

InfoVis Systems & Toolkits



CS 4460 – Intro. to Information Visualization
September 25, 2017
John Stasko

Learning Objectives



- Gain familiarity with visualization toolkits
 - Learn what design choices need to be made
- Understand approaches taken by systems seeking to support visualization creation without programming
- Explain what Many Eyes was, what it provided, and what its contribution was
- Describe a spectrum of approaches for creating visualizations (ranging from automatic creation given data to low-level graphics libraries) and identify representative systems that occupy different places along that spectrum

Background



- In previous classes, we have examined different techniques for presenting multivariate data
 - We'll continue to show more later too
- Today we look at systems that implement these ideas and provide some of their own new visualization techniques

Creating Visualizations



- Suppose you have a data set
- What are the different (general) ways of creating a visualization of that data?

Agenda



- Toolkits that can be used to build systems
 - D3, Processing, ...
- Tools for creating vizies w/o programming
 - Lyra, iVisDesigner
- Systems providing a view or views
 - Many Eyes
 - Commercial systems
 - Spotfire, InfoZoom, Tableau, QlikView...

Toolkits & Infrastructures



- Set of components or capabilities that allow others to put together visualization systems
- Growing trend

Toolkit Design



- What would you include in a toolkit like this if you designed it?

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D3: Data-Driven Documents



- Newest entry in the Heer-Bostock line of toolkits
 - Prefuse, Flare, Protovis
- “Not just an infovis toolkit”
- Javascript-based
- Very similar to Protovis...
 - Except makes use explicitly of web standards such as Scalable Vector Graphics (SVG) rather than a proprietary “marks” graphics set

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D3 Design Pattern



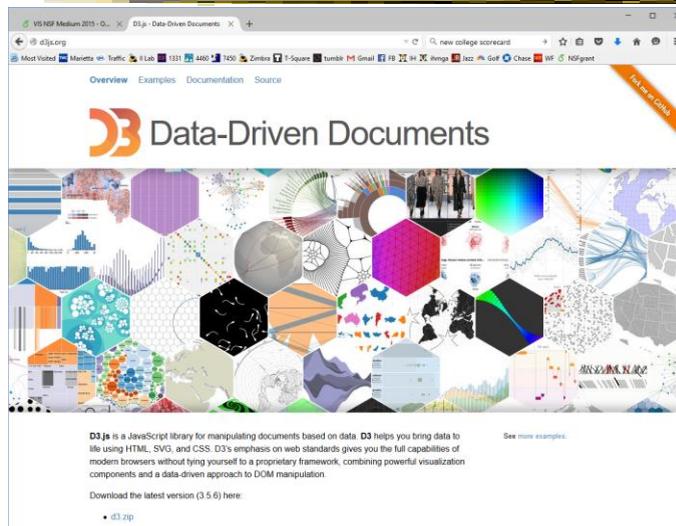
- Declarative Syntax
- Creating/Modifying selections of the HTML DOM
- “An elegant for-loop with a bunch of useful helper functions”
- Excellent support for changing data
 - Taking advantage of CSS3 Transformations and Transitions
- Integrates seamlessly into any webpage

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D3 Website



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D3 Support



- Active community online
 - <https://github.com/mbostock/d3/wiki>
 - Including Mike Bostock often answering questions
- John T. starts describing on Weds.

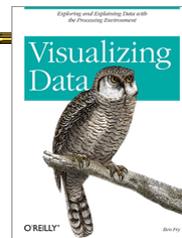
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Processing

<http://processing.org>



- Java based
- Unlike protovis & D3, not specifically designed for InfoVis
 - Data Reader? Layout algorithm?
 - But can definitely be used to build visualizations!
- Well documented, lots of tutorials with contributions from many people and even books

Ben Fry

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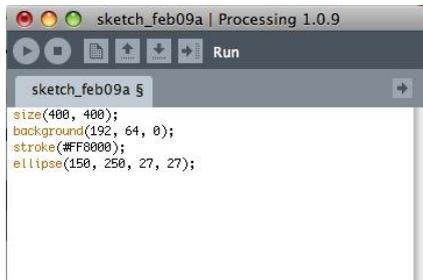
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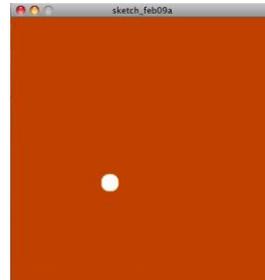
Processing: the idea



- Programming as scripting
 - PDE: processing development environment
 - A program is called a *sketch*
 - written as a list of statements

A screenshot of the Processing IDE window titled 'sketch_feb09a | Processing 1.0.9'. The window has a toolbar with icons for play, stop, save, and run. Below the toolbar is a text area containing the following code:

```
sketch_feb09a §  
size(400, 400);  
background(192, 64, 0);  
stroke(#FF8000);  
ellipse(150, 250, 27, 27);
```



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More toolkits

(Which do you know?)

