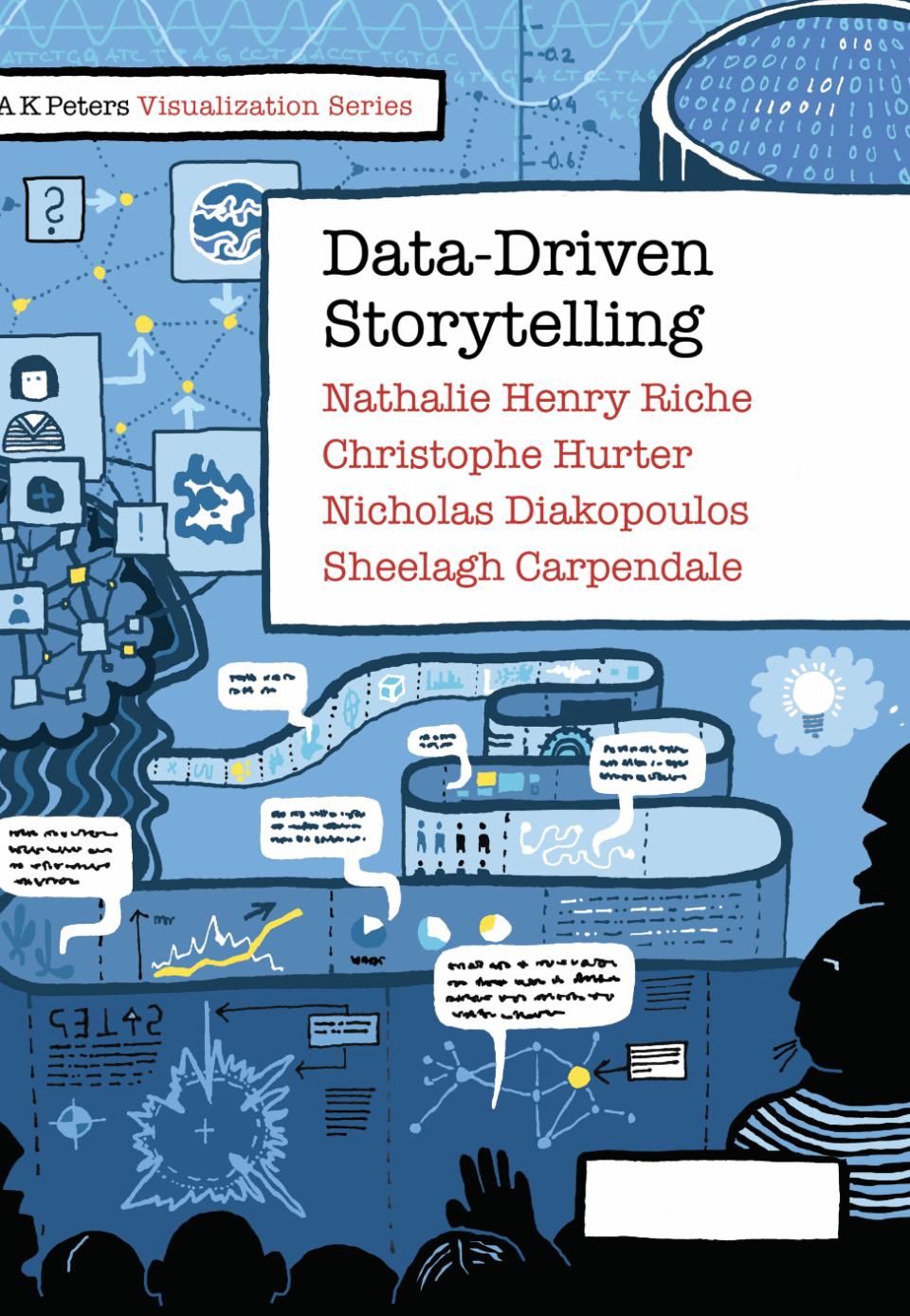
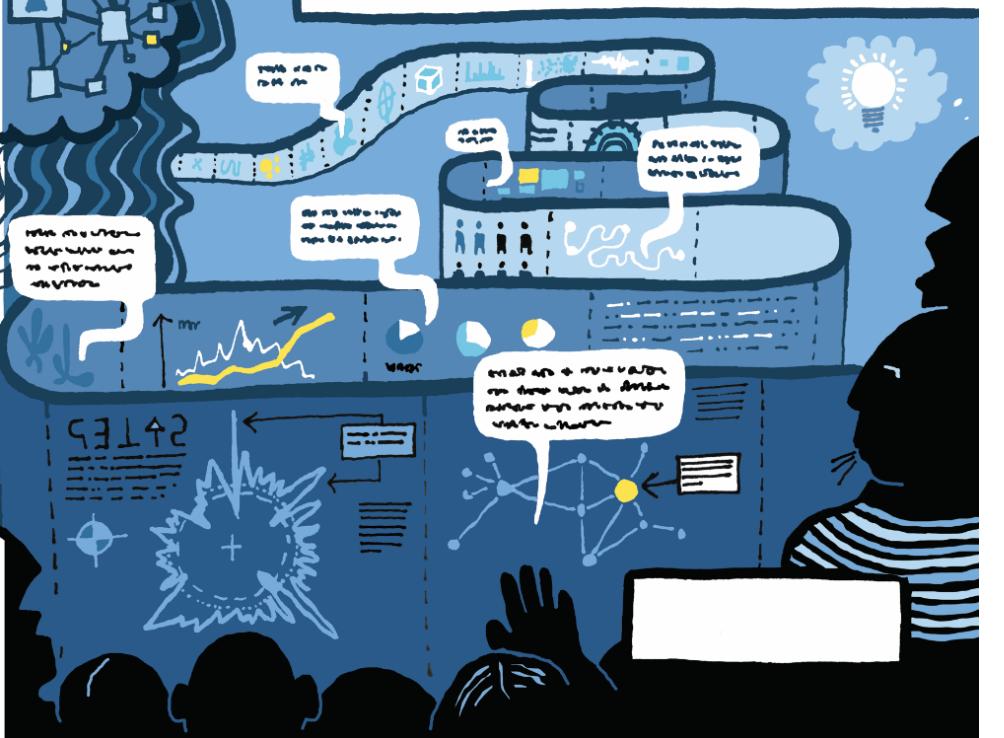
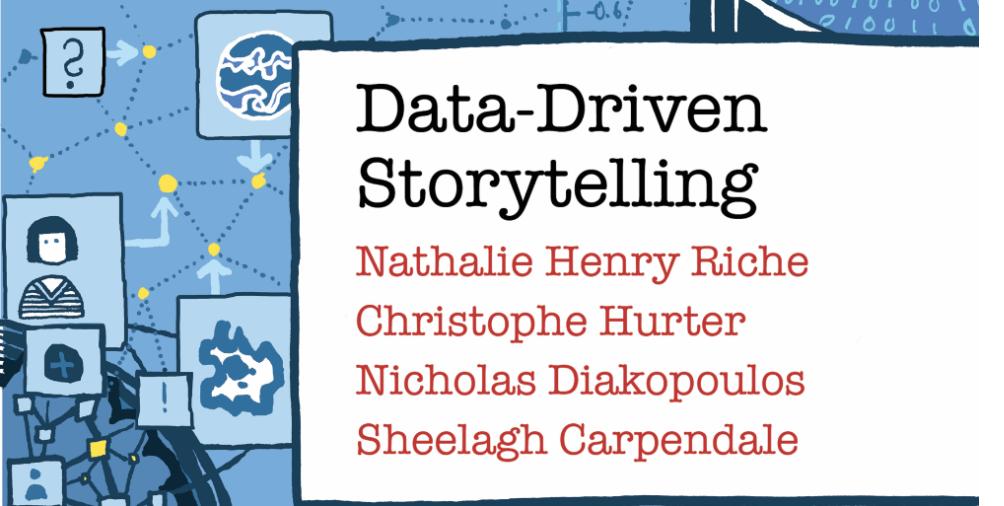
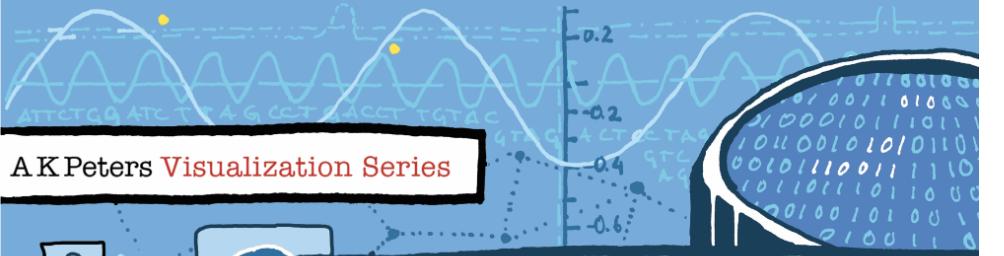




