Terminology

What is Information Visualization?

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Terminology

- Data Visualization

- Scientific Visualization

- Information Visualization

- Statistical Graphics

- Visual Analytics

- Information Dashboards

- Infographics

- Informative Art

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Terminology

- **Differences between terms are often fuzzy**
  – Information visualization *versus* infographics

- **Differences between terms are sometimes highly contested**
  – Information visualization *versus* statistical graphics

- **Differences between terms often come down to 2 aspects**
  – Type of data being visualized
  – Why data is being visualized

http://andrewgelman.com/2011/07/22/information-visualization-vs-statistical-graphics/

Data Visualization

- **Communicates non-visual data visually**

- Results should be readable and recognizable*

- Transforms raw **data** into **information**

- Subfields include **scientific visualization** and **information visualization**
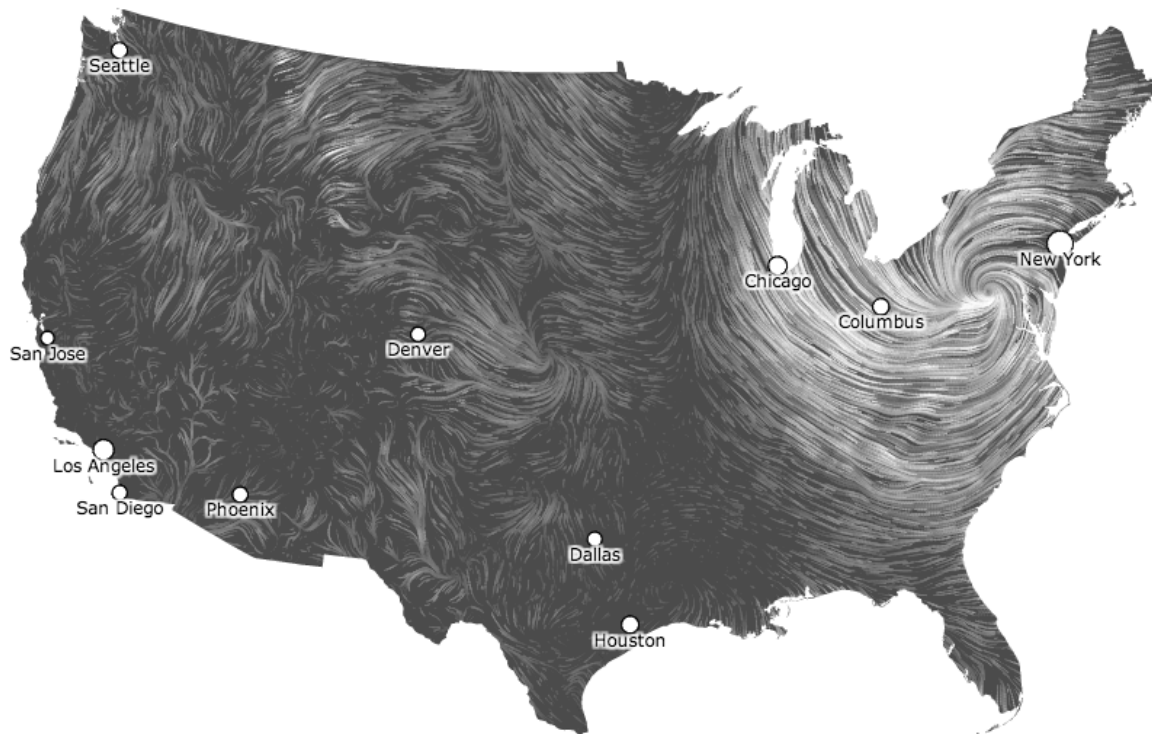
* http://eagereyes.org/criticism/definition-of-visualization

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- 3D rendered image

- Example of computer graphics

- NOT an example of data visualization

http://venturebeat.com/2009/03/08/caustic-graphics-to-create-graphics-chips-with-novel-ray-tracing-technology/

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- Wind map

- Non visual data
  - Wind speed
  - Wind direction

- Displayed visually

- Example of data visualization

http://hint.fm/wind/gallery/oct-30.js.html

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Scientific Visualization

- Visualizes **scientific data** (1D, 2D, or 3D data points)

- Data often scalar or vector fields from computer simulations

- Aims to convey scientific data **accurately**

- Aims to reveal underlying **structure** in data

- Aims to encourage **exploration** of data (interactivity)

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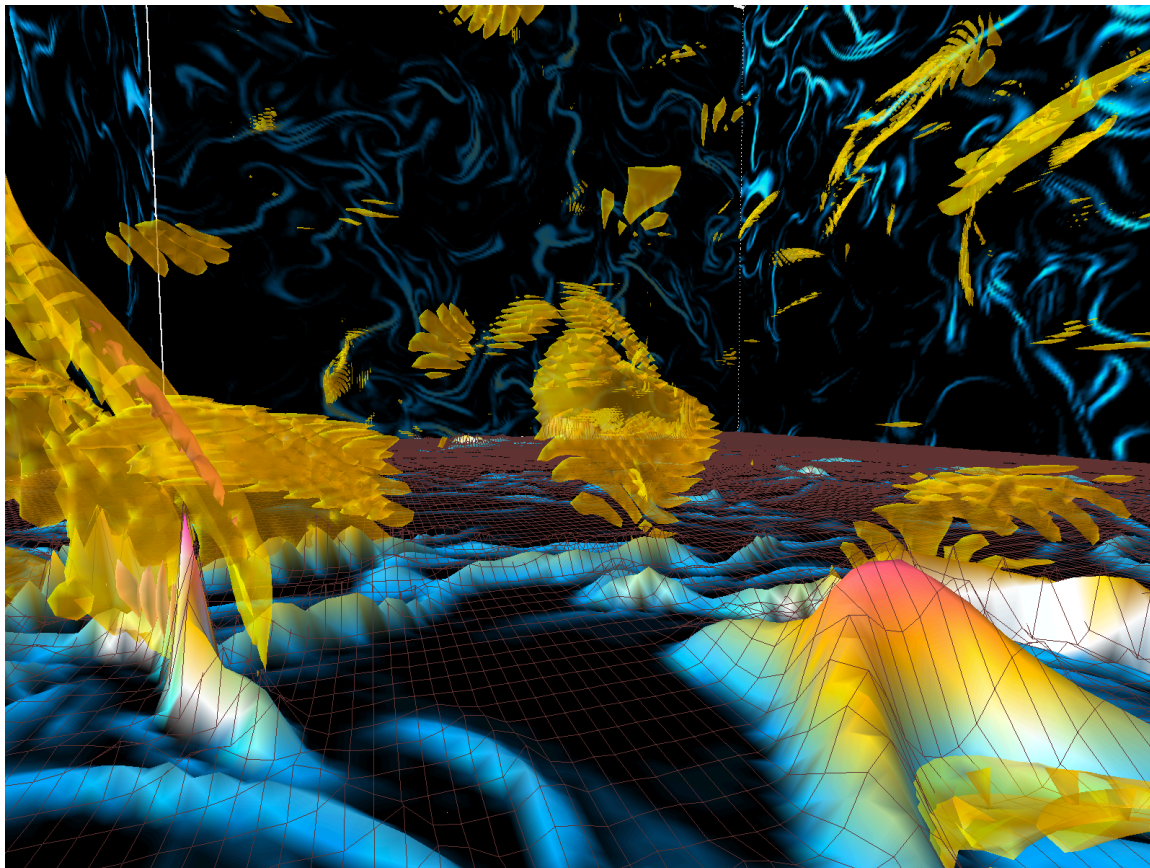
- Visualization to help understand turbulent flows