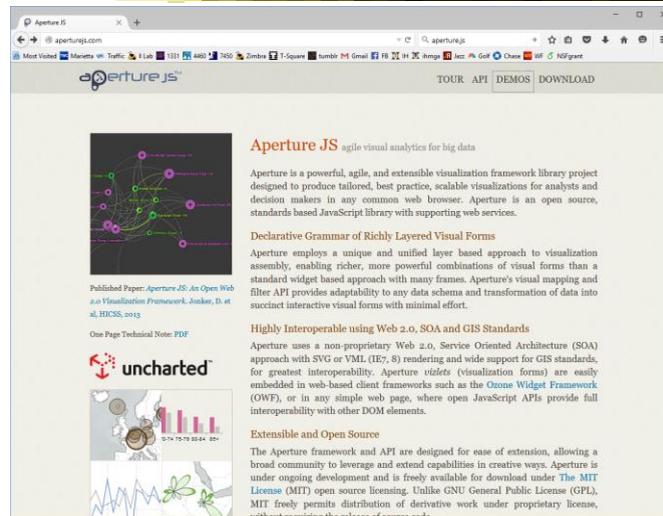
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Aperture.js

<http://aperturejs.com/>



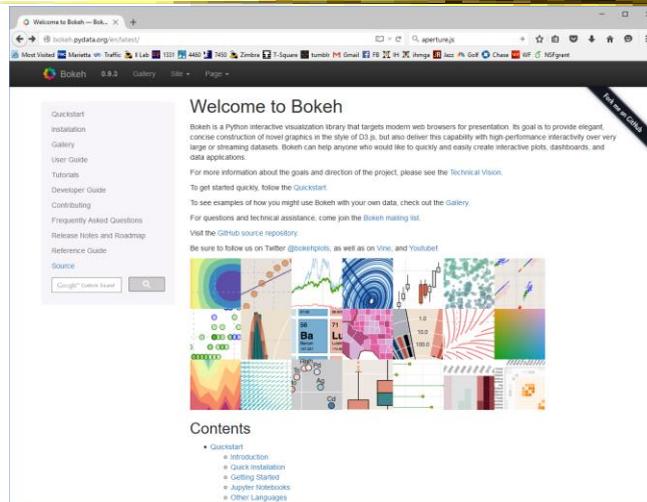
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Bokeh

<http://bokeh.pydata.org/en/latest/>



Python

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http://www.highcharts.com/

HighCharts



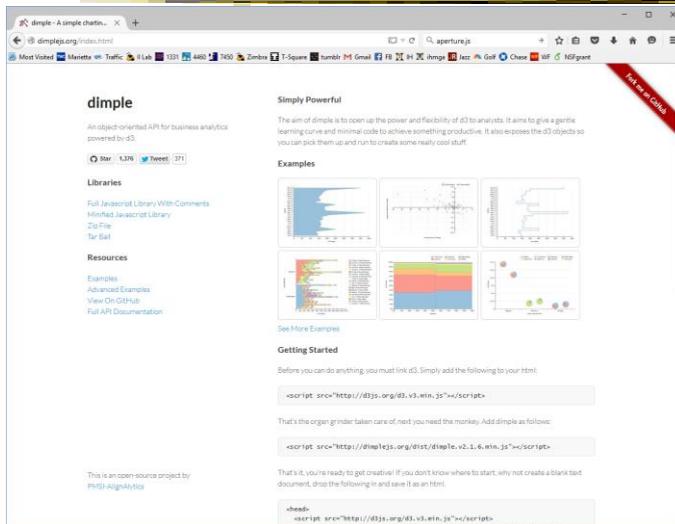
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http://dimplejs.org