[Nicholas Diakopoulos](#)

[Sheelagh Carpendale](#) (University of Calgary, CA)





Data Driven Storytelling

Dagstuhl Seminar 1661
8th-12th february 2016

[Nathalie Henry Riche](#) (Microsoft Research – Redmond, US)

[Christophe Hurter](#) (ENAC – Toulouse, FR)

[Nicholas Diakopoulos](#) (University of Maryland – College Park, US)

[Sheelagh Carpendale](#) (University of Calgary, CA)



200 years that changed the world

with Hans Rosling

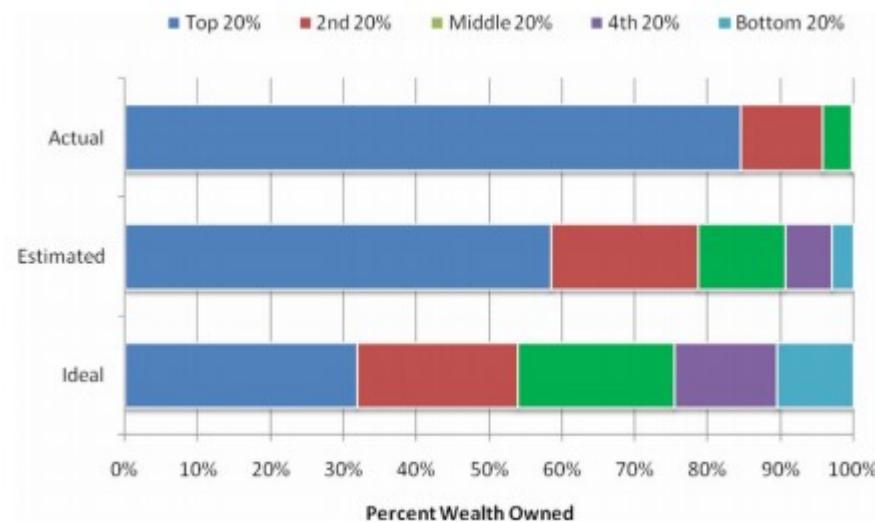
Free to redistribute



www.gapminder.org

wealth inequality (video)

Then they asked Americans what they thought the *actual* distribution of wealth was. Less equal than their ideal, came the answer. But the truth, as Ariely and Norton noted, was that America was much less equal even than that. Reality was twice as far from the average American's ideal as the average American thought. Here's their graph:



<http://www.washingtonpost.com/blogs/wonkblog/wp/2013/03/06/this-viral-video-is-right-we-need-to-worry-about-wealth-inequality/>

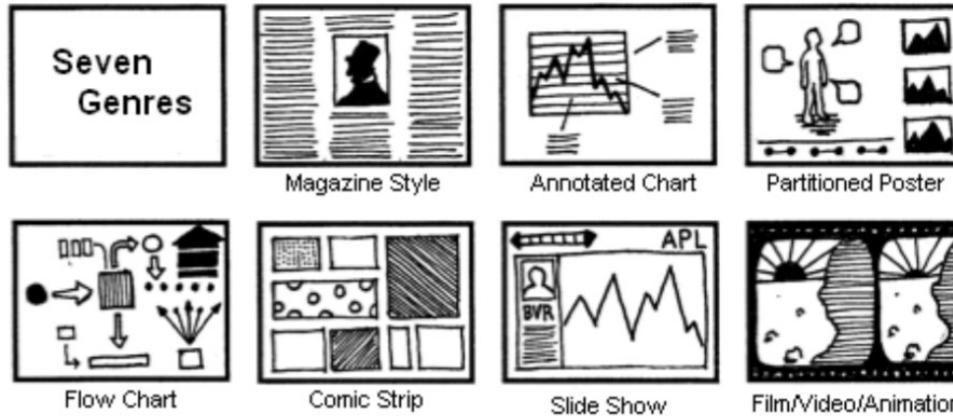






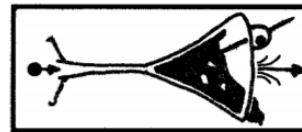
Narrative Visualization: Telling Stories with Data

ward Segel and Jeffrey Heer. 2010. Narrative Visualization: Telling Stories with Data. *IEEE Transactions on Visualization and Computer Graphics*16, 6 (November 2010), 1139-1148. DOI: <https://doi.org/10.1109/TVCG.2010.179>



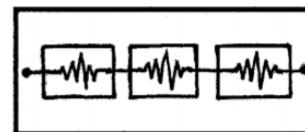
4.4.1 Martini Glass Structure

The Martini Glass visualization structure begins with an author-driven approach, initially



