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

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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

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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 vizes w/o programming
 Lyra, iVisDesigner
- Systems providing a view or views
 - Many Eyes
 - Commercial systems
 - Spotfire, InfoZoom, Tableau, QlikView...

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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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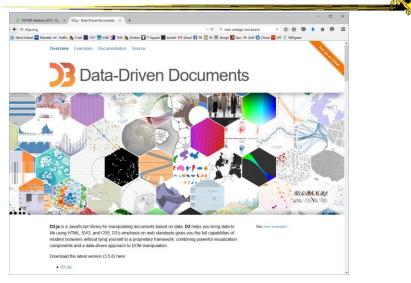
D3 Design Pattern

- 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

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Integrates seamlessly into any webpage

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

- 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

http://processing.org

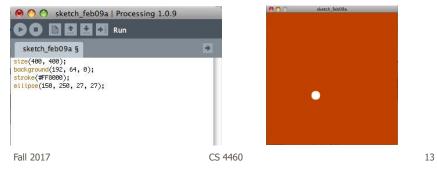
Visualizing

Data

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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



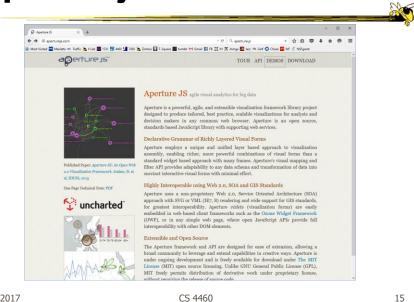
More toolkits

(Which do you know?)

http://aperturejs.com/

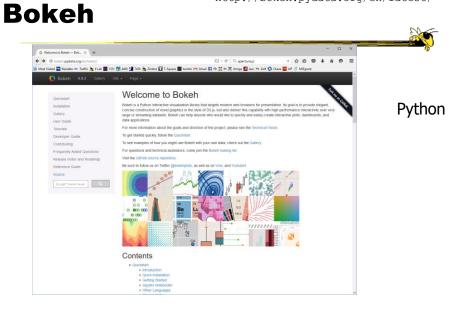
http://bokeh.pydata.org/en/latest/

Aperture.js



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dimple

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http://dimplejs.org



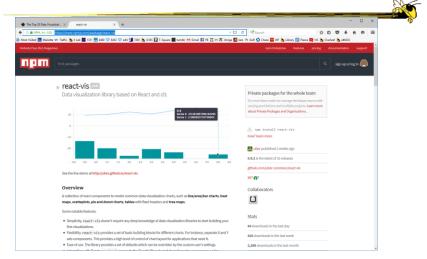
http://philogb.github.io/jit/

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react-vis



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

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https://developer.mozilla.org/en-US/docs/Web/API/WebGL_API

WebGL

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When you need 3D or really sophisticated graphics

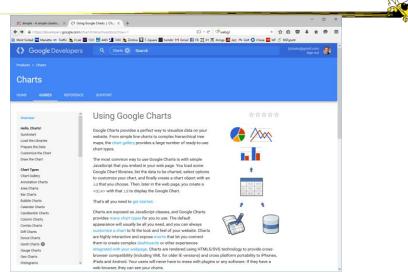
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http://code.google.com/apis/visualization/documentation/

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

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Writing Code is Hard

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

Lyra

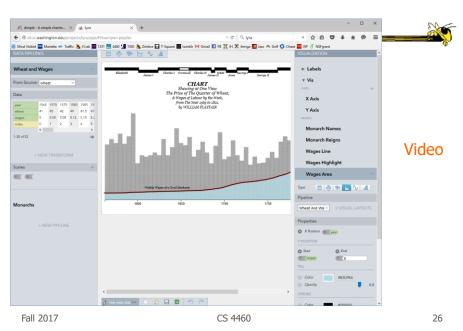
- Interactive vis builder tool without needing to program
- Graphical "marks" are bound to data fields
- User shows what vis is to look like, the mapping from data
- Generates code (Vega) that can be run on the web