dimple



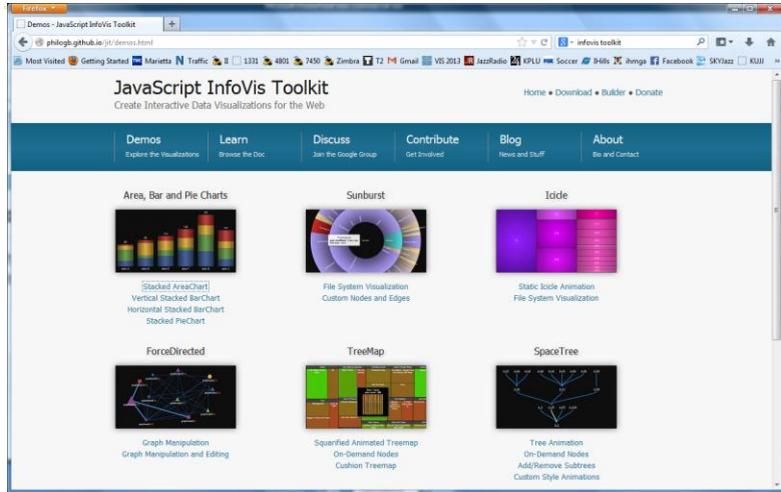
On top of D3

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JavaScript InfoVis Toolkit



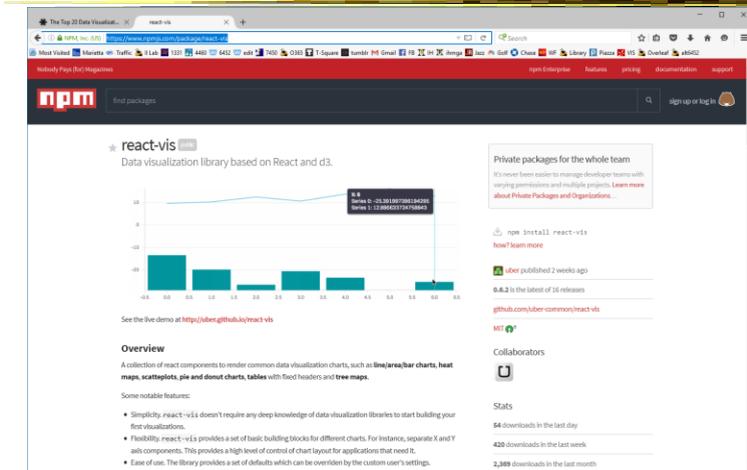
<http://philogb.github.io/jit/>

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react-vis



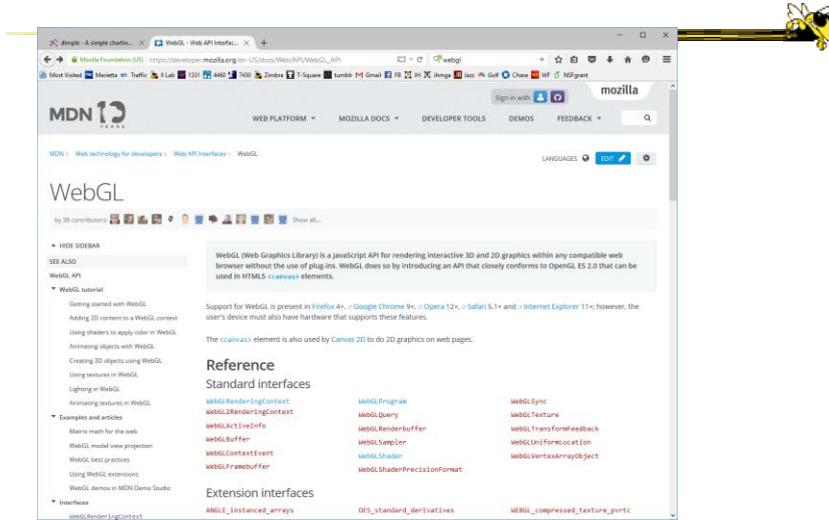
<https://www.npmjs.com/package/react-vis>

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WebGL



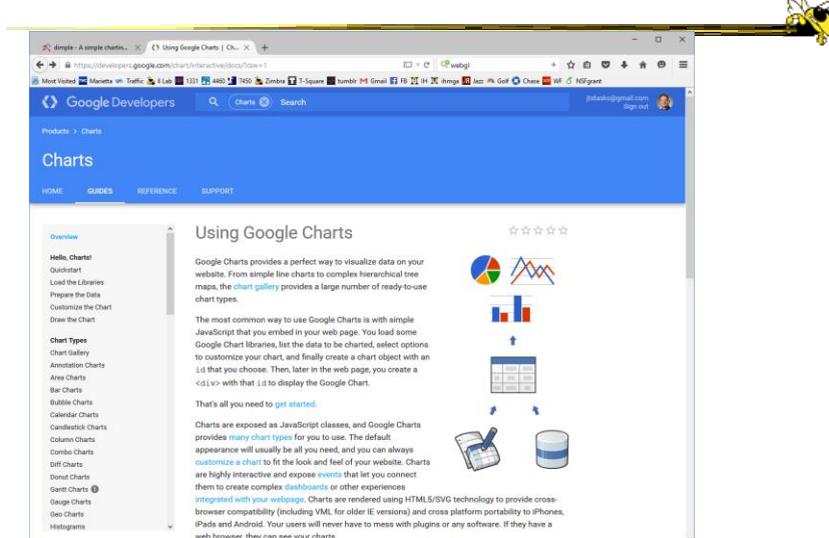
When you need 3D or really sophisticated graphics

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Google Chart Tools



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Toolkit Tradeoffs



- InfoVis-focused
 - Many fundamental techniques built-in
 - Can be faster to get something going
 - Often more difficult to implement something “different”
 - Documentation?
- Generic graphics
 - More flexible
 - Can customize better
 - Big learning curve
 - Doc is often better
 - Can take a long time to (re)implement basic techniques

Writing Code is Hard



- Why not just show what you want the visualization to look like?
 - What’s the challenge?

