InfoVis Systems & Toolkits

CS 4460 – Intro. to Information Visualization
September 25, 2017
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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 vizes 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?

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
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
D3 Support

- Active community online
  - Including Mike Bostock often answering questions

- John T. starts describing on Weds.

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
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?)
Aperture.js

http://aperturejs.com/

Bokeh


Python
HighCharts

http://www.highcharts.com/

On top of D3

http://dimplejs.org
JavaScript InfoVis Toolkit

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

react-vis

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

When you need 3D or really sophisticated graphics

Google Chart Tools

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

iVisDesigner

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

Video

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

Journalism-driven systems
Datawrapper

https://datawrapper.de/

Chartbuilder

http://quartz.github.io/Chartbuilder/
**Systems/Tools**

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

**Many Eyes**

- What is it?
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

Discussion forums
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
WordTree
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

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)

Spotfire

spotfire.tibco.com
Some web collections

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

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

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

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)
Midterm Exam

• One week from today

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Upcoming

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

- Analytic tasks