Satyanarayan & Heer Computer Graphics Forum (EuroVis) '14

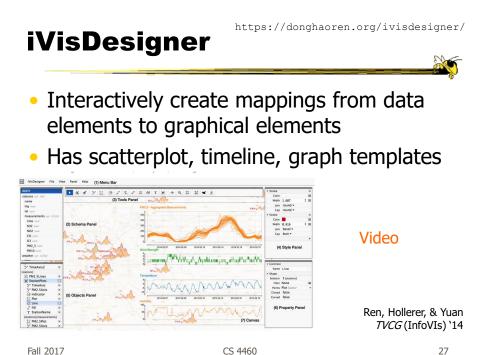
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http://idl.cs.washington.edu/projects/lyra/



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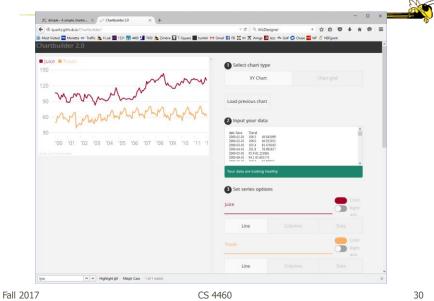
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Journalism-driven systems

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





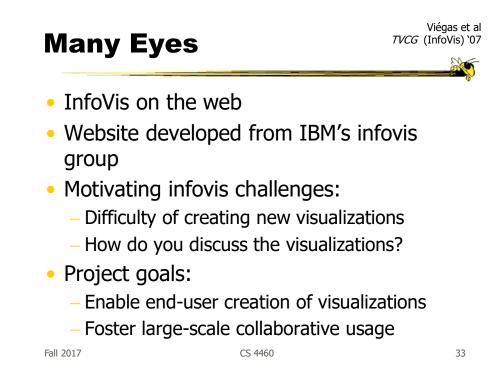
Systems/Tools

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

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Many Eyes

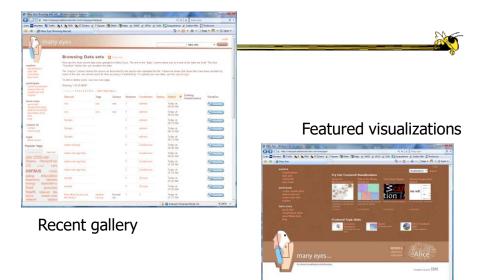
• What is it?



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

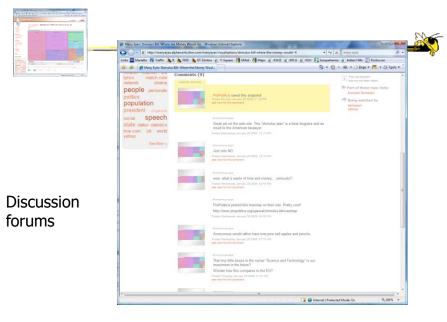


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Data

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

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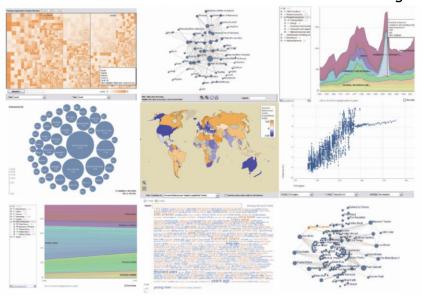
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Visualizations

- 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

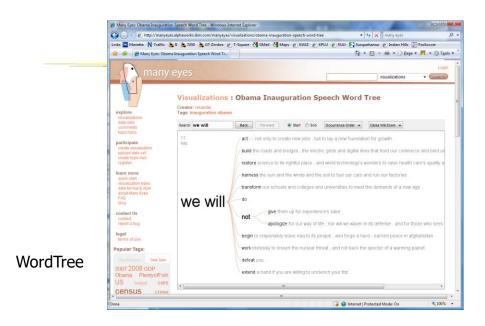
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Originals



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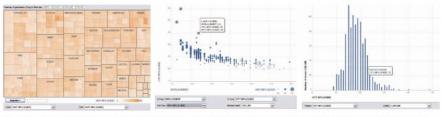


Fig. 3. Three user generated visualizations offering different perspectives on the same dataset on car fuel economy. The grey areas on the top and bottom are automatically generated by the application and allow the user to browse through different dimensions in the data.