Lyra



- Interactive vis builder tool without needing to program
- Graphical “marks” are bound to data fields
- User shows what vis is to look like, the mapping from data
- Generates code (Vega) that can be run on the web

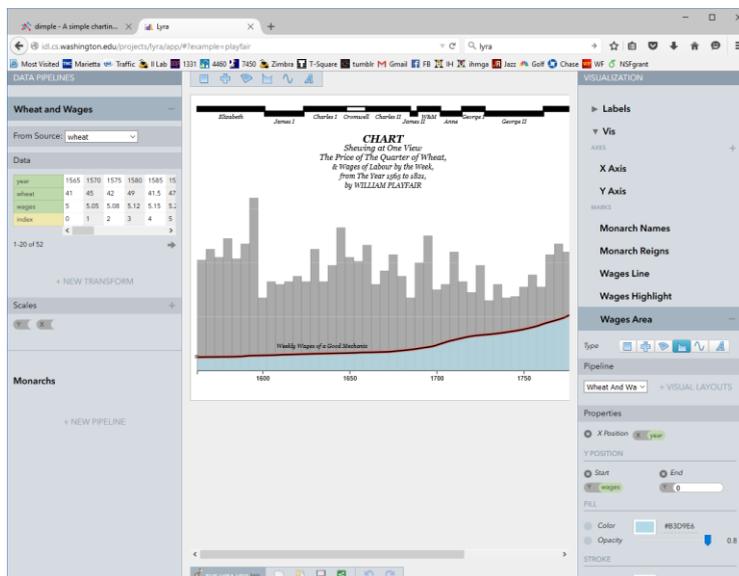
Satyanarayan & Heer
Computer Graphics Forum (EuroVis) '14

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<http://idl.cs.washington.edu/projects/lyra/>



Video

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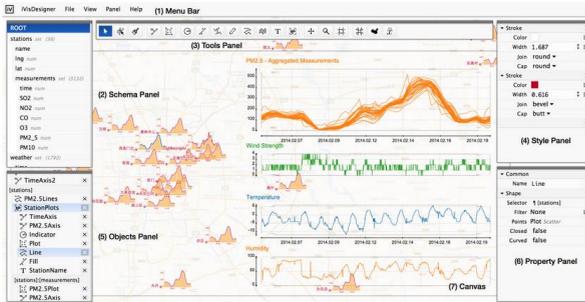
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iVisDesigner



- Interactively create mappings from data elements to graphical elements
- Has scatterplot, timeline, graph templates



Video

Ren, Hollerer, & Yuan
TVCG (InfoVis) '14

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Journalism-driven systems

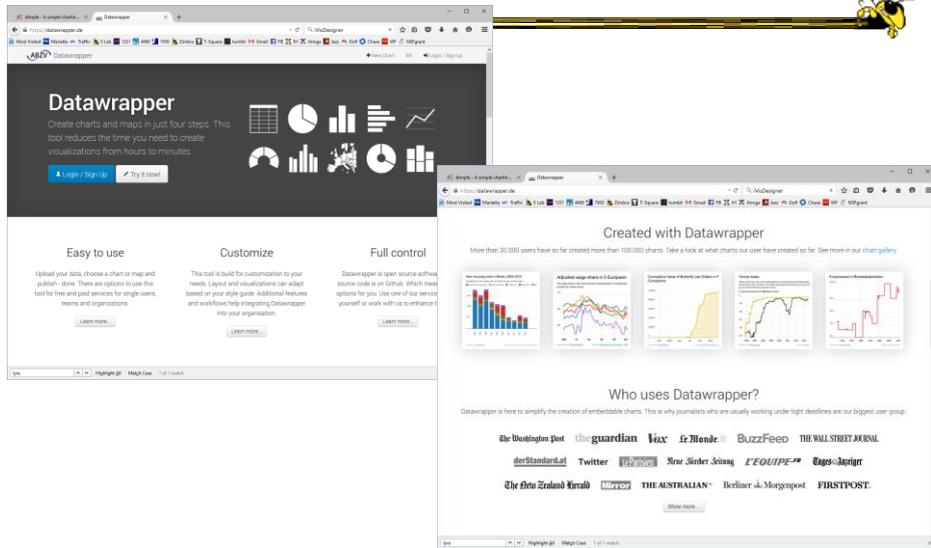
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<https://datarapper.de/>