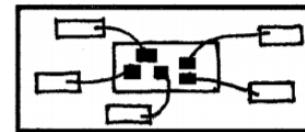
4.4.2 Interactive Slideshow

The Interactive Slideshow structure follows a typical slideshow format, but incorporates in-



4.4.3 Drill-Down Story

The Drill-Down Story visualization structure presents a general theme and then allows the





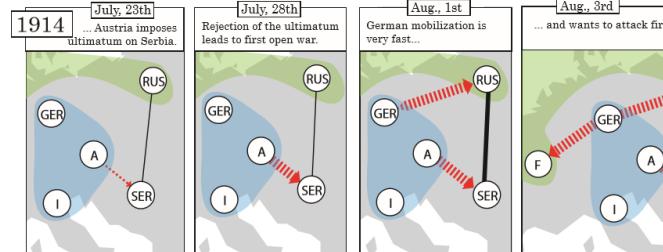
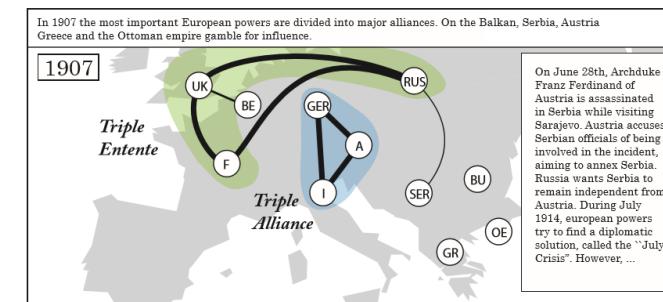
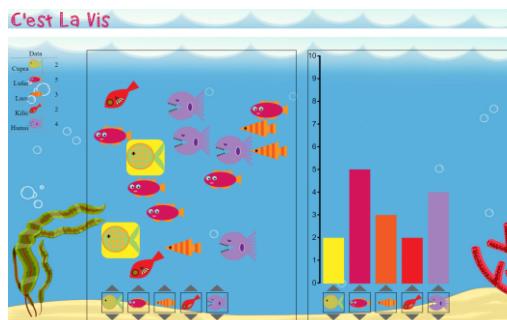
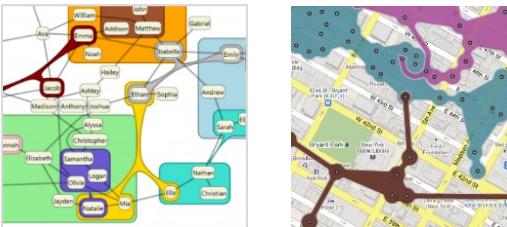
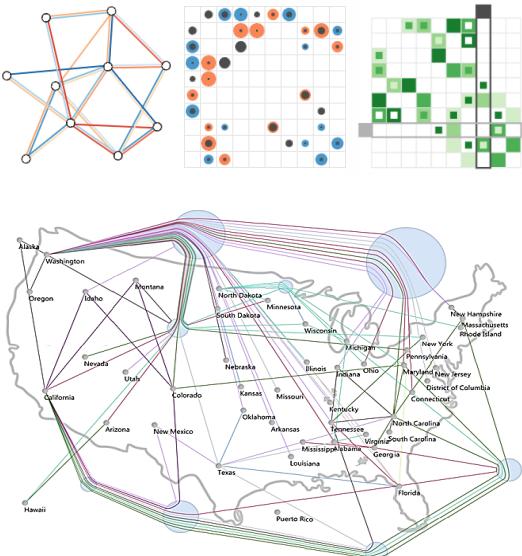
Nathalie (Henry) Riche

Microsoft Research

Human-Computer Interaction



& Information Visualization





Sheelagh Carpendale

Professor, Computer Science, University of Calgary

Canada Research Chair : Information Visualization

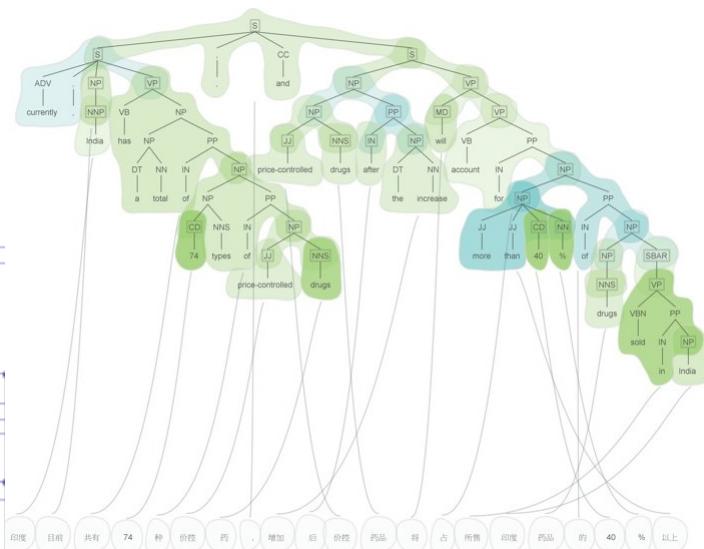
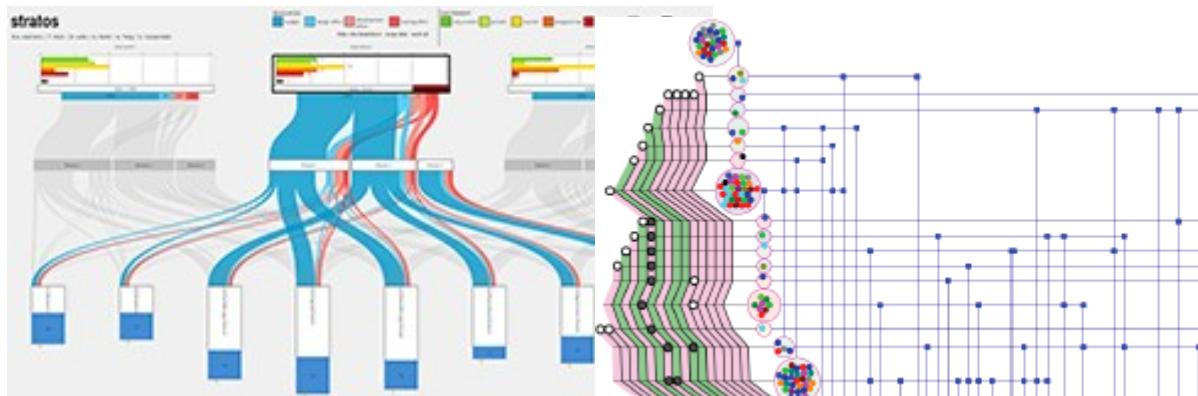
Industrial Research Chair: Interactive Technologies

<http://innovis.cpsc.ucalgary.ca/>



Research interests

- information visualization
- interaction design
- personal visualization
- ‘data for common good’





