Narrative Visualization

Jeffrey Heer  University of Washington
(with material from Edward Segel)
“to affect thro’ the Eyes what we fail to convey to the public through their word-proof ears”

1856 “Coxcomb” of Crimean War Deaths, Florence Nightingale
Increased Border Enforcement, With Varying Results

There are now more agents along the 1,954 mile-long border than ever before...

Border agents per sector.

Satellite Projection, NY Times
How Obama Won Re-election

Romney’s Shift Wasn’t Enough

Most of the nation shifted to the right in Tuesday's vote, but not far enough to secure a win for Mitt Romney.
Texas oil boom is visible from space

Lighting and natural gas flares from drilling on the 400-mile-long Eagle Ford shale formation can be seen from space in this image.

The new formation has helped make Texas the No. 1 oil-producing state in the nation.

Oil production from different U.S. regions (in thousands of barrels per day)

LA Times 2014
Percentage of Chart Which Resembles Pac-man

http://www.boingboing.net/2006/11/02/hilarious-piechartvi.html
Obesity Map Vadim Ogievetsky
Obesity Map Vadim Ogievetsky
Holograms?

Narrator
Narrative Devices for Storytelling with Data

What devices communicate effectively?

... for which contexts and audiences?
STORYTELLING
as ancient as mankind
STORYTELLING changes with technology

PEOPLE TELL STORIES

WORDS TELL STORIES

IMAGES TELL STORIES

COMICS TELL STORIES

MOVIES TELL STORIES
Generals Wary of Move to Cut Their Ranks
By GINGER THOMPSON and THOM SHANKER

WASHINGTON — Maj. Gen. Paul D. Eaton, a retired Army officer, is familiar with the perks and pitfalls of power, having commanded tens of thousands of troops at Fort Benning, Ga., managed budgets exceeding $2 billion in Iraq, and overseen layers upon layers of staff members who helped manage both his professional duties and his personal life.

He has experienced the full range of lifestyles that come with military leadership, living at one point in an elegant antebellum mansion, and at another, with eight other officers crowded in a marble bathhouse behind one of Saddam Hussein’s old palaces.

When he traveled, he was occasionally able to justify the use of military aircraft, but most times, he said, he flew coach. And today he lives on a pension worth 75 percent of his military salary, with health benefits that cover everything except dental and eye care for himself and his wife.

“We are well compensated, and we live very comfortable lives,” General Eaton said, referring to the military’s most senior leaders. “But when you look at all the things going on around a general, the nation is getting a very, very high return on its money.”

Not everyone at the Pentagon agrees. Two weeks ago, Defense Secretary Robert M. Gates announced a sweeping effort to improve efficiency that, among other things, takes aim at the military’s sacrosanct corps of generals and admirals, ordering his staff to cut at least 50 positions, and making clear that he would be happier if they cut more.
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HOW CAN YOU TELL STORIES WITH DATA?
Privacy and the internet

Lives of others

Jennifer Stoddart, Canada's privacy commissioner, and Facebook in August 2009, the social networking site announced it would agree to change its privacy rules. Within a year it is clear that the companies' primary focus has been on revenue. Mr. Sandberg, the company's co-founder and chief operating officer, has admitted Facebook's policy is to "maximize user engagement by adjusting product features and privacy settings". It is also clear that Facebook is in the business of "rights management and usage of data with third parties. It doesn't seem to me that Facebook is using the right..." system in this case," she says. Nor is it stopping there. Without a change of course, the latest could soon become the subject of another coordinated investigation by large organizations.

Facebook is not overly concerned about privacy. Facebook users are surprisingly easy to track. While data networks are borne and sold in some countries, on May 20, Peter Schaar, Germany's federal commissioner for data protection, called for an independent investigation into Google's handling of data, claiming that it had "deeply disturbed normal rules in the development and usage of software.

The data highlight a growing tension between guarantees of privacy and internet connectivity. And they reflect concern among web users about how private data can become public. Several recent Internet trends have made it easier for Facebook to collect data. In some cases, such as social networking sites like Twitter and Digg, users are more willing to share personal information. In other cases, such as online retailers, users may not be aware of the extent to which their data is being collected. In both cases, Facebook has been able to use its large user base to gain access to valuable information.