- Example of scientific visualization

http://vis.lbl.gov/Events/SC04/Incite3/index.html

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Information Visualization

- Visualizes **abstract data** (has no inherent physical form)
- Data may be numerical, categorical, temporal, geospatial, or textual/unstructured
- Aims to convey abstract data **accurately**
- Aims to reveal underlying **structure** in data
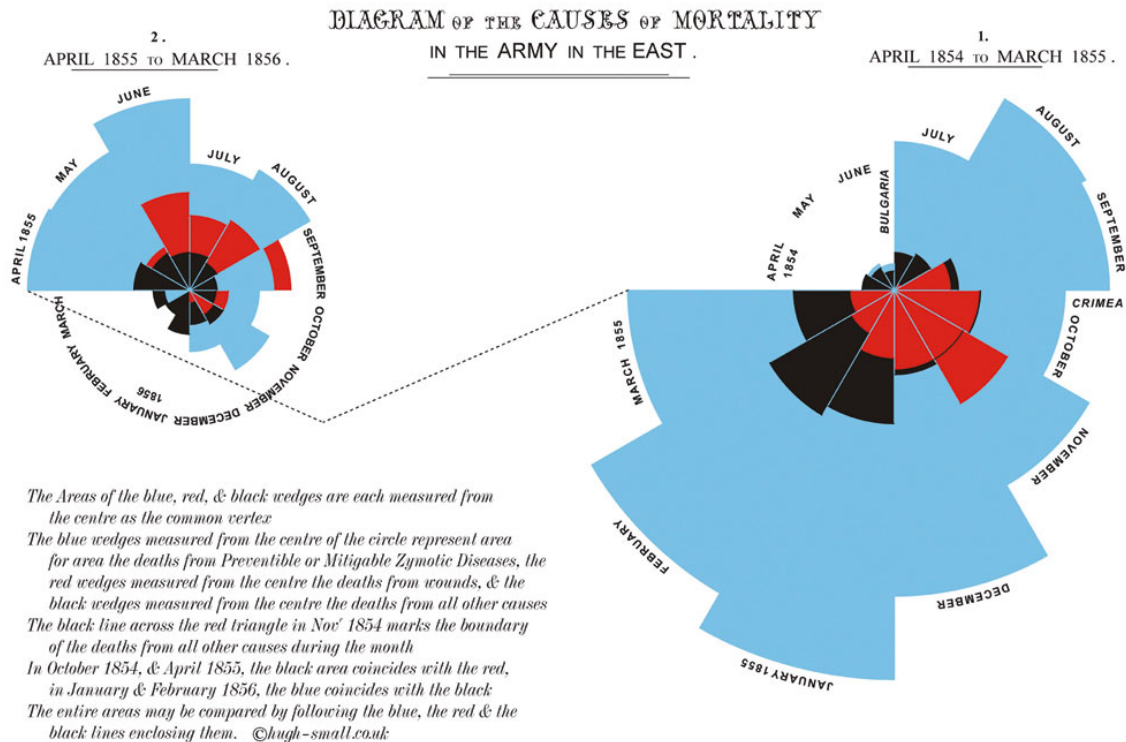- Aims to encourage **exploration** of data (interactivity)
- Aims to display data **aesthetically**

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DIAGRAM OF THE CAUSES OF MORTALITY
IN THE ARMY IN THE EAST.

