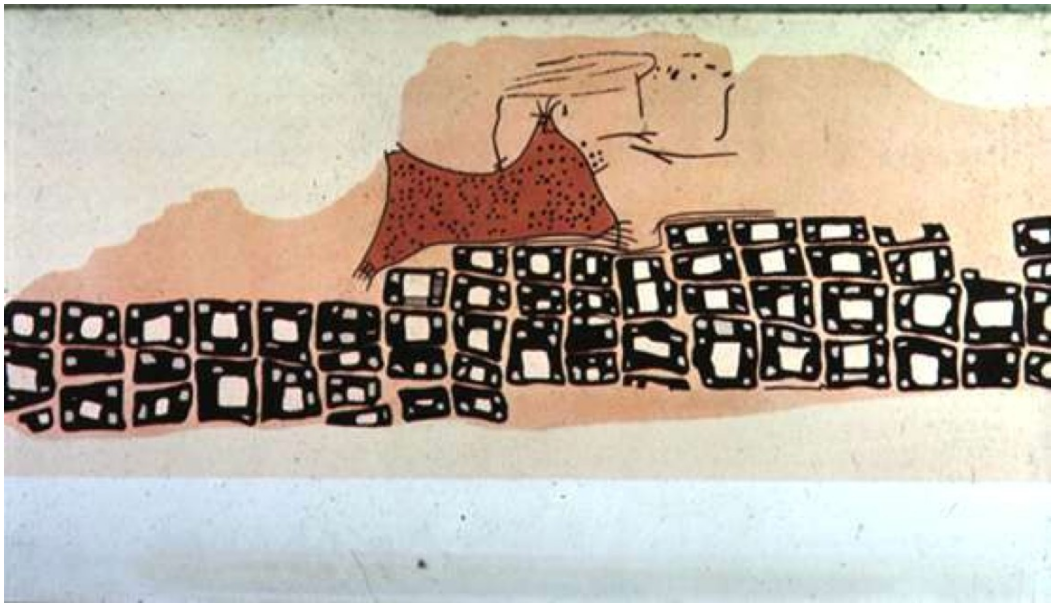
What is not visualization?

Data-driven art

https://vimeo.com/4587178

Beginnings of visualization

Maps



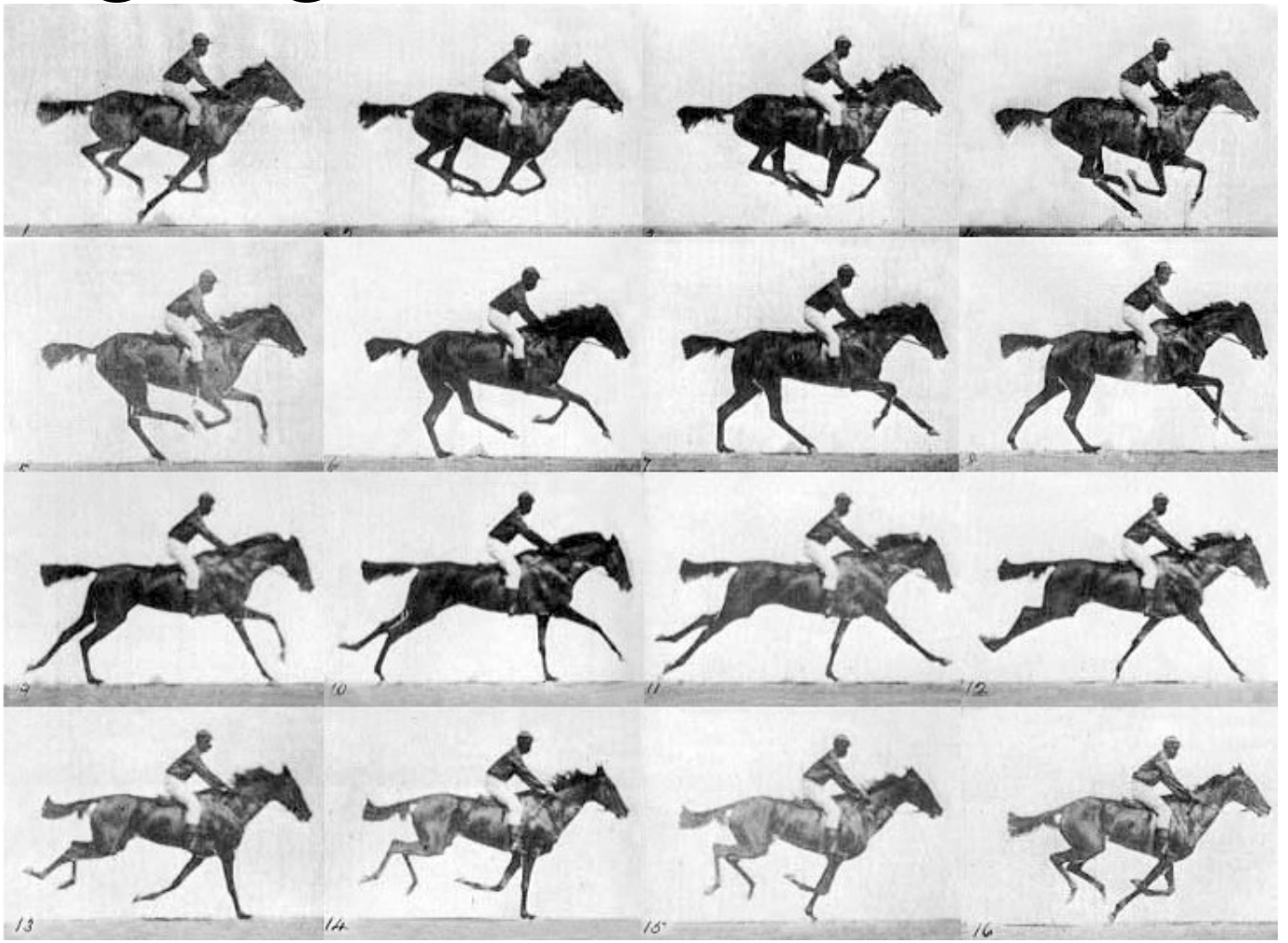
Konya town map, Turkey (~6200 BC)