The switch should not have come as a surprise. Facebook, which recently announced it would start charging companies to access its user data, is known for its aggressive approach to maximizing user engagement and data collection. The company's stated goal is to "maximize user engagement by adjusting product features and privacy settings," which has led to concerns about the company's handling of personal data. Facebook's approach to privacy is not unusual. Many companies are facing similar challenges in balancing user privacy and data collection. However, Facebook's aggressive approach has raised concerns among privacy advocates and users alike.
exciting! beautiful! technical!

BUT what does it mean?
Budget Forecasts, Compared With Reality

Just two years ago, surpluses were predicted by 2012. How accurate have past White House budget forecasts been?

Latest forecast

Today, with a better understanding of the severity of the economic downturn, the deficit situation is much more dire.

... but the 2008 forecast for 2012 did.

The 1995 forecast for 1999 did not predict a surplus...

Use the slider to isolate a single year's forecast.
Budget 2010: reaction from around the UK

People in key constituencies around the country give their responses to Alistair Darling’s budget

Shilpa Wymer, 40, is managing director of two branches of Pitman Training Ltd, a training school specialising in secretarial and PA training

Enquiries from individuals suddenly dropped off a cliff from October 2008 and in January last year we had to lay off a couple of people, though things have picked up since. The budget seems very positive and shows the government are thinking about small and medium sized businesses at last. I think the measures will help businesses be more confident, which will have a knock-on effect on us. It has turned my head and made me think about which way I will vote.

Constituency profile
MP: Greg Hands, Conservative. Majority: 5,029
Unemployment benefit claimants, Feb 2010: 3,281 (up 13% over last year)
CASE STUDIES

70% Journalism
20% Business
10% Research
Observed Narrative Devices

Case Studies
Visual Design

**Messaging**
- Duo-Specific
- Captions
- Attached Article
- Summaries
- Interpret
- Headlines

**Interactivity**
- Tacit Tutorial
- Selection
- Navigation
- Details on Demand
- Timelines
- Filtering
- Highlighting
Genres for Narrative Visualization
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
(more patterns)
THE DESIGN CATALOGUE
VISUAL DESIGN
show

MESSAGING
tell

INTERACTIVITY
engage
VISUAL DESIGN
  show

MESSAGING
tell

INTERACTIVITY
  engage
Choose your visualization type carefully. Know your options. Even obscure ones.

“Cool” and “readability” are often at odds. Recognize the trade-off and choose your audience.
Avoid “chart junk” (Tufte). Extra marks distract from the data.

But... chart junk may reflect cool design choices

Businessweek... does great with labeling only as much as needed
Make it clear where to start. Don’t let readers defect.
The more linear, the more like a story. Stories have a beginning, middle, and end.
Consistent visual frameworks. Keep things tidy.
CONTINUED...
Consistent visual frameworks.
Keep things tidy.

The jump

Five judges award points to competitors based on factors such as variety of tricks, the height snowboarders reach and the difficulty of tricks and rotations. Points are deducted for bad landings and a lack of speed. White’s jump was almost perfect.
Use staging and animation for complicated transitions. Stage big transitions to avoid confusing readers.
Transitions Guidance
Viewing Angle
Viewer (Camera) Motion
Continuity Editing
Object Continuity
Familiar Objects
Use establishing shots. Situate the viewer before diving in.
CONTINUED...

Use establishing shots.
Situate the viewer before diving in.
Highlighting Techniques

Character Direction
Feature Distinction
Close-Ups
Zooming
Framing
Motion
Audio

Make it clear what to look at and when. Guide readers through the story or they’ll get lost.
Grind attention with image and position

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.

Projection Pace Based on Average of Previous Five Seasons

<table>
<thead>
<tr>
<th>Player</th>
<th>Actual</th>
<th>Projection</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aaron</td>
<td>800 HR</td>
<td>700 HR</td>
</tr>
<tr>
<td>Ruth</td>
<td>46.4 HR</td>
<td>42.5 HR</td>
</tr>
<tr>
<td>Bonds</td>
<td>708 HR</td>
<td>650 HR</td>
</tr>
</tbody>
</table>

According to the chart, Bonds actually hit 708 home runs at age 34, outpacing the projected 650 home runs.

Note: Ages as of July 1 of each season.
The problem
Grooves on the pedal head mesh with grooves on the shoe creating friction. Occasionally this has been so great that the pedal has jammed against the shoe.
Use headlines, captions, & annotations. Quickly draw attention to what’s important.
Weave text into the graphic—not just at the beginning. Text and graphics work better together than apart.