2.
APRIL 1855 TO MARCH 1856.

1.
APRIL 1854 TO MARCH 1855.

The Areas of the blue, red, & black wedges are each measured from
  the centre as the common vertex
The blue wedges measured from the centre of the circle represent area
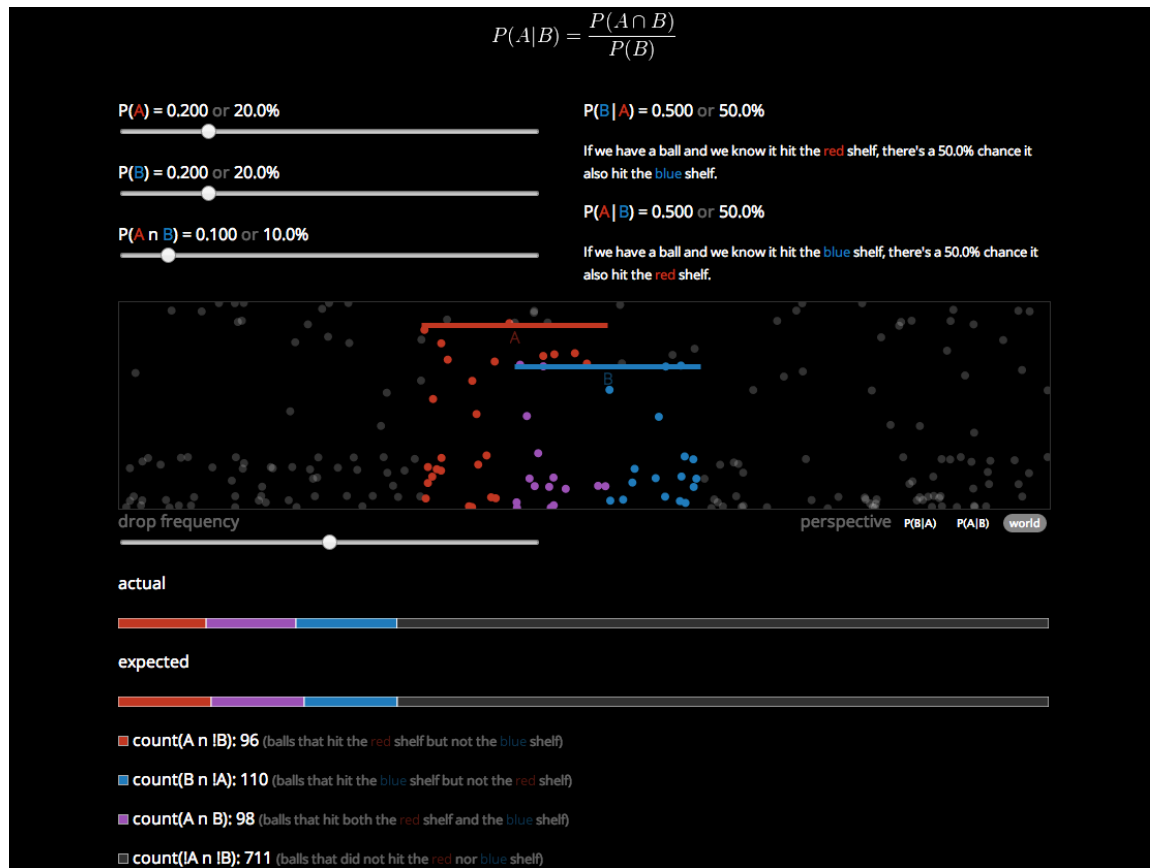 for area the deaths from Preventible or Mitigable Zymotic Diseases, the
  red wedges measured from the centre the deaths from wounds, & the
  black wedges measured from the centre the deaths from all other causes
The black line across the red triangle in Nov' 1854 marks the boundary
  of the deaths from all other causes during the month
In October 1854, & April 1855, the black area coincides with the red,
  in January & February 1856, the blue coincides with the black:
The entire areas may be compared by following the blue, the red & the
  black lines enclosing them.   ©hugh-small.co.uk

- Known as "Nightingale's Rose"

- An early example of information visualization

- Published in 1858

- Visualizes causes of deaths of soldiers during Crimean war

Created by Florence Nightingale, 1858. Image from http://www.economist.com/node/10278643 online.

The Overall Picture | The View by Industry | Find a company or industry…

Effective tax rate 2007-12 | 0% | 10% | 20% | 30% | 40% | 50% | ≥ 60% | N.A.

OVERALL 29.1%

S.&P. 500 companies

About one of every seven companies had an effective tax rate lower than 10 percent, including **Amazon** at 6 percent and **Verizon** at 9 percent. Nine companies paid no taxes at all.

Each circle represents a company, sized by its market capitalization. The largest is **Apple**, at more than $400 billion, with an effective tax rate of 14 percent.

Combining earnings and taxes for all S.&P. 500 companies gives an effective tax rate of 29.1 percent. But rates vary widely by industry.

Show Industries

Three big energy firms paid the most taxes in absolute terms: **Exxon** $146 billion; **Chevron** $85 billion; and **ConocoPhillips** $58 billion.

Effective tax rates cannot be computed for several dozen companies because they lost money over the six-year period. For example, **A.I.G.** lost $83 billion while paying $8 billion in taxes. These companies are still included in overall tax rate calculations.

CHART KEY | **Color** shows effective rate | 10 20 30 40 50% | **Size** shows market capitalization · $1B ○ $10B ○ $50B ○ $100B

- Visualizes tax rates by industry

- Encodes multiple types of data

- Interactive

- Aesthetically pleasing

http://www.nytimes.com/interactive/2013/05/25/sunday-review/corporate-taxes.html

$$P(A|B) = \frac{P(A \cap B)}{P(B)}$$

P(A) = 0.200 or 20.0%

P(B) = 0.200 or 20.0%

P(A n B) = 0.100 or 10.0%

P(B|A) = 0.500 or 50.0%

If we have a ball and we know it hit the red shelf, there's a 50.0% chance it also hit the blue shelf.

P(A|B) = 0.500 or 50.0%

If we have a ball and we know it hit the blue shelf, there's a 50.0% chance it also hit the red shelf.

drop frequency

perspective   P(B|A)   P(A|B)   world

actual

expected

count(A n !B): 96 (balls that hit the red shelf but not the blue shelf)

count(B n !A): 110 (balls that hit the blue shelf but not the red shelf)

count(A n B): 98 (balls that hit both the red shelf and the blue shelf)

count(!A n !B): 711 (balls that did not hit the red nor blue shelf)

