Information Visualization on the Web

Marian Dörk — CPSC 583 — November 29, 2010
Why the Web?
Growing information space
Community and communication
Self-expression
Goals for this lecture

Better understand the potential of the Web for InfoVis

Know at least three applications of InfoVis on the Web
Web as a platform and dataset
Web as platform

Web server and browser at the core
Web as platform

Third-party web services and data sources
Web as platform

Viewer with information needs and interests
Benefits of Web as platform

Creator

– Range of services and sources: GeoNames, OpenCalais, …
– More structured and semantic information: DBpedia, …
– Better support for graphics and interactivity: SVG, Canvas (demo)
– Established and widely available platform
Benefits of Web as platform

Viewer

– Context for community, conversation, and information
– Instant access
Graphics and visualization on the Web

Processing.js

Raphaël

Protovis
Processing.js

JavaScript library implementing the Processing API

Implemented with HTML5’s Canvas element

Version 1.0 just released
Raphaël

JavaScript library for vector graphics in the browser

Main features
- Creation and modification of vector elements
- Animations over shape, colour, size, position

Main benefits
- Hides browser differences
- Simplifies and shortens syntax through chaining
Raphaël: simple example

```javascript
var paper = new Raphael("div#canvas"), 500, 500);

var circle = paper.circle(100, 100, 80).attr({border: 5});

circle.animate({x: 200, y: 300}, 500);

$(circle.node).click(function(){alert("foo");});
```

can be combined with jQuery for eventing
Protovis

Declarative visualization library written in JavaScript using SVG

Follows method chaining approach of jQuery and Raphäel

```javascript
var panel = new pv.Panel()
    .width(160).height(160)
    .bottom(10).left(10).right(30);

panel.add(pv.Area)
    .data([1, 1.2, 1.7, 1.5, .7, .5, .2])
    .bottom(0)
    .height(function(d) d * 80)
    .left(function() this.index * 25)
    .fillStyle("lightblue")
    .anchor("top").add(pv.Line)
        .strokeStyle("black")
        .add(pv.Dot);

panel.add(pv.Rule)
    .bottom(0)
    .add(pv.Rule)
        .data(pv.range(.5, 2, .5))
        .bottom(function(d) d * 80)
        .strokeStyle("white")
        .anchor("right").add(pv.Label);

panel.render();
```
Protovis
Web as growing datasets

Conversation streams  Document collections  Archives and libraries
Web as growing datasets

Change
Temporal development

Diversity
Formats and facets

Size
Number of resources
### Web as dataset(s)

<table>
<thead>
<tr>
<th>Dataset</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Web pages</td>
<td>Most sites on the Web</td>
</tr>
<tr>
<td>Web feeds</td>
<td>Blogs and news sites</td>
</tr>
<tr>
<td>communities</td>
<td>Twitter, Flickr, YouTube</td>
</tr>
<tr>
<td>Semantic data</td>
<td>Freebase and Wikipedia</td>
</tr>
</tbody>
</table>

**Group work**

Considering these datasets, what kind of tasks could be supported by InfoVis?

Which data properties or relations do you find interesting for InfoVis?
Web as a platform and dataset

**Platform:** better graphics support, widely available

**Dataset:** dynamic, diverse and large information space(s)
InfoVis on the Web
Tag Clouds
Faceted Navigation

Not strictly a visualization technique

Provides overviews and interaction along multiple hierarchies
Elastic Lists

Introduces visual aggregation to faceted navigation
Many Eyes: an InfoVis community

Sharing datasets and visualizations

Creating community and conversations around them
Dashiki: visualization wiki dashboards

Integrates wikis and vis for collaborative dashboard creation
InfoVis on the Web

Self-expression

Information seeking

Community and conversation
VisGets
Motivation

World Wide Web

Information Seeking

Visualization

Lorem ipsum dolor sit amet
http://www.ipsum.dolor_sit.amet

Excepteur sint occaecat cupidatat non Proident
http://www.excepteur.sint_occocaeat/cupidatat

Ut enim ad minim veniam, quis nostrud exercitation
http://www.utenim.ad/minim/veniam?quis=nostrud_exercitation

Duis aute irure Dolor in reprehenderit in voluptate velit esse
http://www.duis-aute-ireure-dolor.in/reprehenderit

Sunt in Culpa qui Officia deserunt Mollit!
http://www.suntinculpa.qui/officia/deserunt#mollit

Consectetur adipiscing elit
http://www.consectetur.a/idipiscing/elit.html

Excepteur sint occaecat cupidatat non Proident
http://www.excepteur.sint_occocaeat/cupidatat

Ut enim ad minim veniam, quis nostrud exercitation
http://www.utenim.ad/minim/veniam?quis=nostrud_exercitation

Ut enim ad minim veniam, quis nostrud exercitation
http://www.utenim.ad/minim/veniam?quis=nostrud_exercitation

Duis aute irure Dolor in reprehenderit in voluptate velit esse
http://www.duis-aute-ireure-dolor.in/reprehenderit

Sunt in Culpa qui Officia deserunt Mollit!
http://www.suntinculpa.qui/officia/deserunt#mollit

