CSE 512
Narrative Visualization

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(with material from Jeff Heer, Edward Segel, and Jessica Hullman)
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Advised by Jeff Heer

Background in data journalism
FiveThirtyEight, CNN, New Yorker, New York Times (current)

Lecture will be biased toward data journalism but the material is more generally relevant (education, scientific publishing, policymaking).

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Narrative Storytelling

**Story:**
The events or facts you want to convey

**Narrative:**
How you convey those facts
Narrative Storytelling

**narrative** (n): An account of a series of events, facts, etc., given in order and with the establishing of connections between them.

Effective storytelling “require[s] skills like those familiar to movie directors, beyond a technical expert’s knowledge of computer engineering and science.” - Gershon & Page ‘01
STORYTELLING
as ancient as mankind

Going forward
I carried wax along the line, and laid it thick on their ears. **They tied me up**, then, plumb amidships, **back to the mast**, lashed to the mast, and took themselves again to rowing. Soon, as we came smartly within hailing distance, the two **Sirens**, noting our fast ship, off their point, **made ready, and they sang...**
STORYTELLING across various media

PEOPLE TELL STORIES

WORDS TELL STORIES

IMAGES TELL STORIES

COMICS TELL STORIES

MOVIES TELL STORIES
By Denise Grady and Carl Zimmer

April 14, 2021, 9:34 p.m. ET

The pause in the use of Johnson & Johnson’s Covid-19 vaccine may continue for a week to 10 days, after expert advisers to the Centers for Disease Control and Prevention determined on Wednesday that they needed more time to assess a possible link to a rare but serious blood-clotting disorder.

The decision not to reinstate the vaccine has painful consequences, nationally and globally. It may further erode public confidence in vaccination in general and slow the rollout of desperately needed shots to rural and underserved areas and homebound people. The vaccine is considered ideal for hard-to-reach people and places because it requires only one shot and is more easily stored and shipped than the vaccines made by Moderna and Pfizer-BioNTech, which must be kept at very low temperatures.
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Topics

Narrative visualization

Case Study: Coronavirus Testing
Design space

Interactive articles

Case Study: Carbon Footprint
Authoring tools
STORYTELLING
across various media

PEOPLE TELL STORIES
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STORYTELLING across various media

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COMICS TELL STORIES
MOVIES TELL STORIES
DATA TELLS STORIES?
Business

Lives of others

JENNIFER STODDART, Canada’s privacy commissioner, was in a meeting with Facebook in August when the social network presented her with a deal, offering to change its privacy policies in a bid to comply with the country’s privacy laws. But Nunavut, the company apparently gave her an option to map the data, which included personal information, to the location of users in the company’s servers. It’s a move that has raised concerns about the privacy of the users, as the company’s servers are not directly accessible by the regulator.

Facebook is now reportedly considering a new privacy policy for its users, which would allow the company to collect data about their online behavior. The new policy would also allow the company to sell user data to third-party advertisers. Facebook has already started collecting data about users’ activity on the social network, but the new policy would make it easier for third-party advertisers to access this data.

The new policy has raised concerns among privacy advocates, who argue that it would violate the company’s privacy commitments to users. The policy would also make it easier for Facebook to collect data about users’ online behavior, which could be used to tailor advertising to individual users.

The new policy has also raised concerns about the company’s commitment to user privacy. Facebook has long been under pressure to improve its privacy policies, but the company has been slow to make changes.

The new policy is expected to be implemented within the next few months. It will be a significant step forward for Facebook, which has struggled to balance the need to protect user privacy with the need to generate revenue from targeted advertising.
About **21,000 coronavirus cases** were reported per day in early June, when the positive test rate was 4.8 percent.

**CASE STUDY** COVID-19 TESTING
Conlen, 2020
CASE STUDY COVID-19 TESTING

Input Data
Daily case and test counts.

Points of Focus
1. Baseline (smoothed average of daily cases)
2. Counterfactual case curve (baseline positivity rate * daily test counts),
3. Actual case curve (daily cases)
SHENANIGANS

Change in teen shenanigans from 1993 to 2013. Showing % difference from 2003 levels.
Obesity Map Vadim Ogievetsky
Obesity Map Vadim Ogievetsky
Of the 7,666 times that police officers killed people in the U.S. between 2013 and 2019...
25 (0.3%) resulted in a conviction

74 (1.0%) resulted in a charge but no conviction

and...

Total disbelief about the system doing the bare minimum. George Floyd deserved so much more than this, he deserved to live.