http://setosa.io/conditional/

- Visualizes conditional probability

- Animated and interactive

- Aesthetically pleasing

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Statistical Graphics

- Visualizes **statistical data** (also considered abstract)
- Data may be statistical, quantitative, or numerical
- Aims to convey statistical data **accurately**
- Aims to convey underlying **structure** in data
- *Might not necessarily be aesthetically pleasing?*
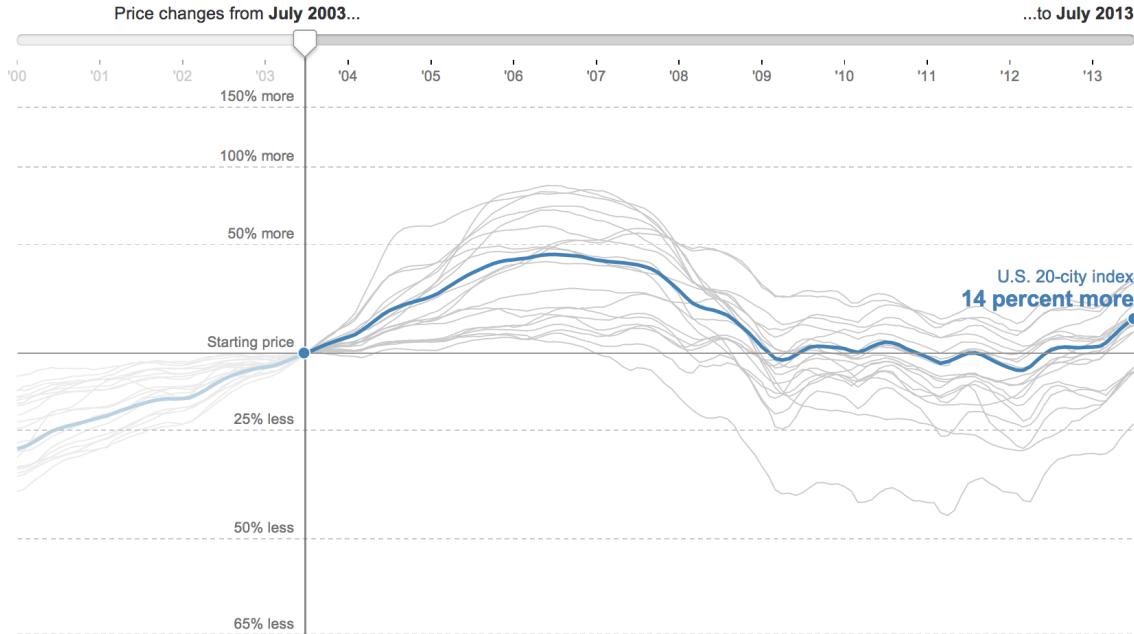- *Might not encourage exploration or be interactive?*

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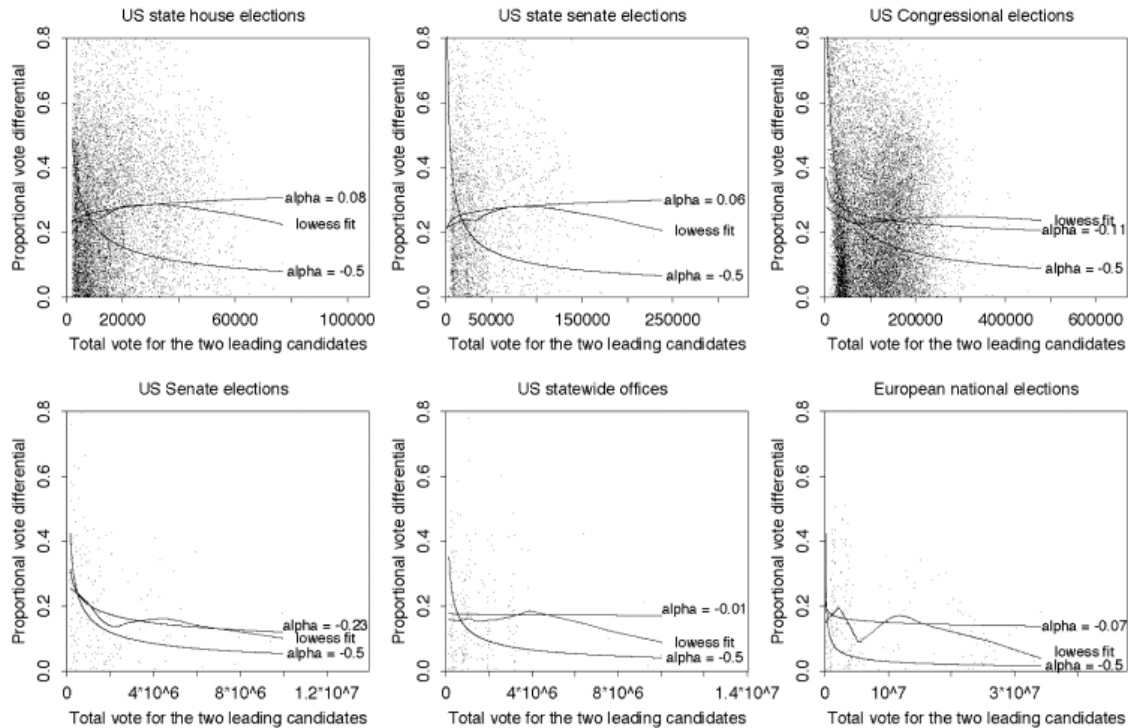
- Examines proportional vote differential

- No interactivity

- Example of statistical graphics

http://andrewgelman.com/2007/10/09/why_the_squarer/

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Housing's Rise and Fall in 20 Cities

If you bought an average home in [a major city ▾] around [Jul. 2003 ▾] it would be worth **14 percent more** today.

Price changes from **July 2003**...