Nick Diakopoulos

University of Maryland, College of Journalism

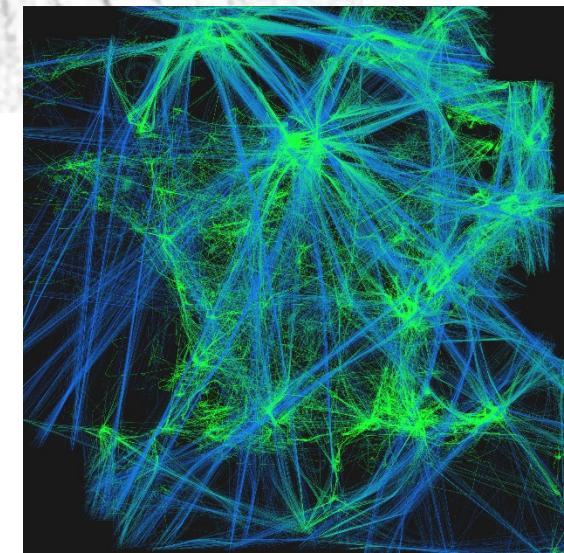
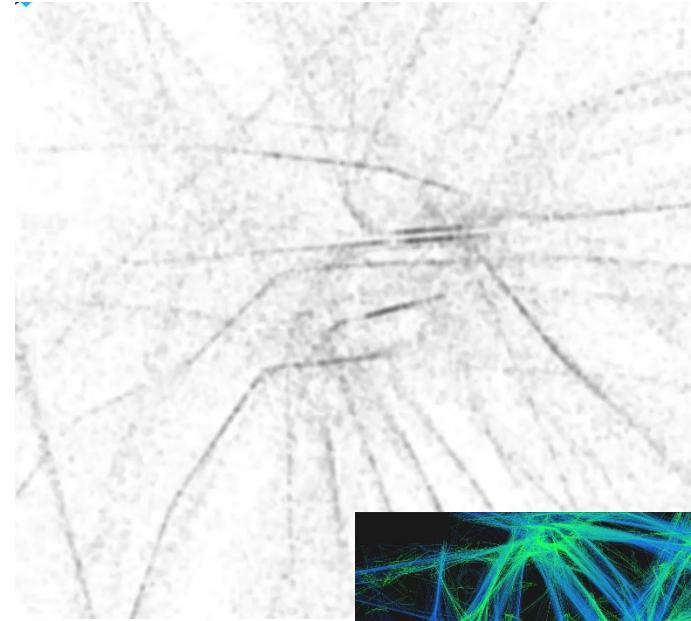
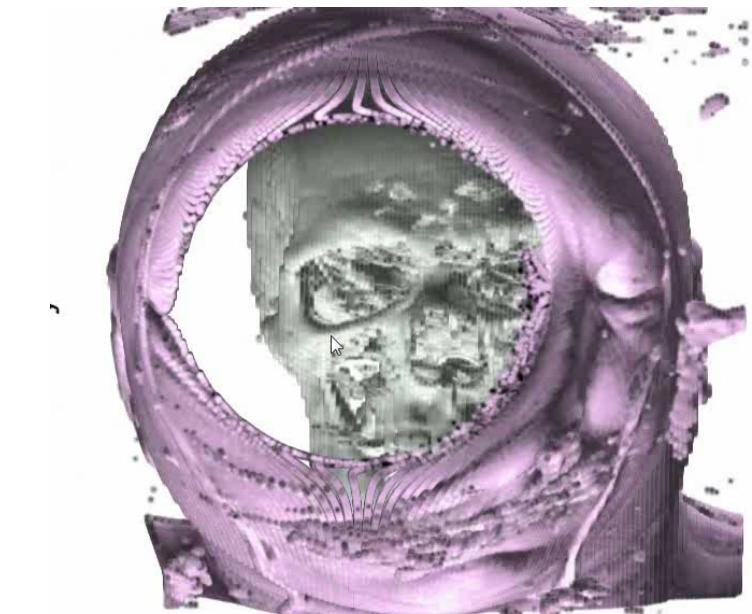
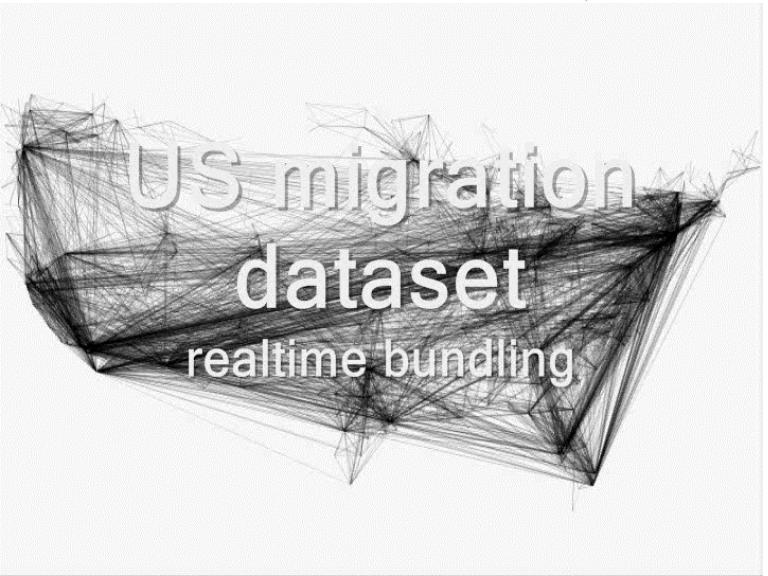
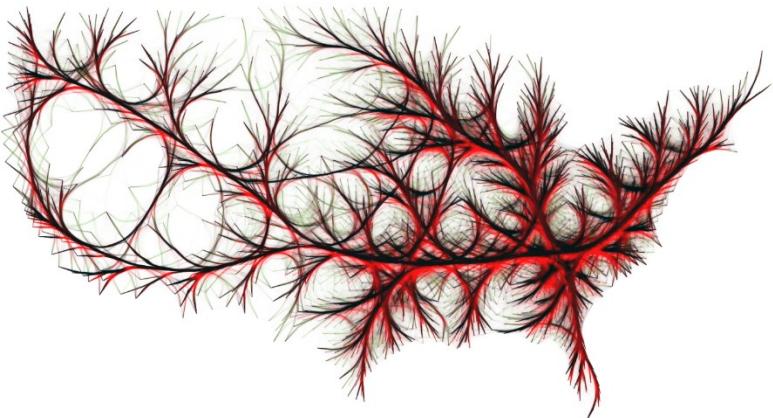
Computer Scientist
+ Journalist
= Computational Journalist

Teach a course on “Storytelling with Data Visualization”