Some detail about those 25 sentences:
Unknown sentence = 4 police killings
Just probation = 3
3 months in jail = 1
1 year in jail, 3 years suspended = 1
1 year in prison = 1
18 months in prison = 1
2.5 years in prison = 1
4 years in prison = 1
5 years in prison = 1
6 years in prison = 1
16 years in prison = 1
20 years in prison = 1
30 years in prison = 2
Narrative Devices
What devices communicates best?
Highly dependent on: audience, context, format

Format
Interactive Article
Animation
Lecture
Still Image
Video
Narrative Visualization
Design Space
CASE STUDIES

70% Journalism
20% Business
10% Research

Segel & Heer, 2010
Steroids or Not, the Pursuit Is On

Barry Bonds is taking aim at the career home run record. He needs only six more to tie Babe Ruth and 47 to equal Hank Aaron.

Hank Aaron
755 homers
23 seasons

Babe Ruth
714 homers
22 seasons

Barry Bonds
708 homers
20 seasons

According to allegations in a book about Bonds, he began taking steroids before the 1999 season, his 14th in the league. Two seasons later, he hit 73 home runs, surpassing Aaron’s career pace.

Homer Pace After Age 34
If the accusations are correct, Bonds was 34 in his first season on steroids. Here are projected home run paces for each player after age 34.

Aaron
Actual homers slightly outpace projected homers for five seasons.

Ruth
Averaged 46.4 homers a season from age 30 to 34. Averaged 42.5 for next four seasons.

Bonds
From age 35 to 39, he averaged 14 more homers a season than projected.

Note: Ages as of July 1 of each season.

Differing Paths to the Top of the Charts
The top seven players on the career home run list, along with a look at Griffey (12th), Rodriguez (37th) and Pujols (tied 257th).
## Observed Narrative Devices

**Visualization Description**

<table>
<thead>
<tr>
<th>Architecture and Justice (Brooklyn Crime Blocks)</th>
<th>Observations</th>
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<tbody>
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### Case Studies

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Genres for Narrative Visualization (2010)
Genres + Interactivity + Messaging = DESIGN SPACE

**Author Driven**
- strong ordering
- heavy messaging
- limited interactivity

**Reader Driven**
- weak ordering
- light messaging
- free interactivity

**STORYTELLING**
- CLARITY
- SPEED

**ASK QUESTIONS**
- EXPLORE
- FIND

martini
glass

interactive
slideshow

drill-down
story
Interactive Articles
In comparison, only 12% of YouTube’s traffic went through cellular networks, but they were by far the most expensive part of YouTube’s content delivery pipeline, accounting for approximately 8,500 Gigawatt-hours of electricity usage—enough to power over 750,000 U.S. homes [3]. At over 10 times the electricity usage per unit of traffic, the relative inefficiency of cellular transmission is clear.
Communicating with Interactive Articles

Examining the design of interactive articles by synthesizing theory from disciplines such as education, journalism, and visualization.

Hohman, Conlen, Heer, Chau
2020
Communicating with Interactive Articles

Examining the design of interactive articles by synthesizing theory from disciplines such as education, journalism, and visualization.

5 affordances of the format
- Connecting people and data
- Making systems playful
- Promoting self reflection
- Personalizing reading
- Reducing cognitive load

60+ Interactive Articles
NYTimes, WaPost
Distill, VisXAI
+more

Hohman, Conlen, Heer, Chau
2020
5 AFFORDANCES OF THE FORMAT  Connecting people and data
Making systems playful
Promoting self reflection
Personalizing reading
Reducing cognitive load

Follow the lives of 932 boys who grew up in rich families …

<table>
<thead>
<tr>
<th></th>
<th>WHITE MEN</th>
<th>BLACK MEN</th>
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</thead>
<tbody>
<tr>
<td>Rich adult</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Upper-middle-class adult</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Middle-class adult</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Lower-middle-class adult</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Poor adult</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

… and see where they end up as adults:

Most white boys raised in wealthy families will stay rich or upper middle class as adults, but black boys raised in similarly rich households will not.

Even when children grow up next to each other with parents who earn similar incomes, black boys fare worse than white boys in terms of income in life even when income in childhood is similar. Adult outcomes reflect household incomes in 2014 and 2015.
5 AFFORDANCES OF THE FORMAT

Connecting people and data
Making systems playful
Promoting self reflection
Personalizing reading
Reducing cognitive load

Teachable Machine

Train a computer to recognize your own images, sounds, & poses.