Allows the user to control the mapping from data to image

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Social Aspects

• Users identified by login ID

- Can leave comments about different visualizations
- Can take snapshot of visualization state

 Unique URL
- "Blog this" button



Thoughts?

 What do you think of the design choices they made?

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.tibco.com

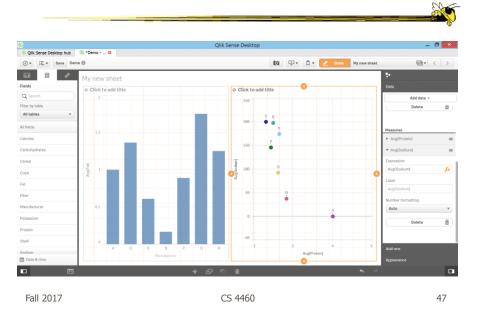
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www.qlik.com

Qlik Sense



www.tableau.com

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Tableau

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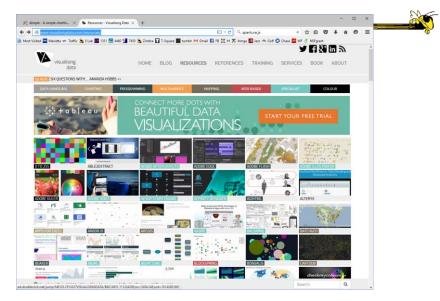


Some web collections

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

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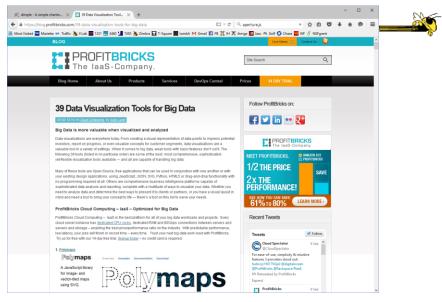


http://www.creativebloq.com/design-tools/data-visualization-712402

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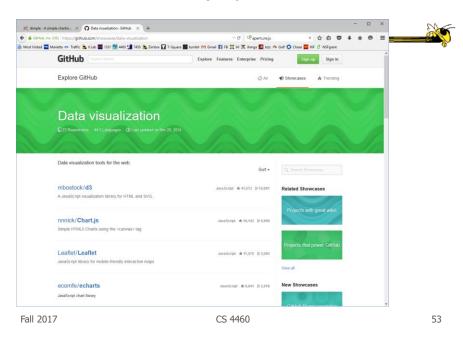


https://blog.profitbricks.com/39-data-visualization-tools-for-big-data

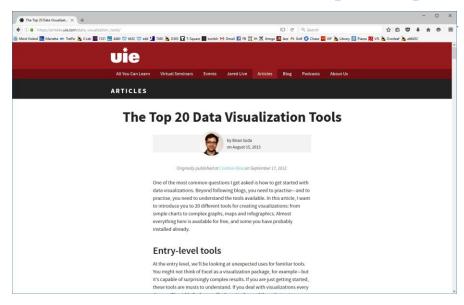
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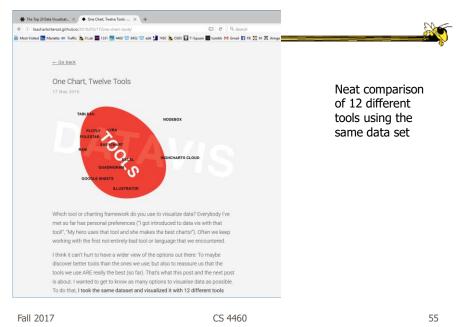
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https://github.com/showcases/data-visualization



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





http://lisacharlotterost.github.io/2016/05/17/one-chart-tools/

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 wi Download a from Instructions in 	ee copy	ţ

- 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)

Midterm Exam

One week from today

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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

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Upcoming

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

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61