Connect the text to the relevant graphics. See Fig. 5
The Supreme Court gets the Wal-Mart ruling right.

Everything about Wal-Mart Stores Inc. (WMT) is big. Total sales, at $422 billion last year, exceeded the gross domestic product of all but 18 countries. Its 4,200 U.S. stores employ more than 1.4 million people, more than any other U.S. company.

So the verdict handed down yesterday by the U.S. Supreme Court in Wal-Mart v. Dukes was suitably outsized; it decided the largest workplace discrimination case in history. The decision, which was unanimous in one part, and split along the familiar 5–4 ideological lines in another, was the correct one.

The lawsuit was brought on behalf of every woman who worked for Wal-Mart since late December 1998, more than 1.5 million in all. The Supreme Court, which hadn’t reviewed the standards for class-action suits in 12 years, told the women they didn’t have enough in common to sue the company as a monolithic class.

The female plaintiffs claimed that they had been illegally denied pay and promotions despite company policy against sex discrimination. The suit relied largely on statistics, which seemed damning enough.

Women filled 70 percent of Wal-Mart’s hourly jobs, yet made up only 33 percent of management employees. Women were paid less than men in every region, even when they had higher performance ratings and seniority.

The plaintiffs bolstered their case with affidavits detailing the experiences of 120 individuals. One female worker said she was told to “dial up” if she wanted a promotion.

Wal-Mart devastatingly turned the numbers against the plaintiffs. One brief filed on behalf of the women cited Census Bureau figures showing that U.S. median earnings of women in 2009 were 77 percent of men’s earnings. The company pointed out that women at Wal-Mart earned between 85 percent and 95 percent of what male colleagues earned. They actually did better at Wal-Mart than in the country at large.

As for the advocates, the company said they represented just one-thousandth of one percent of women employed at the retailer since December 1998.

As Justice Antonin Scalia wrote for the majority, “Without some glue holding together the alleged reasons” for Wal-Mart’s pay and promotion decisions, it was impossible to say that all of the class members suffered the same injury at different stores run by different managers across the nation. Wal-Mart allows local managers wide latitude in wages and promotions.

The plaintiffs can still bring lawsuits individually, and many certainly will. Some may even band together in smaller classes — if they worked at the same stores, for example, and believe they experienced systemic discrimination from the same managers.

In the end, what the women were really trying to prove is that Wal-Mart has a corporate culture that favors men. Some of the briefs filed with the court claimed that promotions were characterized as a “tap on the shoulder” with local managers having great discretion in deciding whose shoulder to tap. Vacancies were not regularly posted. Employees were discouraged from discussing their compensation, presumably to prevent comparisons.

As Justice Ruth Bader Ginsburg wrote in a partial dissent, such behavior could be a cover for bias against women. It will be up to other courts to make sure Wal-Mart doesn’t use its decentralized management to escape legal responsibility. But those cases should be dealt with on their individual merits — and unique facts.

This opinion is likely to make litigation harder for other employment class actions that bind together disparate litigants in a single class. But a class of 1.5 million employees faces an appropriately high hurdle. This class didn’t clear it.

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The female plaintiffs claimed that they had been illegally denied pay and promotions despite company policy against sex discrimination. The suit relied largely on statistics, which seemed damaging enough. And this is the end of my first graphic for Bloomberg.
Word-Specific
Pictures illustrate the words

Picture-Specific
Words accentuate aspects of the scene

Duo-Specific
Words and pictures send the same message

Intersecting
Words and pictures contribute information independently

Interdependent
Word and pictures combine to convey an idea neither conveys alone

Parallel
Words and pictures seem to be independent.

Montage
Words and pictures combine pictorially.
Start with an editorially interesting view.
Default views can be boring. Curate the experience from the beginning.

Make data relatable. Put numbers and facts in context.
250 thousand square miles means nothing. It’s the size of Texas!

Wetlands Destruction

Coastal marshes absorb fertilizer runoff from farms and buffer civilization from Gulf storms.

<table>
<thead>
<tr>
<th>Losses in coastal watersheds, 1998 to 2004</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Great Lakes</strong></td>
</tr>
<tr>
<td>20,000 acres</td>
</tr>
<tr>
<td><strong>Atlantic</strong></td>
</tr>
<tr>
<td>110,000 acres</td>
</tr>
</tbody>
</table>

Aug 16, 2010
Mind your precision. Significant digits, tickmarks, and labels suggest what deserves attention.
Interactive features should scream interactivity. Avoid a click-and-seek experience.