...to **July 2013**

'00 '01 '02 '03 '04 '05 '06 '07 '08 '09 '10 '11 '12 '13

150% more
100% more
50% more
Starting price
25% less
50% less
65% less

U.S. 20-city index
14 percent more

- May be considered statistical graphics

- May be considered information visualization

- Interactive and aesthetically pleasing

http://www.nytimes.com/interactive/2011/05/31/business/economy/case-shiller-index.html

Visual Analytics

- Visualizes **abstract data** (has no inherent physical form)
- Aims to answer a specific question (**goal-oriented**)
- Aims to support **analytical reasoning** with interactive visual interfaces
- Aims to support **expert users**, not general public
- *Might not be aesthetically pleasing*
- *Might not be constrained by a single display*

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- Created to answer specific questions

- Not constrained to a single display

- Example of visual analytics

http://ff.cx/vast-challenge-2012/

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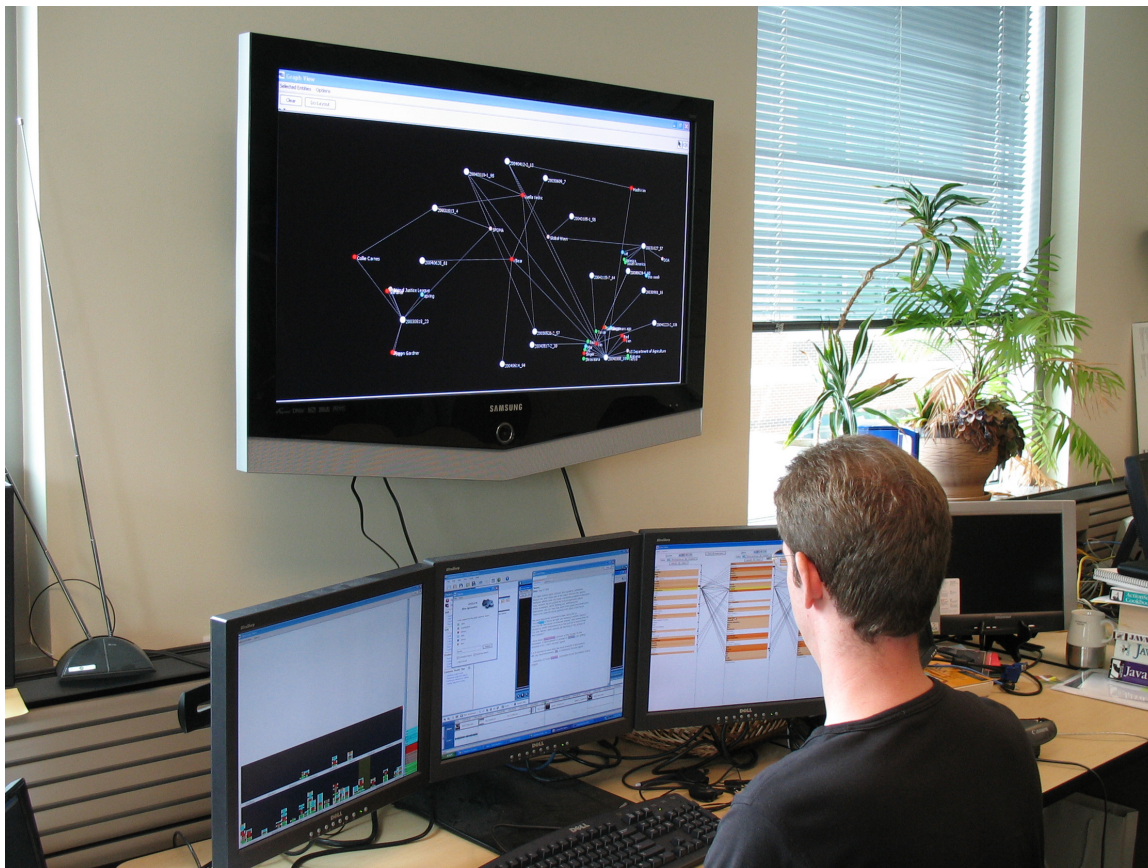
- Multiple views and displays

- Combined with expert user interface
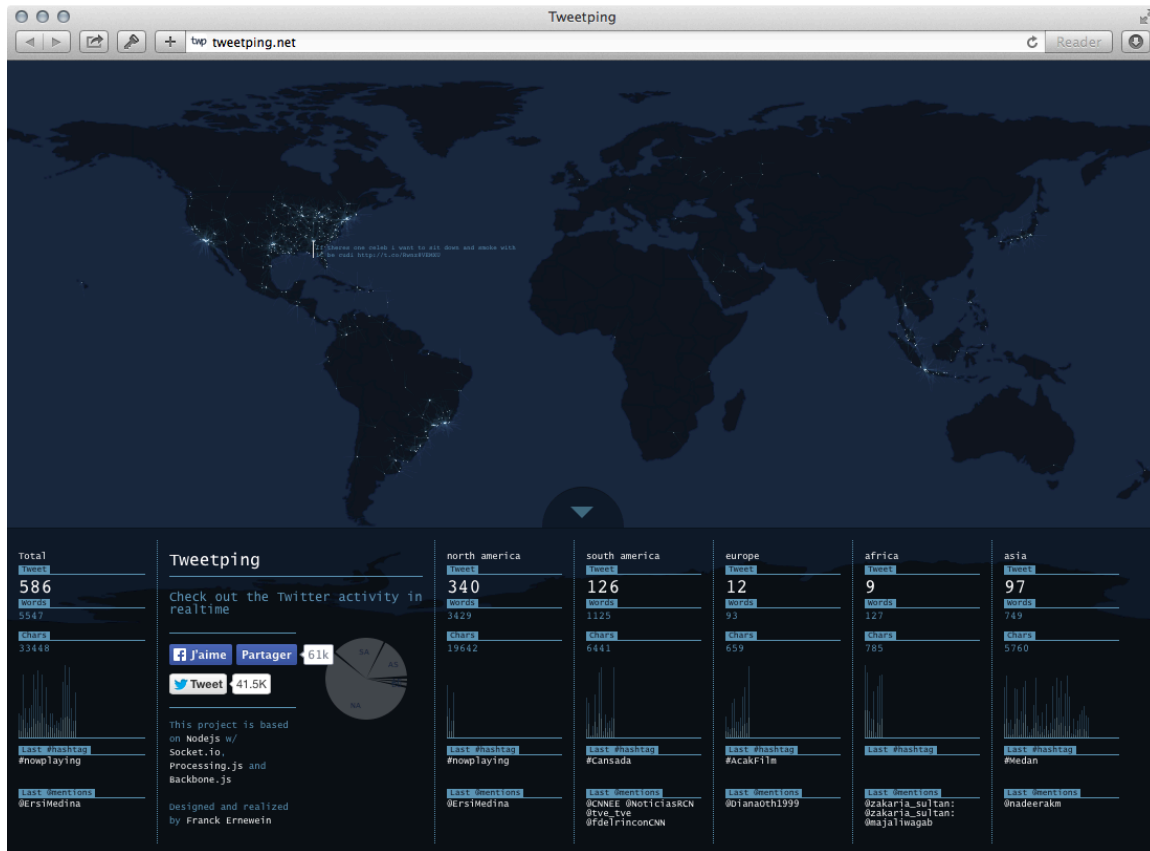
- Used for analysis of document collections

http://gtresearchnews.gatech.edu/newsrelease/visual-analytics.htm • http://www.cc.gatech.edu/gvu/ii/jigsaw/