A fast, easy way to create machine learning models for your sites, apps, and more – no expertise or coding required.

Get Started

What is Teachable Machine?
5 AFFORDANCES OF THE FORMAT

- Connecting people and data
- Making systems playful
- Promoting self reflection
- Personalizing reading
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You Draw It: What Got Better or Worse During Obama’s Presidency

By LARRY BUCHANAN, HAEYOUN PARK and ADAM PEARCE  JAN. 15, 2017

Draw your guesses on the charts below to see if you’re as smart as you think you are.

Under President Obama, the unemployment rate ...

Draw the line for the Obama years.
Connecting people and data
Making systems playful
Promoting self reflection
Personalizing reading
Reducing cognitive load

5 AFFORDANCES OF THE FORMAT

When you were born, the Melbourne, Florida area could expect about 53 days per year to reach at least 90 degrees.
Connecting people and data
Making systems playful
Promoting self reflection
Personalizing reading

5 AFFORDANCES OF THE FORMAT
Reducing cognitive load

If job growth had been accelerating...

...the jobs report could look like this:
Interactive Documents: Steppers, Scrollers, …
Gun Deaths In America

By Ben Casselman, Matthew Conlen and Rouben Fischer-Baum

CLICK to advance
About 21,000 coronavirus cases were reported per day in early June, when the positive test rate was 4.8 percent.
In comparison, only 12% of YouTube’s traffic went through cellular networks, but they were by far the most expensive part of YouTube’s content delivery pipeline, accounting for approximately 8,500 Gigawatt-hours of electricity usage—enough to power over 750,000 U.S. homes [3]. At over 10 times the electricity usage per unit of traffic, the relative inefficiency of cellular transmission is clear.
Discrete step vs. Continuous scroll

Different means for narrative navigation.
A source of debate among practitioners!

Step: sequential frames as in a slideshow
Simple and familiar, but as engaging?

Scroll: continuous navigation of page
Parameterize content by scroll position
May cause usability / scrolljacking issues

Hybrids: scroller with discrete sections
Narrative Implementation

Do-It-Yourself
Monitor scroll position & element positions
Guidance: M. Bostock, J. Vallandingham

Third-Party Support
Helper Libraries
Interactive Document Formats: Idyll
A toolkit for creating data-driven stories and explorable explanations.
Text + Parameterized Graphics

Write articles in markdown.

Embed parameterized data visualizations.

Connect reactive variables to user input widgets to add interactivity.
# Hello World

[var name:"x" value:5 ]

The value of x is [Display value:x format:"d" ].

[Range value:x min:0 max:10 ]
28 Built-in Components

- Input
  - Action
  - Boolean
  - Button
  - Dynamic
  - Radio
  - Range
  - Select
  - Text Input

- Presentation
  - Chart
  - Conditional
  - Display
  - Equation
  - Gist
  - Latex
  - Link
  - SVG
  - Table
  - Youtube

- Layout
  - Aside
  - Full Width
  - Fixed
  - Float
  - Inline
  - Scroller
  - Stepper

- Helpers
  - Analytics
  - Meta
  - Preload
Bring your own graphics

A JavaScript component API is exposed to end users.

Use with libraries like D3, Mapbox, Processing (P5), React, Vega-Lite
# A Sad Guitar.

Take a second and strum the guitar. It doesn't sound so good, does it?

We've just taken it out of storage and *it's all out of tune...*

# Electric Tuner to the Rescue.

Tune the guitar using the tuner knobs on the right to tighten. 

// Need a reward state to let

[Tuner selectedString:targetString]

[conditional if:isInTune]
Great work, scroll on.
[/conditional]
class Range extends Component {

  handleChange(event) {
    updateProps({
      value: +event.target.value
    });
  }

  render(props) {
    return
      <input
        type="range"
        value={props.value}
        onChange={handleChange}
      >
  }

}

The value of x is

The value of x is 5.

Hello World
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The average number of cases per day in Texas has been decreasing by 0.64 cases per day over the last 14 days. Based on the data available, the true rate of change may be anywhere from -135.56 to 134.29 new cases per day. There is not enough evidence to show a downward trend in new cases per day.

... OR a Downward trajectory of positive tests as a percent of total tests within a 14-day period (flat or increasing volume of tests)
Examples

See full gallery online.
Thanks!

Feel free to reach out:

mconlen@cs.washington.edu