Datarapper



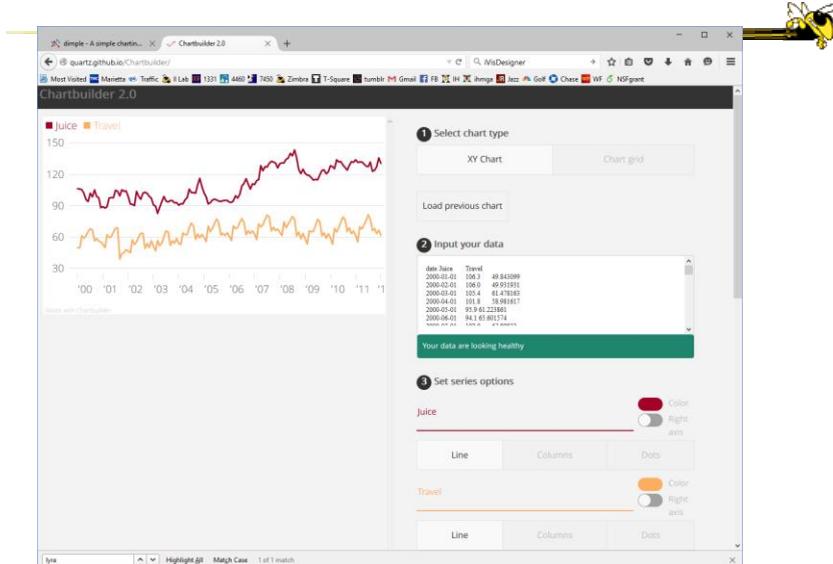
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<http://quartz.github.io/Chartbuilder/>

Chartbuilder



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Systems/Tools



- Academic/research systems that provide preexisting views
- Commercial tools with suite of well-known visualizations

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Many Eyes



- What is it?

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Many Eyes

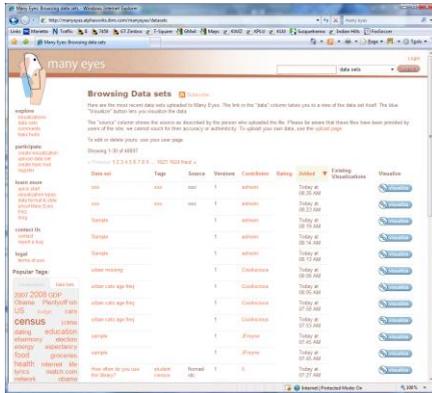


- InfoVis on the web
- Website developed from IBM's infovis group
- Motivating infovis challenges:
 - Difficulty of creating new visualizations
 - How do you discuss the visualizations?
- Project goals:
 - Enable end-user creation of visualizations
 - Foster large-scale collaborative usage

Features



- Provides data upload capabilities and choice from library of visualizations
- Includes
 - Gallery of recently uploaded visualizations for browsing
 - Chosen highlighted visualizations
 - Attached discussion forums for each vis



Recent gallery

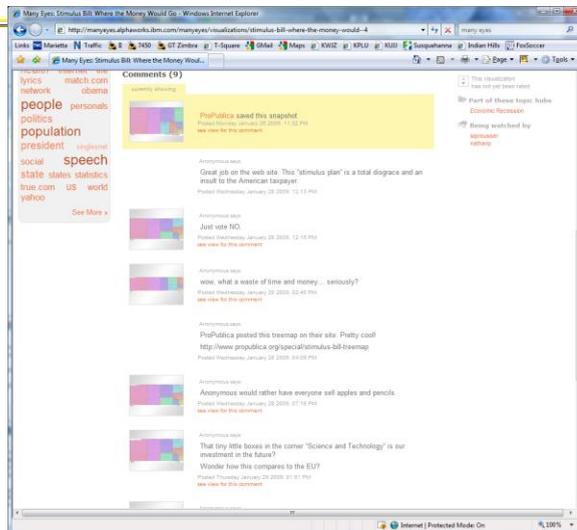
Featured visualizations



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Discussion forums

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Data



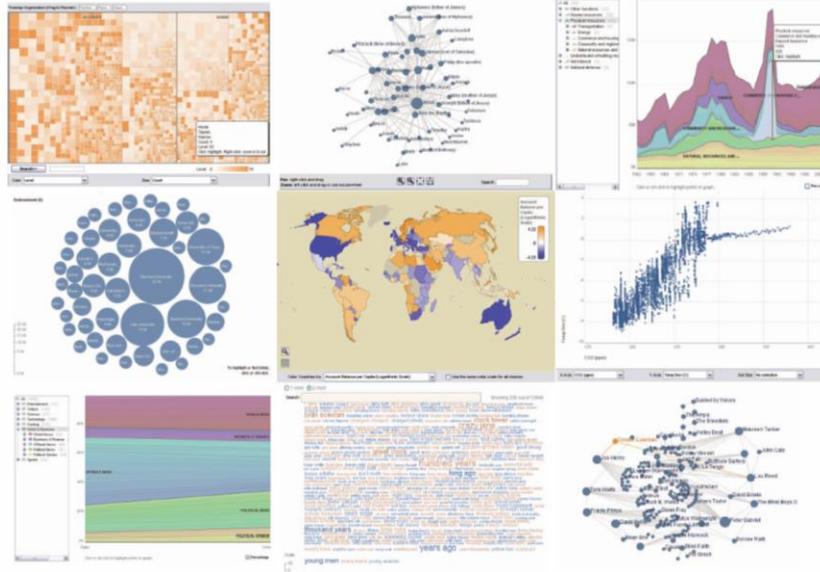
- Users upload their own data sets
 - All become public
- Format: table or unstructured text
 - Metadata allowed
- Immutable once uploaded