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Information Dashboards

- Visualizes **temporal data/time series** (also considered abstract)

- Aims to convey large amount of information **quickly**

- Aims to convey **outliers** and **trends** at a glance

- *Might not be interactive (view-only)*

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http://www.perceptualedge.com/blog/?p=1374
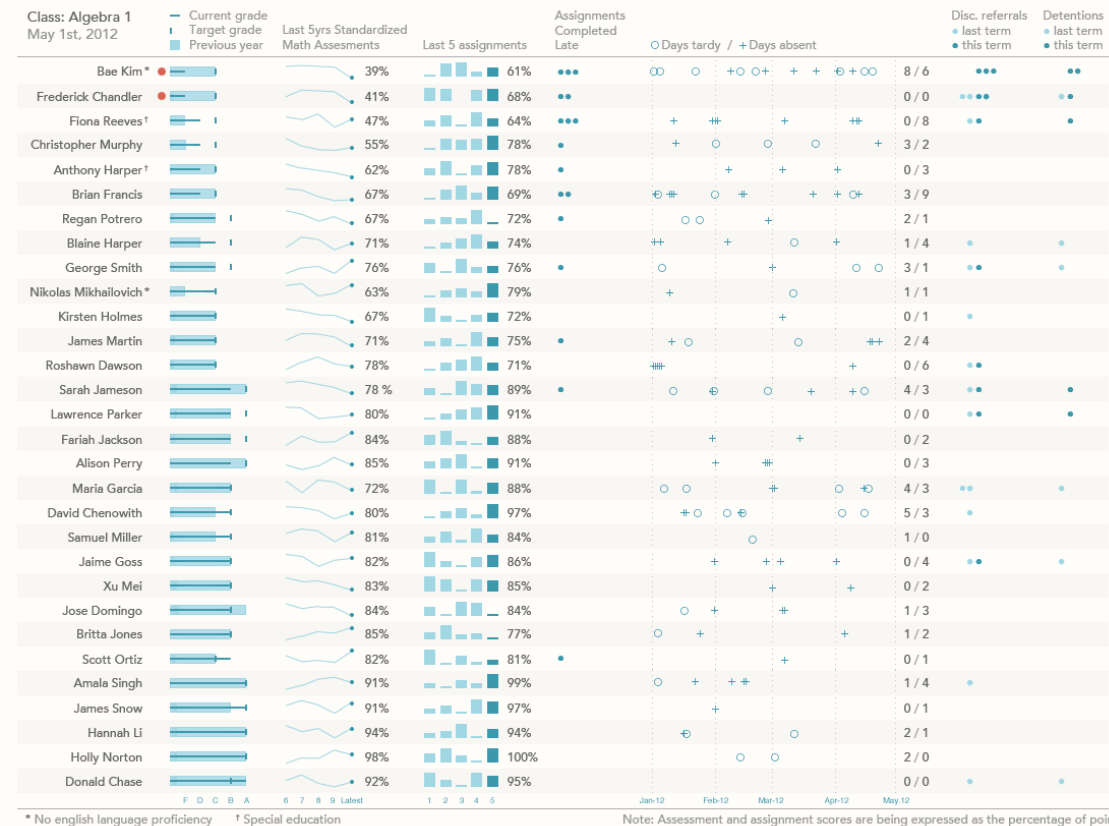
- Red alert icons make outliers easily visible

- Able to see general trends in data

- Extremely dense (parts cutoff for slide)

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- Shows Twitter activity in real-time

- Something you watch more than interact

http://tweetping.net

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Infographics

- Visualizes **abstract data** (has no inherent physical form)