Consectetur adipiscing elit
http://www.consectetur.a/idipiscing/elit.html

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 ... Next
Related Work

Coordinated Visualizations

Visual Query Formulation

Web-based Visualization
Concept of VIEW

Visual Information Exploration on the Web
- Web: platform and information space
- New type of information seeking
- Conceptual dimensions
- VisGets: visualization and query formulation
# Visual Information Exploration

## Goals
- Overview and orientation
- Discover interrelations
- Comprehensible changes

## Techniques
- Visual summaries
- Linking and brushing
- Transitions
Multidimensionality

Conceptual dimensions

- Meaningful for information seekers
- Extractable from information space

1. Time
   - Blog entries, last changes,

2. Location
   - Photos, news, …

3. Tags
   - Bookmarks, music, …
VisGets: InfoVis Query Widgets

Visualization and query formulation

Multidimensional exploration
Coordinated Interactivity

Weighted brushing and multidimensional query refinement
Web-based Architecture

Hypertext
Syndicated Content
Semantic Web
Data Sources
GeoNames
Geographic Lookup

Data Processing and Filtering
CakePHP
PHP
MySQL

Web Server

Visualization and Interaction
jQuery
JavaScript
DOM

Web Browser

HTTP GET, SPARQL
HTML, RSS, RDF

HTTP GET
XML, GeoRSS

HTTP GET
JS, CSS, HTML, JSON
Web-based Architecture

Web data

Hypertext
Syndicated Content
Semantic Web

Data Sources

GeoNames

Geographic Lookup

Web Server

Data Processing and Filtering
CakePHP
PHP
MySQL

Web Browser
Visualization and Interaction
jQuery
JavaScript
DOM

HTTP GET, SPARQL
HTML, RSS, RDF

HTTP GET
XML, GeoRSS

HTTP GET
JS, CSS, HTML, JSON
Web-based Architecture

Hypertext
Syndicated Content
Semantic Web

Data Sources
GeoNames
Geographic Lookup

Web services

Visualization and Interaction
jQuery
JavaScript
DOM

Web Server
CakePHP
PHP
MySQL

Data Processing and Filtering

HTTP GET
HTTP GET
HTML, RSS, RDF
XML, GeoRSS

HTTP GET
HTTP GET
JS, CSS, HTML, JSON

WebService

Web Browser
Web-based Architecture

**Web Server**

- **Data Processing and Filtering**
  - CakePHP
  - PHP
  - MySQL

**Web Browser**

- **Visualization and Interaction**
  - jQuery
  - JavaScript
  - DOM

**Data Sources**

- **Hypertext**
- **Syndicated Content**
- **Semantic Web**

**Geographic Lookup**

- **GeoNames**

**Storage and retrieval**

- **HTTP GET, SPARQL**
  - HTML, RSS, RDF
- **HTTP GET**
  - XML, GeoRSS
- **HTTP GET**
  - JS, CSS, HTML, JSON
Web-based Architecture

Hypertext
Syndicated Content
Semantic Web

Data Sources
GeoNames

Geographic Lookup

Data Processing and Filtering
CakePHP
PHP
MySQL

Web Server

Visualization and Interaction
jQuery
JavaScript
DOM

Web Browser

HTTP GET, SPARQL
HTML, RSS, RDF

HTTP GET
XML, GeoRSS

HTTP GET
JS, CSS,
HTML,
JSON

Presentation and interactivity
Web-based Architecture

HTTP-based communication
Query Parameter Conversion

SELECT items.id, ...  
FROM items  
WHERE items.date >= '2008-02-14' AND 
    items.date <= '2008-02-25' ...
Case Studies

Hypertext: WWW papers

Syndication: Geotagged photos

Semantic Web: Famous people
Hypertext: Publications

Web Scraping

Date of conference

Institution of first author

Terms and keywords

~1200 papers
Syndicated Content: Photos

~ 43000 photos

GeoRSS

Date

Location

Tags
Semantic Web: People

About: Barack Obama
An Entity in Data Space: dbpedia.org

Barack Hussein Obama II (born August 4, 1961) is the junior United States Senator from Illinois and the Democratic Party in the 2008 United States presidential election.

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>dbpedia-owl:almaMater</td>
<td>dbpedia:Columbia_University</td>
</tr>
<tr>
<td></td>
<td>dbpedia:Harvard_Law_School</td>
</tr>
<tr>
<td></td>
<td>dbpedia:Occidental_College</td>
</tr>
<tr>
<td>dbpedia-owl:birthdate</td>
<td>1961-08-04 (xsd:date)</td>
</tr>
<tr>
<td>dbpedia-owl:birthplace</td>
<td>dbpedia:Hawaii</td>
</tr>
<tr>
<td></td>
<td>dbpedia:Honolulu%2C_Hawaii</td>
</tr>
<tr>
<td></td>
<td>dbpedia:United_States</td>
</tr>
<tr>
<td>dbpedia-owl:children</td>
<td>dbpedia:Family_of_Barack_Obama%23Malia_Ann_and_Sa</td>
</tr>
<tr>
<td>dbpedia-owl:nationality</td>
<td>dbpedia:United_States</td>
</tr>
<tr>
<td>dbpedia-owl:religion</td>
<td>dbpedia:Christian</td>
</tr>
<tr>
<td></td>
<td>dbpedia:United_Church_of_Christ</td>
</tr>
</tbody>
</table>