Visualizations



- Preloaded visualization types
 - Has grown over time
- User chooses one to combine with their data
- Provides named, typed slots that the user maps particular pieces of data to
 - System makes some reasonable guesses too

Originals

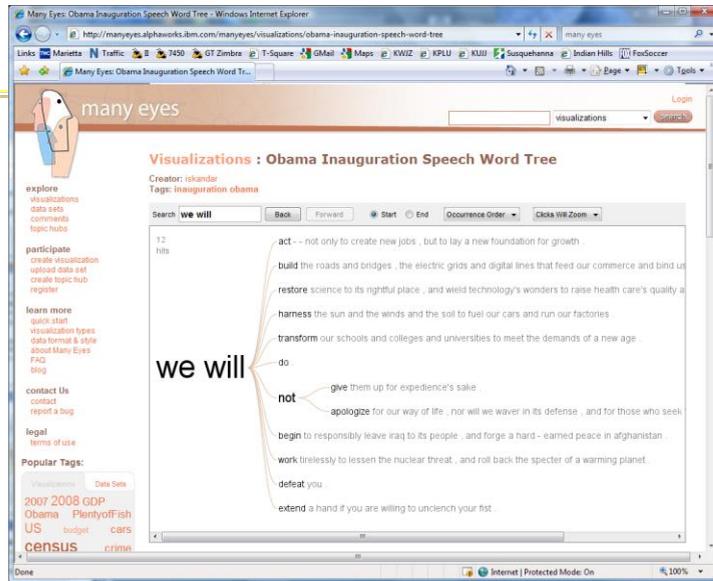


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WordTree



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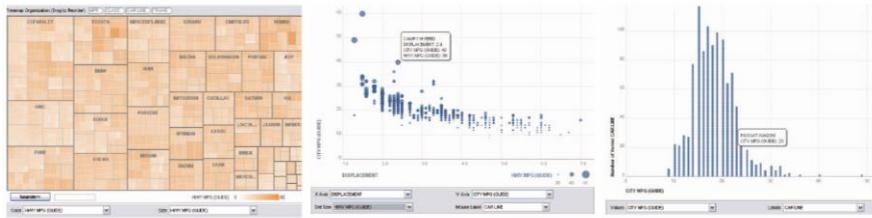


Fig. 3. Three user generated visualizations offering different perspectives on the same dataset on car fuel economy. The grey areas on the top and bottom are automatically generated by the application and allow the user to browse through different dimensions in the data.

Allows the user to control the mapping from data to image

Social Aspects



- Users identified by login ID
- Can leave comments about different visualizations
- Can take snapshot of visualization state
 - Unique URL
- “Blog this” button

Status



- Shut down by IBM on June 12, 2015



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Thoughts?



- What do you think of the design choices they made?

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Commercial Systems



- Designed to handle wide variety of data types and sets
- Typically provide suite of well-known visualizations
- (Preview of upcoming HW)

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Spotfire

spotfire.tibco.com



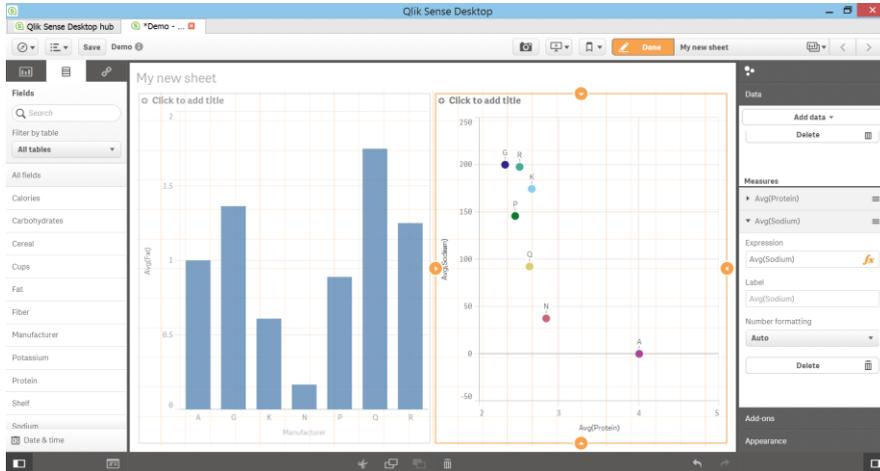
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Qlik Sense