Anaximader's Map of the World

Anaximander of Miletus, (~550 BC)

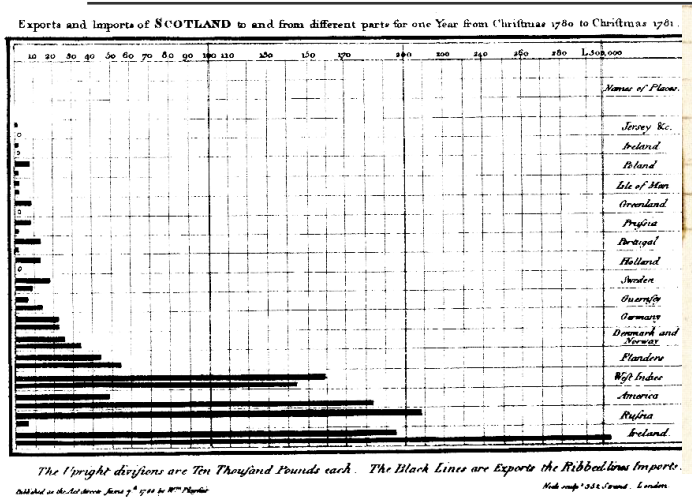
Milestones Project
http://www.math.yorku.ca/SCS/Gallery/milestone/