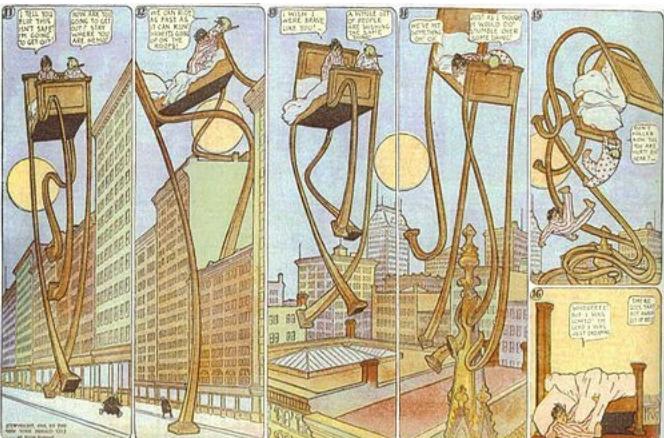
Research on narrative data vis, visual analytics for journalists

Interactive Multidimensional Data Exploration

Image-Based Visualization



Chapter 2: From Cognitive to Design Principles



This chapter lays out the perceptual and cognitive foundation of how humans understand and perceive events, stories, data graphics, and ultimately visual storytelling. Creating meaningful and memorable stories based in data is challenging, a craft that brings together disparate strands of inquiry. There is the structure and understanding of events from which stories are crafted. There is the structure of stories and related kinds of discourse, descriptions, explanations and conversations. There is visual story-telling, ancient and modern. There is the understanding of, memory for and uses of graphic displays. Then there are the constraints of the media, print and digital, static and interactive, and the newsworthiness of the stories. This chapter points to a substantial corpus of existing research and highlights open questions and challenges for designing effective data-driven stories.

Carte Figurative des pertes successives en hommes de l'Armée Française dans la Campagne de Russie 1812-1813.
 Dressée par M. Minard, Inspecteur Général des Ponts et Chaussées en retraite
 Paris, le 20 Novembre 1869.

Les nombres d'hommes présents sont représentés par les largeurs des zones colorées à raison d'un millimètre pour dix mille hommes; ils sont de plus écrits en travers des zones. Le rouge désigne les hommes qui entrent en Russie; le noir ceux qui en sortent. — Les renseignements qui ont servi à dresser la carte ont été puisés dans les ouvrages de M. M. Chiers, de Léger, de Fezensac, de Chambray et le journal médical de Jacob, pharmacien de l'Armée depuis le 28 Octobre.

Pour mieux faire juger à l'œil la diminution de l'armée, j'ai supposé que les corps du Prince Jérôme et du Maréchal Davout, qui avaient été détachés sur Minsk et Mohilow et qui rejoignirent vers Orscha et Witebsk, avaient toujours marché avec l'armée.

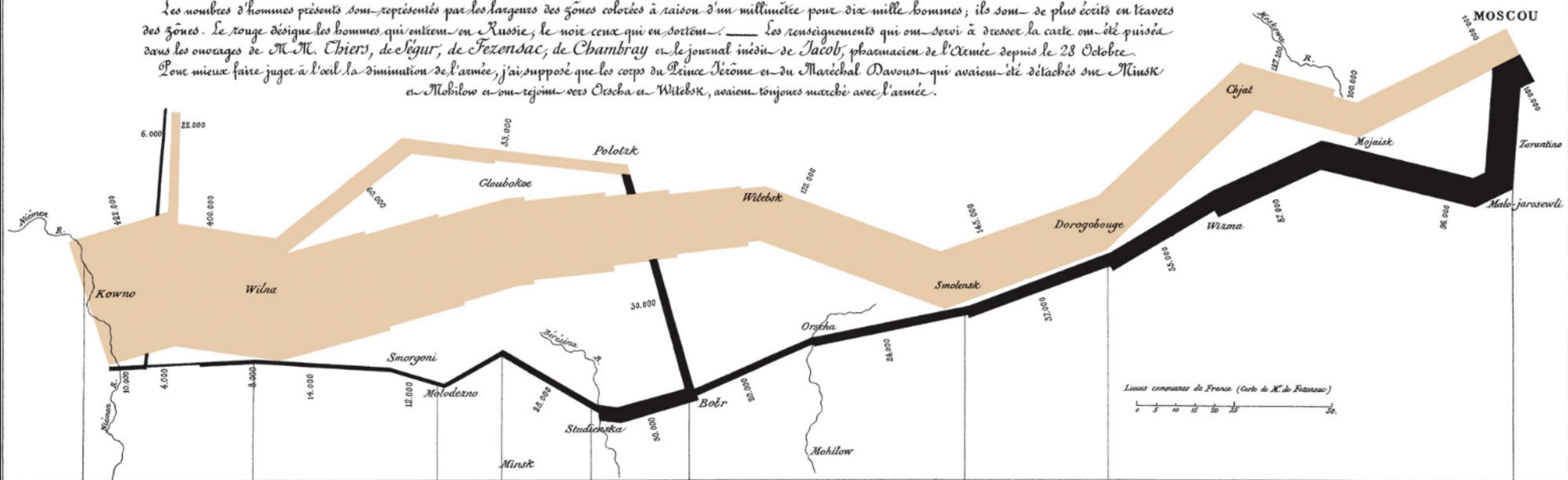
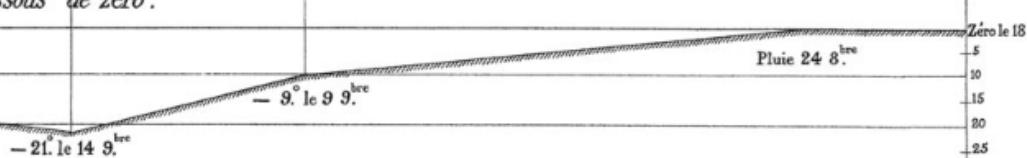