Be explicit. Click here.

Visual cues

Suggested actions

Familiar widgets

We first looked at whether policy was counter-cyclical in any given quarter.

CONTINUE
Interactive features should react to the user.
Depress buttons, highlight items, animate widgets.

Don’t obscure data. Avoid letting pop-ups obscure data.
Make the visualization “look alive”. Things move even without the user!

Demonstrate interactivity. Animate interactive widgets for tacit tutorials.
Include a progress bar and “back” and “reset” buttons. Linear navigation is important—especially with lots of interactivity.

Restrict interactivity to key dimensions. The more interactivity, the less story.
VISUAL DESIGN
show

MESSAGING
tell

INTERACTIVITY
engage
WHAT'S NEXT
DATA JOURNALISM IS NOT GRAPHICS AND VISUALIZATIONS. IT’S ABOUT TELLING THE STORY IN THE BEST WAY POSSIBLE. SOMETIMES THAT WILL BE A VISUALIZATION... BUT SOMETIMES IT’S A NEWS STORY. SOMETIMES, JUST PUBLISHING THE NUMBER IS ENOUGH.

SIMON ROGERS, THE GUARDIAN // 2011
PEOPLE HAVE BEGUN TO FORGET HOW POWERFUL HUMAN STORIES ARE, EXCHANGING THEIR SENSE OF EMPATHY FOR A FETISHISTIC FASCINATION WITH DATA... THE HUMAN STUFF IS THE MAIN STUFF, AND THE DATA SHOULD ENRICH IT.

JONATHAN HARRIS // 2008
Interactive Visualizations Drive Traffic
Slow burn vs. Burn out

Quite significantly more work than traditional stories. To make this work economical, visualizations led to stories that are either persistent or viral in order to generate traffic. **Persistent stories** cover thematic themes that maintain relevance over time (crisis, food economics, the housing market). Visualizations to persistent themes “fattens and elongates” other visualizations (which are already fatter and longer stories). During this slow-burn, these visualizations lead hundreds of stories over several months and evolve. **Viral stories** achieve heavy traffic punctuated spikes of popularity. These stories tend to technology, personalities, or sensational news. To get the buck, produce visualizations for editorial content persistent or viral.
Fast Turnaround
What can be done quickly?

Print to Digital
Templates & Tools
High demand for visualization tools for non-technical journalists
What are the big seminal themes over the next year?

Build visualizations that update with those themes...

Link to them every chance you get!
Magical Candidate
Who has all these skills?
(1) Choose your visualization type carefully. Know your options. Even obscure ones.
(2) Be more linear; the more like a story, stories have a beginning, middle and end.
(3) Use establishing shots. Situate the viewer before diving in.
(4) Make it clear what to look at and when—especially where to start.
(5) Limit complexity at first. Reveal as needed. Guide readers through the story or they’ll get lost.
(6) Consistent visual frameworks. Don’t confuse the reader with extraneous information.
(7) Use staging and animation for complicated transitions. Stage big transitions to avoid confusing readers.
(8) Design Matters. Duh.
(9) Avoid “chart junk” (Tufte). Extra marks distract from the data.
(10) “Cool” and “readability” are at odds. Recognize the trade-off and choose your audience.

"Visual Design"
show the story
(1) The more text, the more storytelling. Graphs are abstract. Words give concrete interpretations.

(2) Say the point you’re making with the graphic. Don’t make the reader figure it out on his own.

(3) Use headlines, captions, & annotations. Quickly draw attention to what’s important.

(4) Weave text into the graphic—not just the beginning. Text and graphics work better together than apart.

(5) Start with an editorially interesting view. Default views can be boring. Curate the experience from the beginning.

(6) Make data relatable. Put numbers and facts in context. 250 thousand square miles means nothing. It’s the size of Texas!

(7) Connect the text to the relevant graphics. See Fig. 5

(8) Don’t ignore summaries & conclusions. Answer the “so what?” or the reader leaves empty handed.

(9) Mind your precision. Significant digits, tickmarks, and labels suggest what deserves attention.
(1) Demonstrate interactivity.
Animate interactive widgets for tacit tutorials.

(2) Interactive features should scream interactivity.
Avoid a click-and-seek experience.

(3) Interactive features should react to the user.
Depress buttons, highlight items, animate widgets.

(4) Restrict interactivity to key dimensions.
The more interactivity, the less story.