www.qlik.com



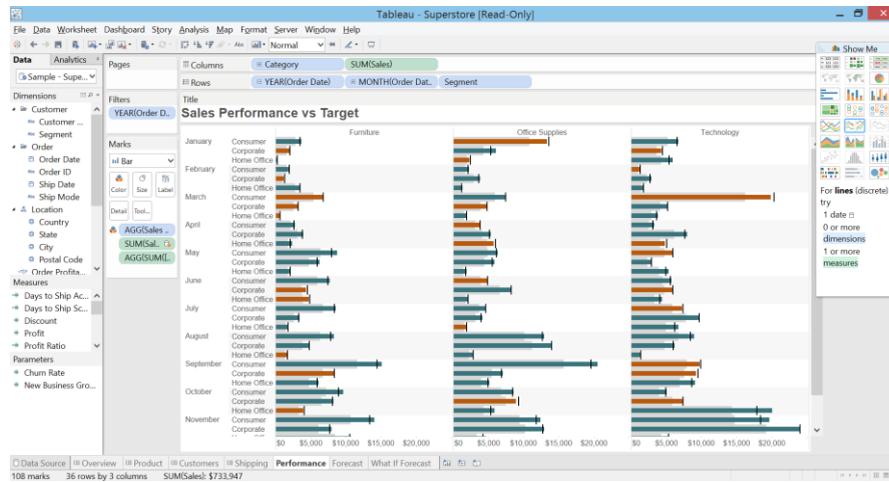
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Tableau

www.tableau.com



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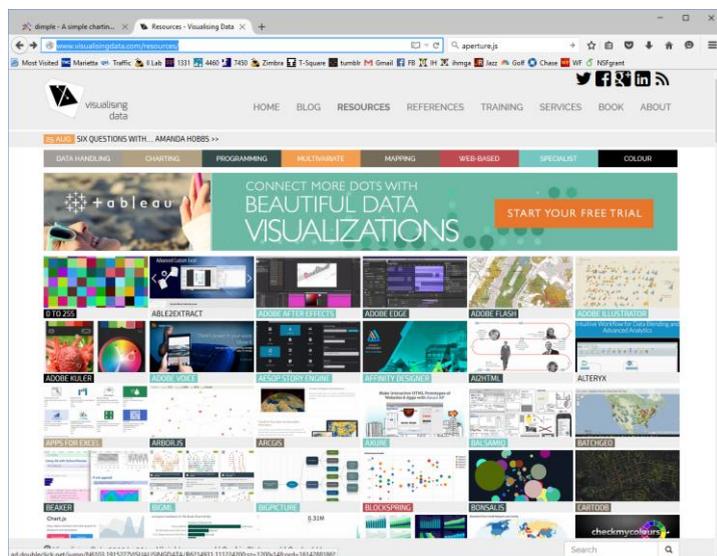
Some web collections

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<http://www.visualisingdata.com/resources/>

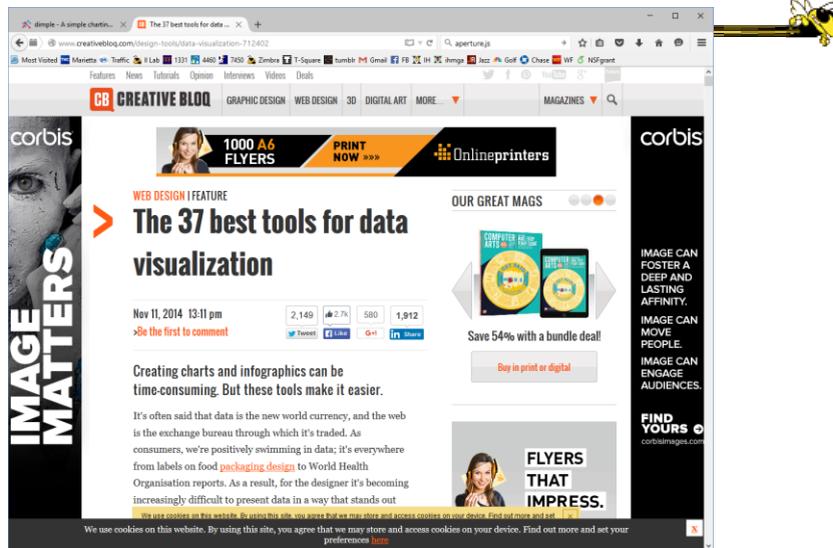


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http://www.creativeblog.com/design-tools/data-visualization-712402