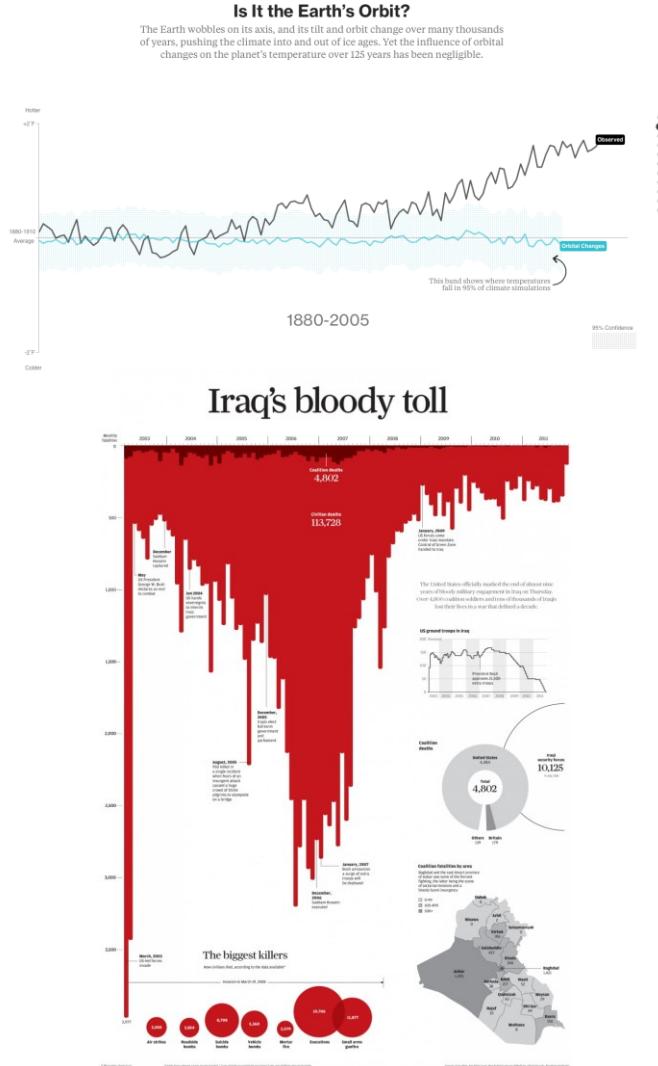
TABLEAU GRAPHIQUE de la température en degrés du thermomètre de Réaumur au dessous de zéro.

Les cosaques passent au galop
le Niemen gelé.

-26° le 7 X.
 -30° le 6 X.
 24. le 1^{er} X.
 -20° le 28 9.
 -11°



Chapter 3: Exploration and Explanation in Data-Driven Storytelling

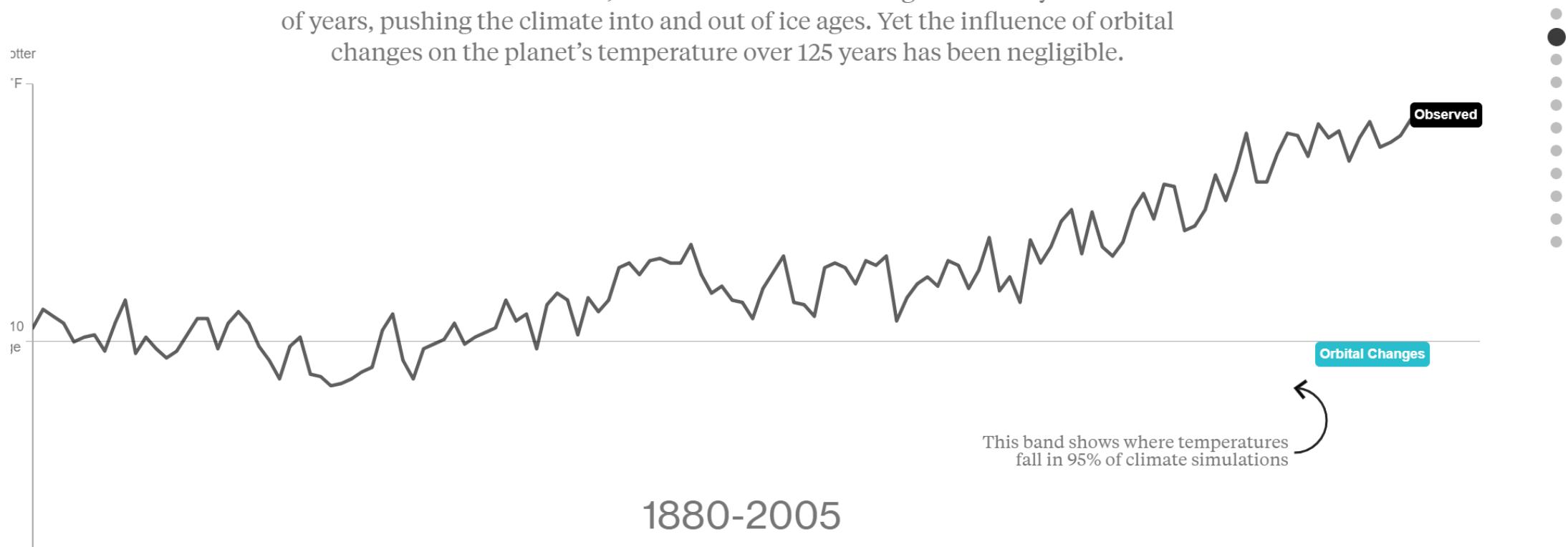


This chapter reflects on exploratory and explanatory aspects of data-driven stories. Exploratory aspects give readers freedom and control over how they experience the story, while explanatory aspects provide context and interpretation for the reader and allow the authors to communicate a particular narrative. The authors argue that data-driven stories can have high amounts of both explanation and exploration. To this end, the authors view data stories through multiple dimensions: they examine the flexibility and interpretation provided in data stories' view, the data they focus on, and the sequences in which the data can be viewed. Examples from data-driven stories are used to illustrate how differing amounts of exploration and explanation can be provided in practice. Viewing these as complementary aspects could lead to new ways of integrating exploration and explanation in data-driven stories.

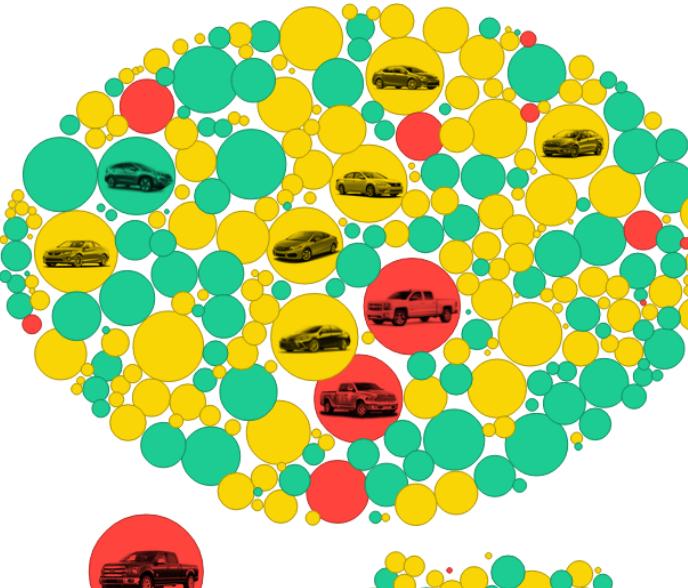
<https://www.bloomberg.com/graphics/2015-whats-warming-the-world/>

Is It the Earth's Orbit?

The Earth wobbles on its axis, and its tilt and orbit change over many thousands of years, pushing the climate into and out of ice ages. Yet the influence of orbital changes on the planet's temperature over 125 years has been negligible.