(5) Make the visualization “look alive”.
Things move even without the user!

(6) Don’t obscure data.
Avoid letting pop-ups obscure data.

(7) Include a progress bar and “back” and “reset” buttons
Linear navigation is important—especially with lots of interactivity.

New York Times. How many households are like yours?

New York Times. The Death of a Terrorist: a Turning Point?

http://www.nytimes.com/ref/sports/20070731_BONDS GRAPHIC.html


New York Times. Aerial Photographs of Joplin Before and After the Tornado

New York Times. How different groups spend their day.


New York Times. Alpine Skiing, From Technical Turns to Tucks and Speed


**The Guardian**

Guardian. Toyota’s sticky accelerator problem.
http://www.guardian.co.uk/business/interactive/2010/feb/04/toyota-automotive-industry

Guardian. Shaun White’s Double McTwist.
http://www.guardian.co.uk/sport/interactive/2010/feb/19/winterolympics2010-vancouver

Guardian. Earthquakes: Why they happen.
http://www.guardian.co.uk/world/interactive/2008/jan/23/earthquakes

Guardian. Oscars 2011: an interactive guide to this year’s best picture nominees

Guardian. Inflation in the UK.

Guardian. The World’s Economy Turns the Corner.
http://www.guardian.co.uk/business/interactive/2010/Jan/26/recession-gdp

**Miscellaneous**

Aaron Koblin. Personal website with work.
http://www.aaronkoblin.com/work.html

Jeff Heer. Senseus.
http://vis.stanford.edu/papers/senseus

Stamen. MTV Video Music Awards.
http://stamen.com/clients/mtv

Simon Rogers. Data journalism at the Guardian: what is it and how do we do it?

GapMinder
http://www.gapminder.org


People Movin
http://peoplemov.in/

Visual Complexity. Football Drawings.
http://www.visualcomplexity.com/vc/project_details.cfm?id=452&index=452&domain

Dan Archer. Nisoor square shootings of 2007
http://www.cartoonmovement.com/icomic/11
**BGOV**

Federal Programs on Debt-Limit Bubble  
http://about.bgov.com/2011/07/12/august-invoices-show-u-s-treasury%E2%80%99s-limited-choices/

Hospitals Wary of Data Breaches Seek Cyber Insurance From AIG  
http://www.bgov.com/news_item/4D53U6teO2rko9nUq8XDoQ

Medicare-Medicaid Costs $1.5 Trillion by 2020: Chart of the Day.  
http://www.bgov.com/news_item/XwqMzluxD58Dh0n6lvp8WA

Kentucky Bourbon’s Seoul Appeal May Rise With Trade Agreement.  
http://www.bgov.com/news_item/PtRA9_pVGxAHIVVsZev_g

Preparing Americans for Death Lets Hospices Neglect End of Life.  
http://www.bgov.com/news_item/On7zzinP-22zIl6mQUeigw

Tea Party Debt Deal Opponents Gain From U.S. Awards.  
http://www.bgov.com/news_item/JcPzqhvW8bn8LuuhhO8KNA

August Invoices show Treasury’s Limited Choices.  
http://about.bgov.com/2011/07/12/august-invoices-show-u-s-treasury%E2%80%99s-limited-choices/

Dodd-Frank One Year Later: The Key Players  
http://www.bgov.com/news_item/WMrg8l6JoxhifG-KDDpytq

**Businessweek**

The Credit Boom’s Best and Worst Deals.  
http://images.businessweek.com/mz/10/34/1034mergers47.pdf?chan=magazine+channel_news++markets+%2Bfinance

Amid doping furor, Lance Armstrong’s reputation heads downhill.  
http://images.businessweek.com/mz/10/34/1034endorsements22.pdf?chan=magazine+channel_news++companies+%2Bindustries

Bloomberg Interactive Insights. America tied up by debt record.  

How to save Greece.  
http://www.businessweek.com/magazine/content/11_27/b4235000567802.htm

The Big Apple is Recovering its Shine.  
http://images.businessweek.com/mz/10/34/1034therecovery11.pdf?chan=magazine+channel_news++global+economics

Problem? What Problem?  
http://www.businessweek.com/magazine/content/11_26/b4234013596135.htm

Oil on Troubled Waters.  
http://images.businessweek.com/mz/10/34/1034oilbp53.pdf
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Washington Post. Obama’s Calendar.
http://projects.washingtonpost.com/potus-tracker/