- Aims to be eye-catching and **capture attention**

- Aims to convey information **quickly**

- *Might not be accurate*

- *Might not use space efficiently*

- *Might not encourage exploration of data*

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http://visual.ly/new-world-marketing
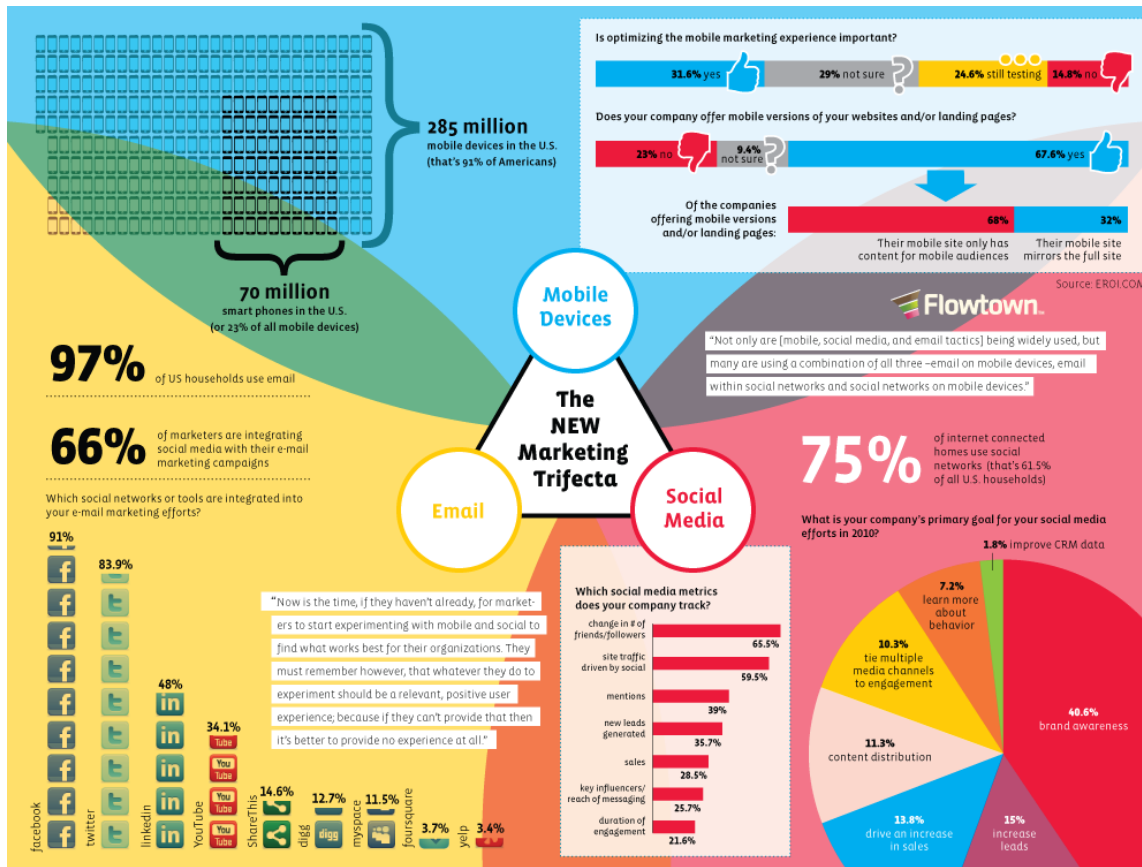
- Extremely colorful and eye-catching

- Silly representations of data (use of icons)
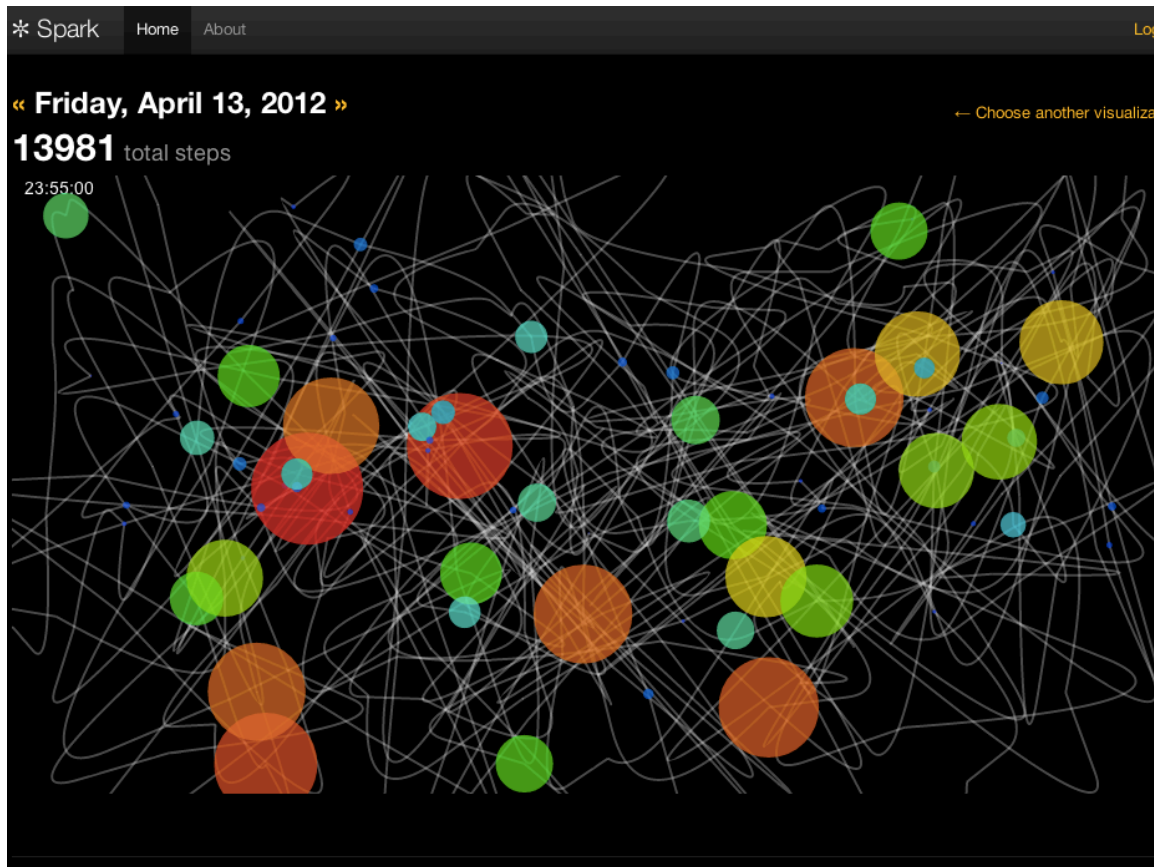
- Ineffective types of visualizations (cutoff pie chart)