DBpedia: SPARQL

- Birthdate
- Birthplace
- Occupation/“type”

~ 16000 people
Visual Backchannel
Microblogs as Digital Backchannels

Professional events  Political developments  Leisurely activities

Photo: Hazel Owen  Photo: Naheed Nenshi  Photo: Anirudh Koul
Problems

Too many voices in a sea of strangers

Losing focus: What just happened?
Visualizing Information Streams
Visualizing Twitter
Design Goals

- Summarize ongoing conversation
- Integrate ‘now’ and ‘recent’
- Provide flexible filtering techniques
- Create organic aesthetics
nrchtct giving talk on Visual Backchannel in social apps session http://twitpic.com/31ihs1 at #visweek one minute ago via web
nrchtct giving talk on Visual Backchannel in social apps session http://twitpic.com/31ihs1 at #visweek
one minute ago

Participant originality and activity
Tweets: Linked Images

RT?

giving talk on Visual Backchannel in social apps session [http://twitpic.com/31ihs1](http://twitpic.com/31ihs1) at #visweek

one minute ago

Participant originality and activity

Photo popularity
Tweets: String Cleaning

giving talk on visual backchannel in social apps session [http://twitpic.com/31ihs1](http://twitpic.com/31ihs1) at #visweek

one minute ago
Tweets: Stop Words

giving talk on visual backchannel in social apps session

one minute ago

Participant originality and activity

Photo popularity

Stop words

Links

Search term/tag
Tweets: Stemming

Giving talk on visual backchannel in social apps session one minute ago

Topic newness and development

Participant originality and activity

Photo popularity

Stop words
Links
Search term/tag
nrchtct giving talk on Visual Backchannel in social apps session http://twitpic.com/31ihs1 at #visweek

one minute ago
Designing a Visual Backchannel

nrchtct giving talk on Visual Backchannel in social apps session http://twitpic.com/31ihs1 at #visweek one minute ago

Topic newness and development

Participant originality and activity

Posts

Photo popularity

Stop words
Links
Search term/tag
Supertamas: I was duly to real people phonetically pronounce PARK(ing) Day... "It's Parking Day. PARK...eeneeening day" #parkingday
September 18, 2009 19:43:33

JeanineA: woo-eel! Met tons of great people today during our Art Park for Parking(ing) Day & awesome creative play. + @lee_richmond rocks. #parkingday
September 18, 2009 19:39:41

JRadhirsch: Did you all hang out in some Micro parks today? #parkingday
September 18, 2009 19:32:59

tigerbeat: #parkingday @parkcycle leaving Ritual it is now parked on 22nd @ Valencia http://flic.kr/p/6ZyoW
September 18, 2009 19:20:25

delynnium: At haight ashbury with the photocoo for parkingday-come get pic-ed n parked! The best things a free baby!
September 18, 2009 19:18:42

dougfredericks: http://twipic.com/81rg - Ben and Adam the Sacramento Park(ing) day Park #parkingday
Topic Streams

Interactive and evolving stacked graph
Topic Streams

Stream height per interval: relative frequency of active topics
Topic Streams

Ordering and colour: topic newness = mean timestamps so far

Labels: relative frequency, where stream the thickest
Colour scale perceptually linear in brightness
Topic Streams: Zoom

Range of temporal granularities

Topic order changes, but graphical streams fixed
Move time window between present and past

Previous and subsequent time windows rendered off screen
Filter along topic (shown), participant, and search

Stream of selected topic visually removed
Topic Streams: Evolution

Integrate current activity in context of recent development

Recent → shape, position, and colour scale

Now → animation and fading colour highlights
Topic Streams: Evolution

Adjusting shape and fading colour highlights
Topic Streams: Evolution

Adjusting shape and fading colour highlights
Topic Streams: Evolution

Adjusting shape and fading colour highlights
People Spiral

Order and dot/font size: activity of participant

Saturation: ratio of original tweets vs retweets
People Spiral

Adjusting between dense spiral and circle
Image Cloud

Size: number of tweets referencing image
Image Cloud

Self-adjusting layout maximizing space use
Visual Backchannel: Interaction
Visual Backchannel: Evolution
Initial Feedback

Uses
- Audience reaction
- Seeing oneself
- Product conversations
- Event experiences

Ideas
- Search
- Pin topics and people
- Sentiment analysis
- Threads
Visual Backchannel

Evolving visualizations
integrating current activity with recent development

Interactive views
for three backchannel facets: topics, people, and photos
Wrap-up
Summary

The Web is both a platform and dataset for InfoVis
- Better graphics support, widely available
- Dynamic, diverse and large information space(s)

Visualization is used for a range of applications including self-expression, conversations, and information seeking.

Visual Backchannel VisGgets