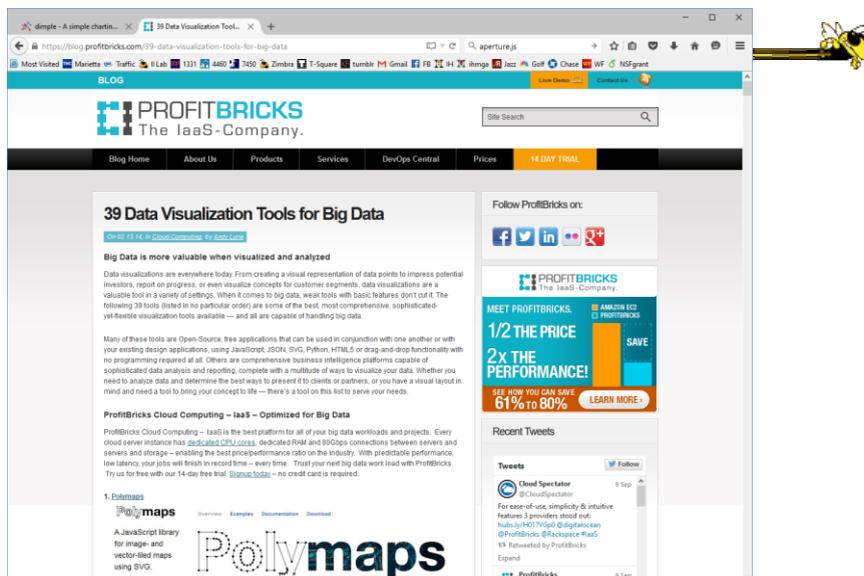


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https://blog.profitbricks.com/39-data-visualization-tools-for-big-data

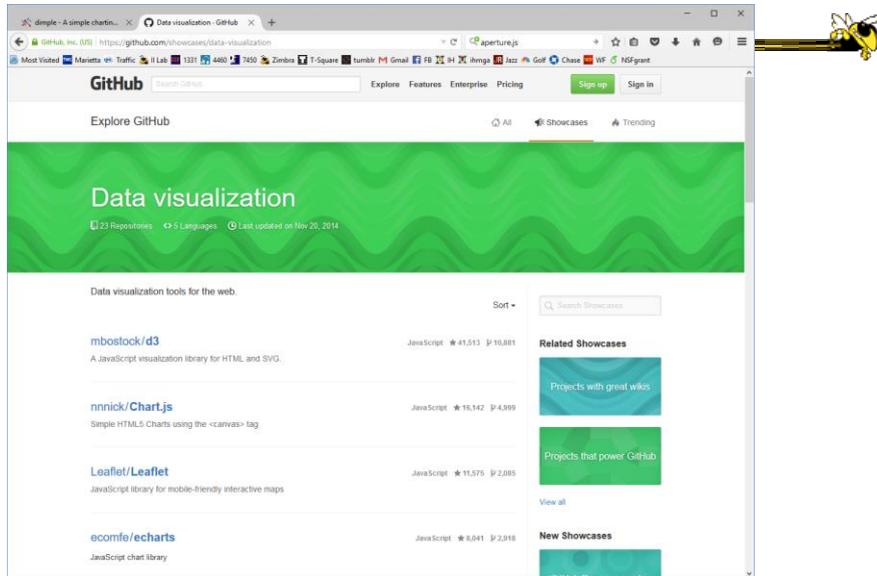


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https://github.com/showcases/data-visualization



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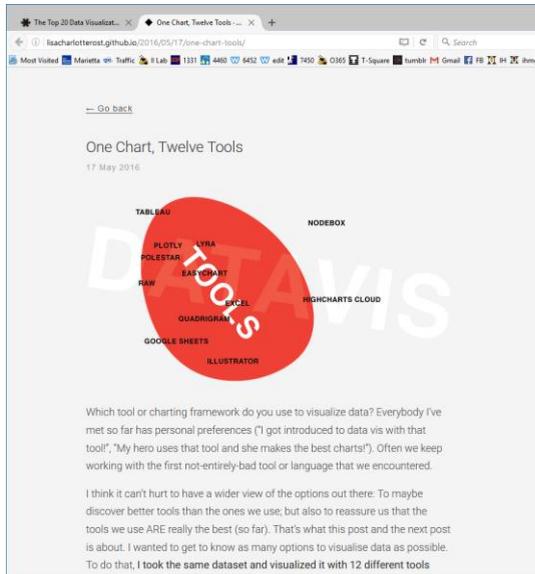
https://articles.uie.com/data_visualization_tools/



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Neat comparison of 12 different tools using the same data set

HW 2



- Recap
- Some solutions
- Problems & issues
- Nice designs

HW 3



- Investigative analysis
- Thumbs up/down?
- Discuss process & your thoughts
- The hidden plot
- Jigsaw suggestions

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HW 4



- Get familiar with Tableau
- Download a free copy
 - Instructions in t-square
- Watch "Getting started" video (in t-square)
- Choose one of three data sets
- Formulate questions, explore, answers
- Produce 5-page report (3/2)
- Due on Friday Oct. 6 at 1pm (no class)

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Midterm Exam



- One week from today

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Upcoming



- Lab: D3 intro
 - Prep: Murray, chapters 5 & 6
- Analytic tasks