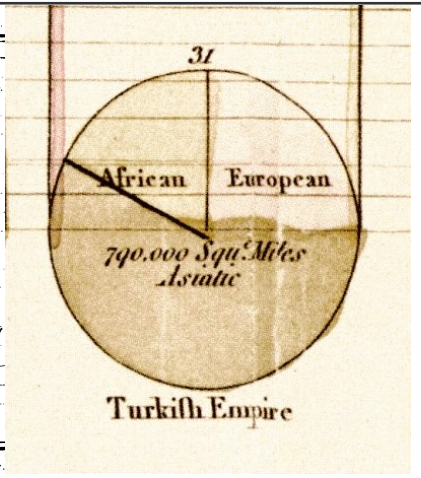
Solving arguments

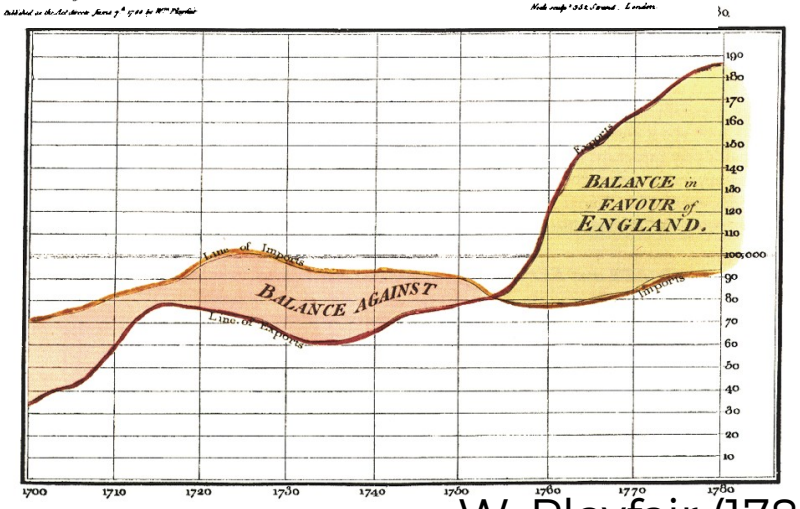


E. J. Muybridge (1878)

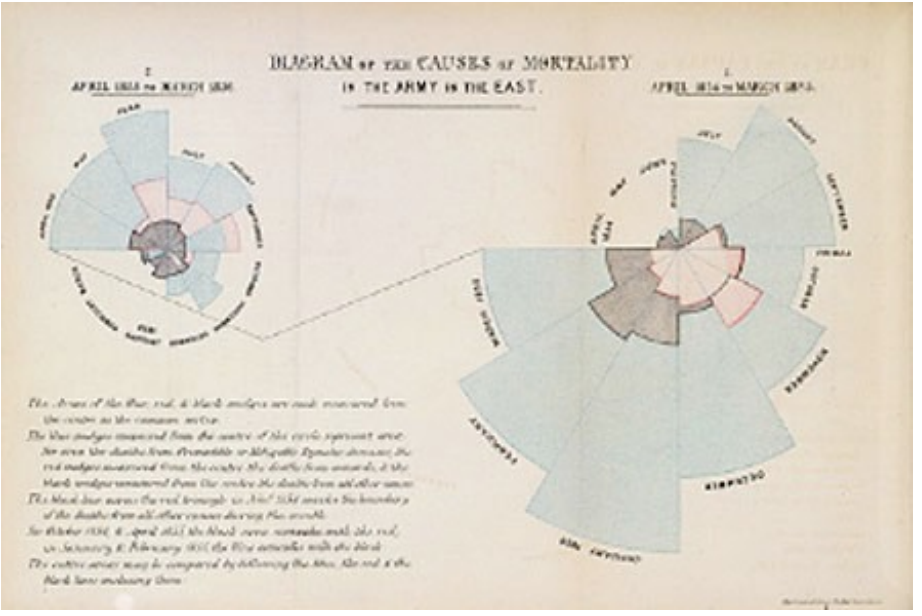
Abstract data







W. Playfair (1786)

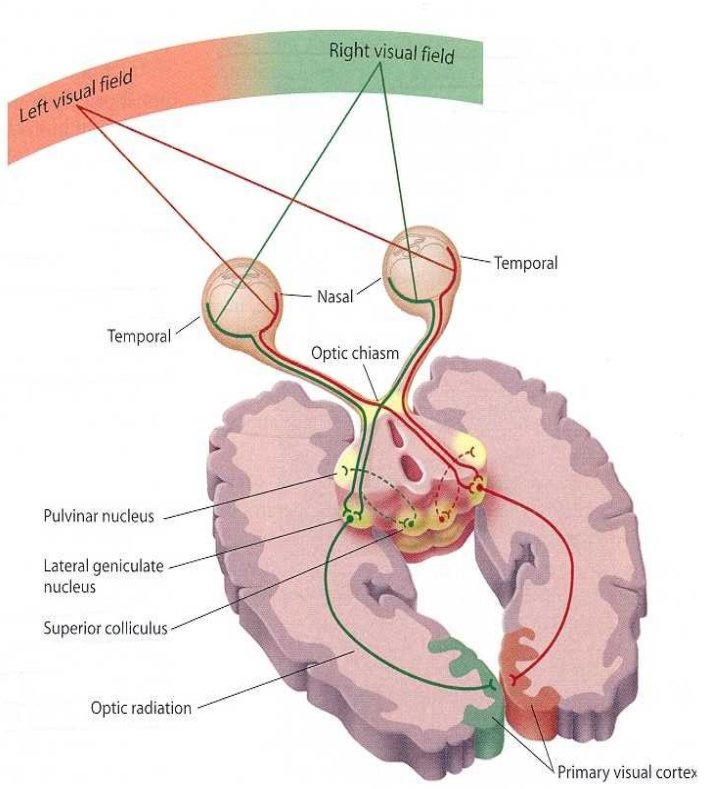


F. Nightingale (1856)

Why visualization?