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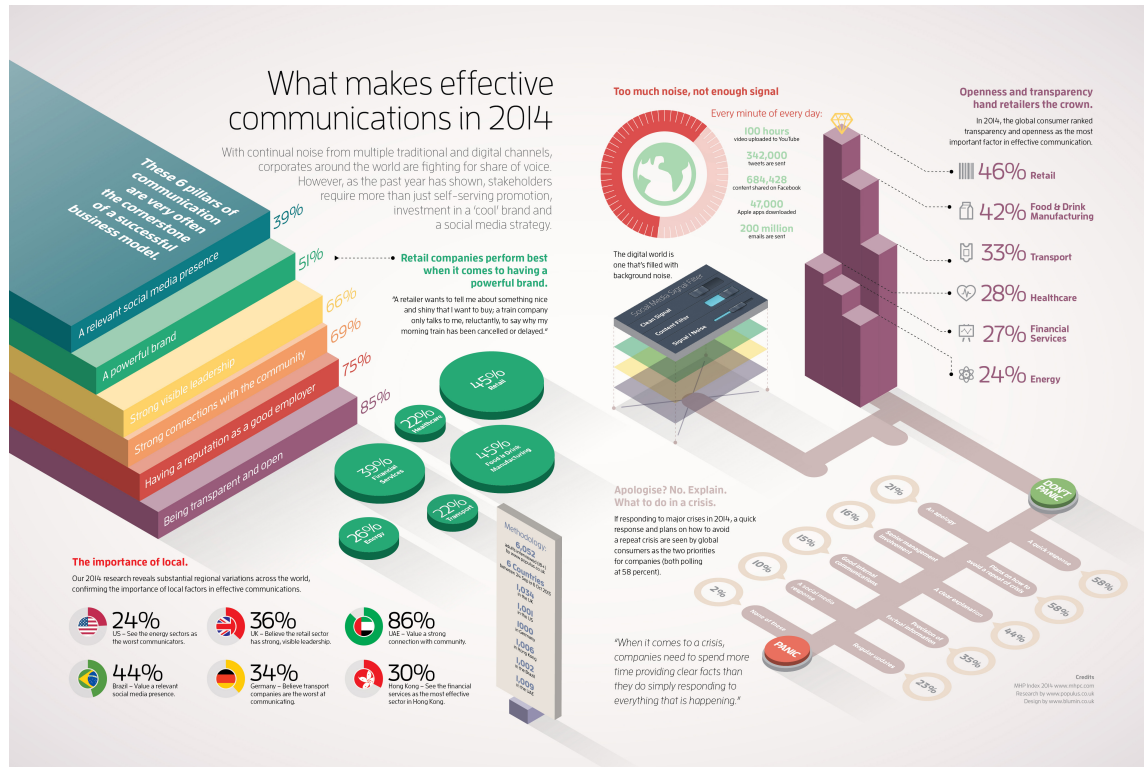
- Cheesy use of 3D hinders ability to interpret data

- Not dense (very few data points shown)

- Aesthetically pleasing

http://visual.ly/what-makes-effective-communications-2014
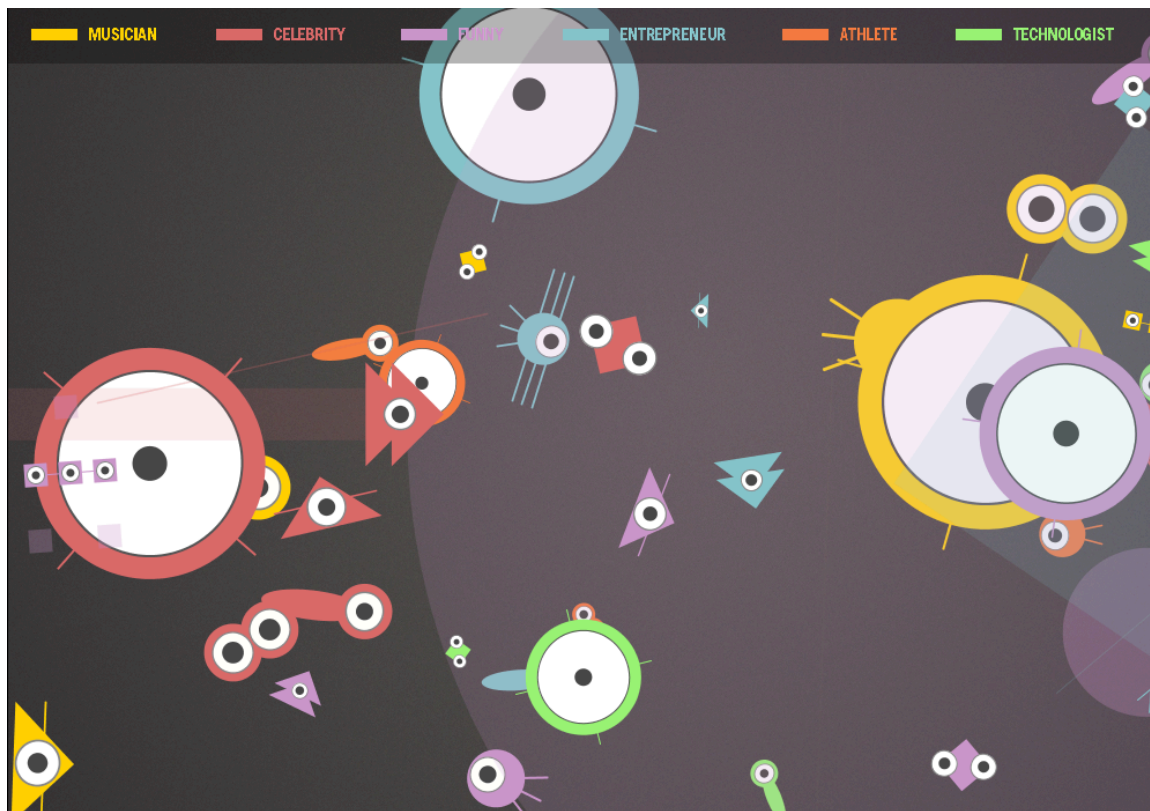
Informative Art

- Sometimes known as ambient visualization

- Visualizes **abstract data** (has no inherent physical form)

- Aims to make visualization **ambient** or a part of everyday life

- Aims to be **aesthetically pleasing**

- *Might not be informative*

- *Might not be eye catching*

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- Inspired by Jackson Pollock

- Lines are random

- Activity causes bubbles to be drawn

http://quantifiedself.com/2012/05/spark-visualizing-physical-activity-using-abstract-ambient-art/

- Visualizes Twitter users as organisms

- Based on dataset with reputation scores

- Interesting to watch, but not necessarily informative

http://kunalanand.com/tweetures/

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- Data wall visualizes in real time data

- Includes interactive touchscreens

- Something you can walk past and appreciate aesthetics, or spend time with

http://www-03.ibm.com/ibm/history/ibm100/us/en/thinkexhibit/

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QUESTIONS?

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