Chapter 4: Data-Driven Storytelling Techniques: Analysis of a Curated Collection of Visual Stories



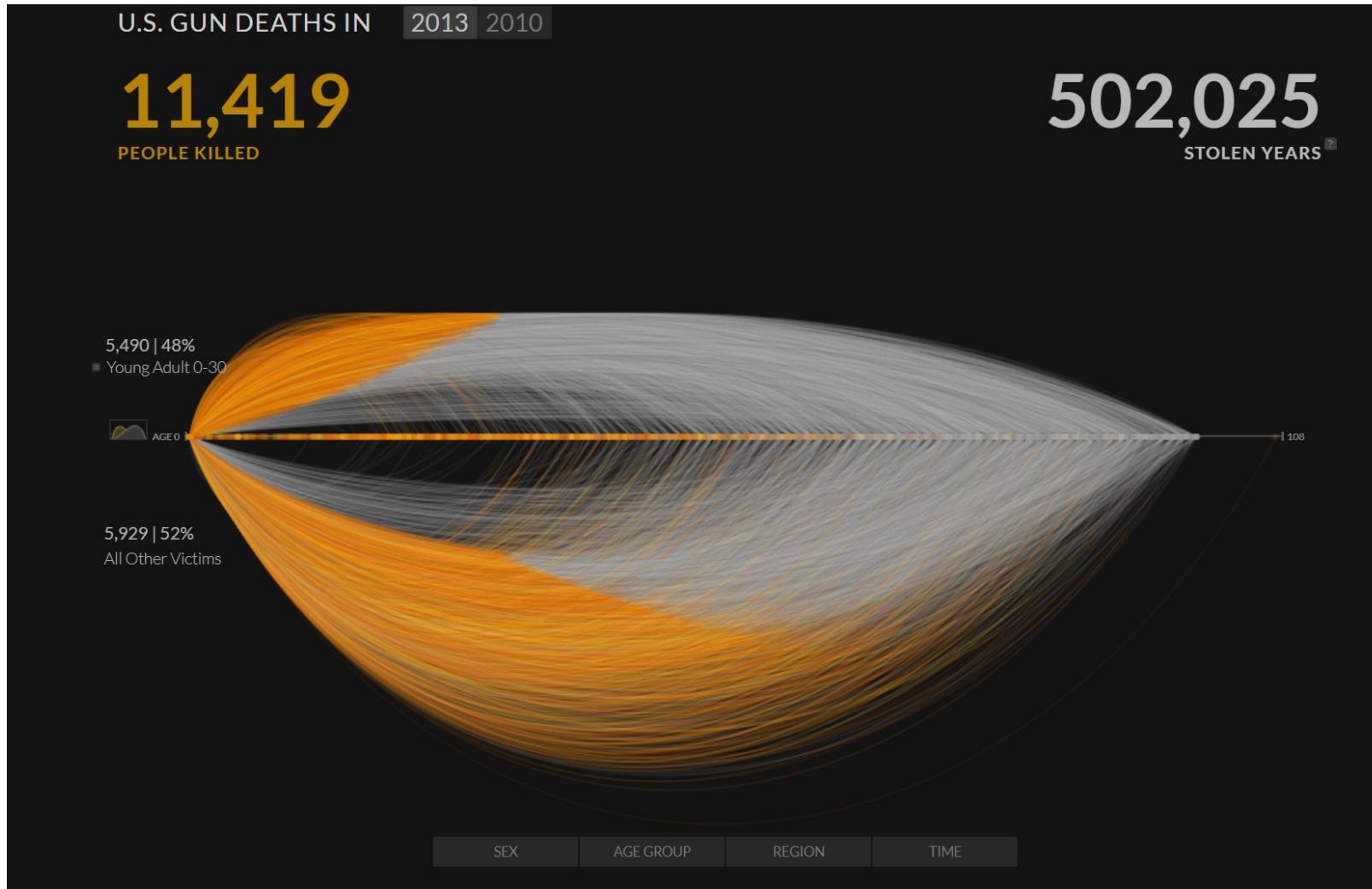
Integrating data visualization into narrative stories has now become commonplace. Authors are enabling new reader experiences, such as linking textual narrative and data visualizations through dynamic queries embedded in the text. Novel means of communicating position and navigating within the narrative also have emerged, such as utilizing scrolling to advance narration and initiate animations. This chapter advances the study of narrative visualization through an analysis of a curated collection of data-driven stories shared on the web. Drawing from the results of this analysis, it presents a set of techniques being employed in these examples, organized under four high-level categories that help authors tell stories in creative ways: communicating narrative and explaining data, linking separated story elements, enhancing structure and navigation, and providing controlled exploration. The benefits of each storytelling technique along with a number of example applications of the ideas in data-driven stories are discussed. Furthermore, the evolution of the field and areas for future research are outlined.

Chapter 5: Narrative Design Patterns for Data-Driven Storytelling



This chapter introduces the concept of narrative design patterns, which aim to facilitate the shaping of compelling data-driven stories. There are many different ways storytellers can narrate the same story, depending on their intentions and their audience. Here, the authors define and describe a set of these narrative design patterns that can be used on their own or in combination to tell data stories in a myriad of ways. The authors then analyze eighteen of them, and illustrate how these patterns can help storytellers think about the stories they want to tell and the best ways to narrate them. Each pattern has a specific purpose, for example, engaging the audience, evoking empathy, or creating flow and rhythm in the story. The authors assume storytellers already know what story they want to tell, why they want to tell it, and who they want to tell it to. These patterns may not only facilitate the process of creating compelling narratives, they may also stimulate a wider discussion on techniques and practices for data-driven storytelling.

<https://guns.periscopic.com/?year=2013>



http://demonocracy.info/infographics/usa/us_debt/us_debt.html



Chapter 6: Watches to Augmented Reality: Devices and Gadgets for Data-Driven Storytelling