Visual cortex

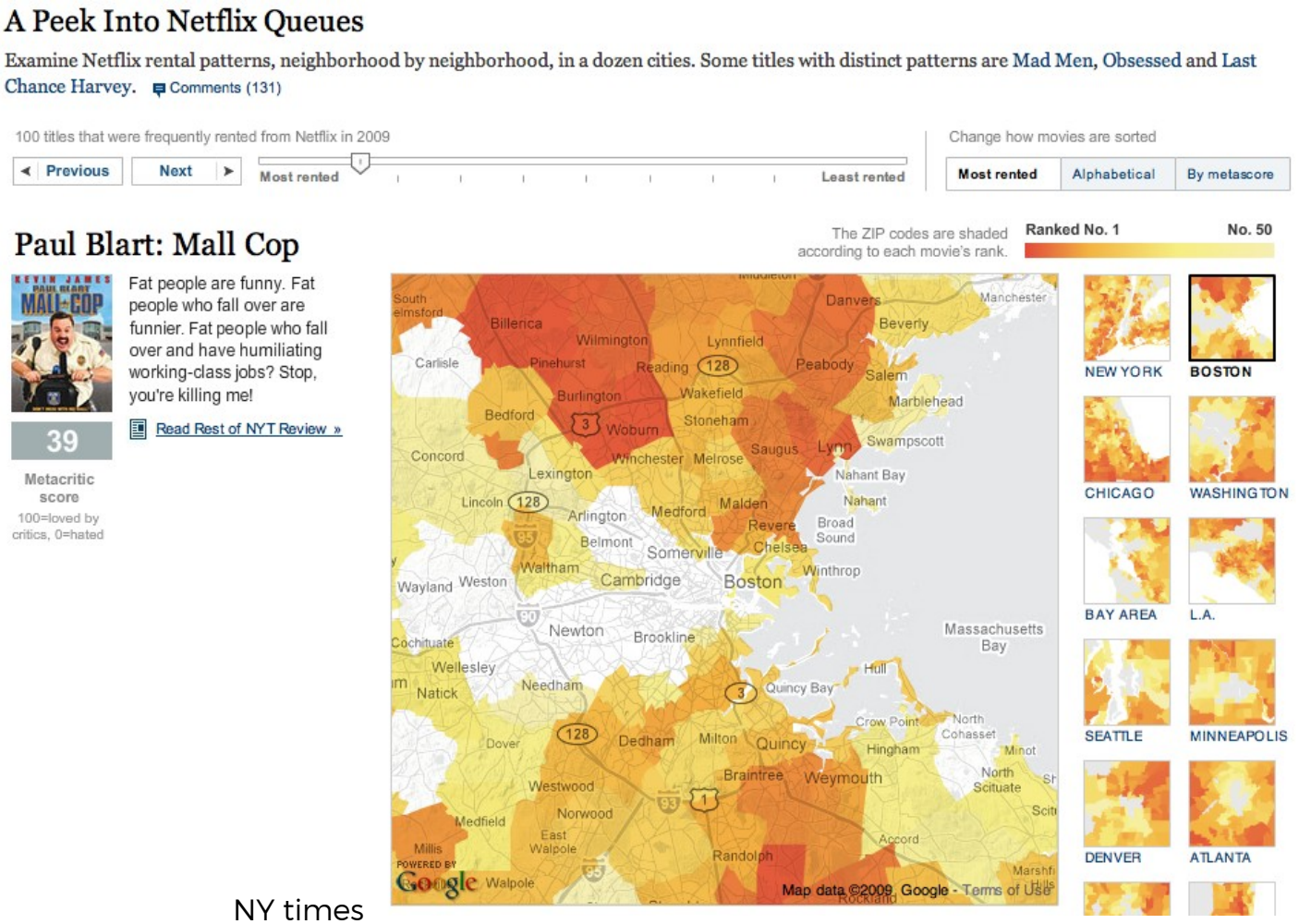
- Visualization exploits our powerful visual system
- Several billion neurons devoted to analyzing visual information (30% cortex)
- 8% for touch, 3% for hearing (Discover, 1993, Ware, 2013)
- Enables massively parallel processing of the visual field, i.e., incoming color, motion, texture, shapes etc.



Discovery

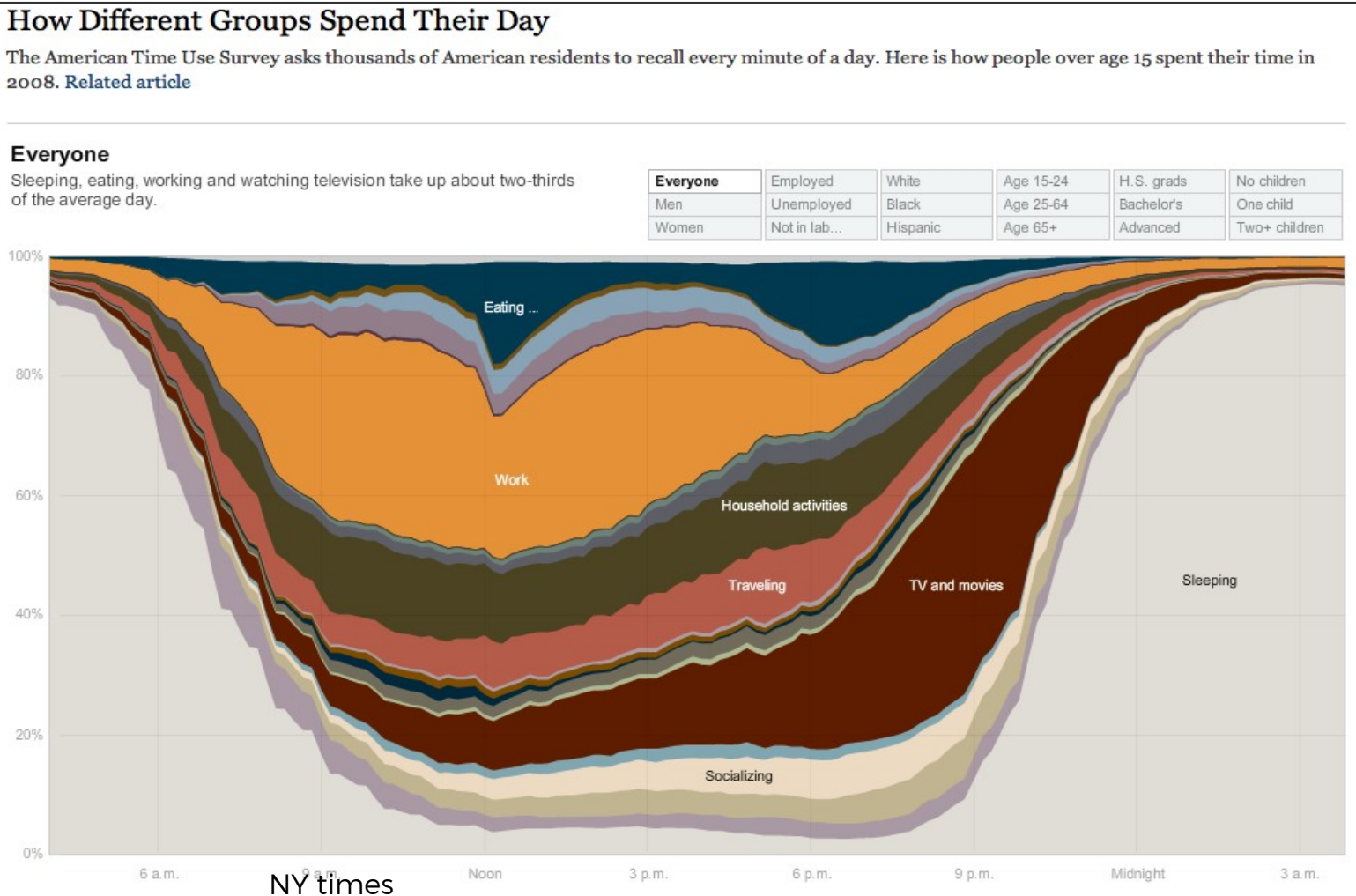
John Snow (1854)

Interaction



NY times

Communication



NY times

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