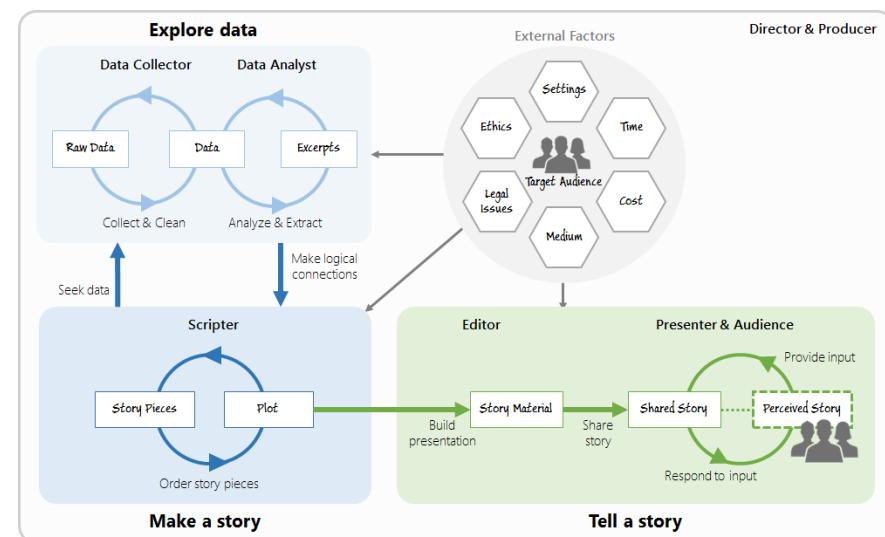


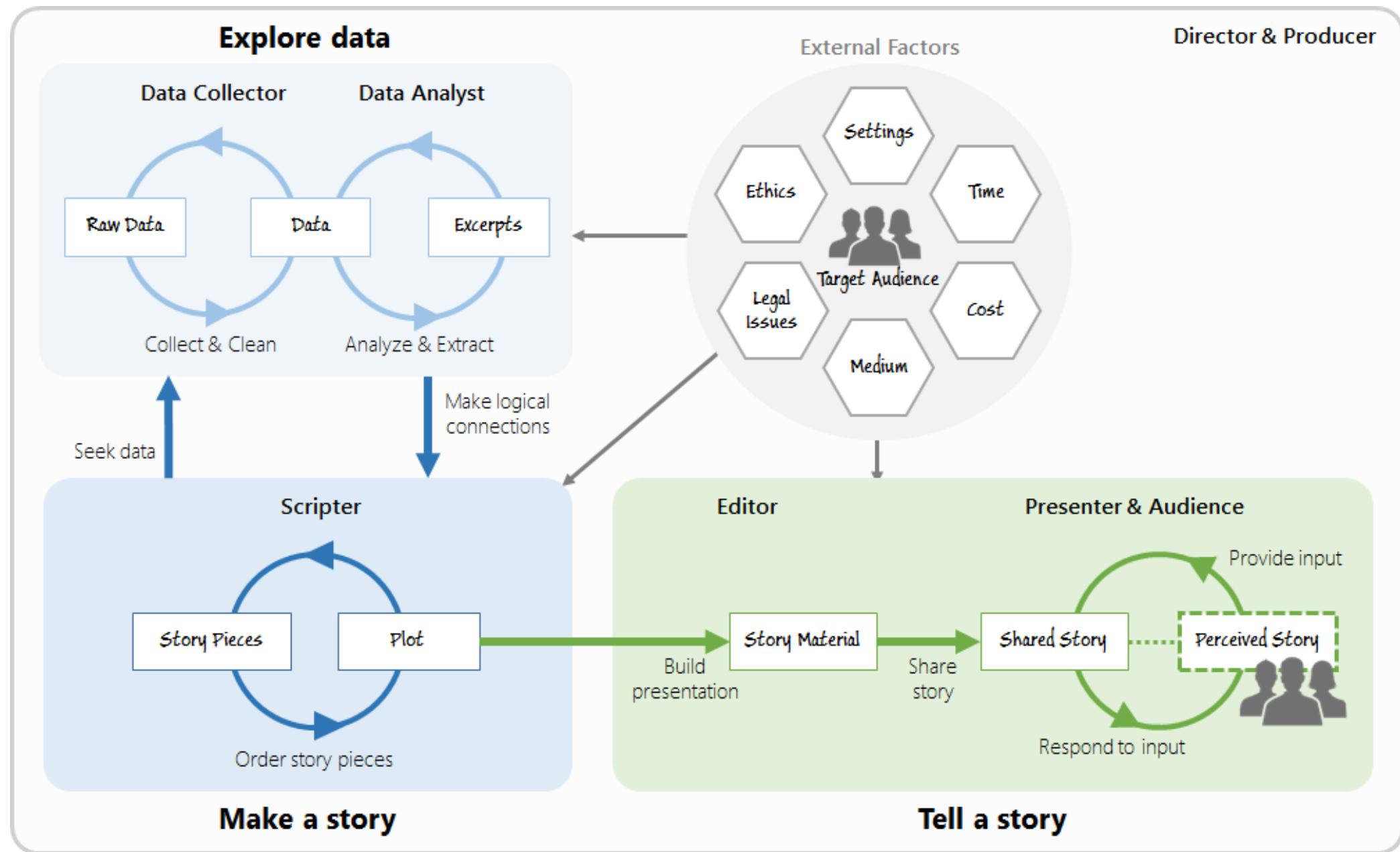
This chapter discusses different device form factors and their affordances and characteristics for different storytelling settings. A wide range of form factors for data-driven storytelling, including not only the obvious electronic “devices” but also more diverse media such as tangible props (i.e., things that people can pick up and hold, gesticulate with, and so on) are considered. The latter are worth considering because they can give insights into how data storytelling might occur in futuristic mixed-reality digital environments that may be enabled by the current rapid progress in virtual and augmented reality display and interaction technologies. In addition, this discussion of devices considered not only display contents but also the possibilities for direct interaction. The chapter also presents a set of examples that use different devices in data-driven storytelling, reflecting on how to tell data-driven stories when using different devices and media.



Chapter 7: From Analysis to Communication: Supporting the Lifecycle of a Story

This chapter describes the lifecycle of visual data stories, including the tools and methods that authors employ to create visual stories, the processes they go through, and the major pain points they experience. The discussion of current practice as presented, is based on interviews with nine professional data storytellers. Each of these interviews explored the participant's experience with one past story production project. The chapter focuses on the visual data storytelling process, from conception through production, including data collection and preparation, data analysis, story development, and visual presentation. Also included is a detailed description of the main roles and activities that storytellers engage in as they turn raw data into a visually shared story, and the tools they use to support their work. Based on the example projects described by participants, the process of story production is summarized, an overview of the tools that are in use is given, and opportunities for research and design are detailed.





Chapter 8: Organizing the Work of Data-Driven Visual Storytelling

Name	Description	Link
Chat Tools		
Google Hangouts	Communication platform developed by Google, allowing users to video chat and use instant messaging	https://hangouts.google.com/
HipChat	Group and private chat, file sharing,	https://www.hipchat.com/
Productivity/Management Tools		
Asana	Web and mobile application for project management and collaboration.	https://asana.com
Basecamp	Web and mobile application for project management and collaboration.	https://basecamp.com/
Evernote	Web, mobile, and desktop application designed for note taking, organizing,	https://evernote.com
Web Programming Tools		
Angular	A structural framework for dynamic web apps that can be used to extend HTML's syntax.	https://angularjs.org/
CSS	Style sheet language used for describing the presentation of a document written in a markup language like HTML.	http://www.w3schools.com/css/

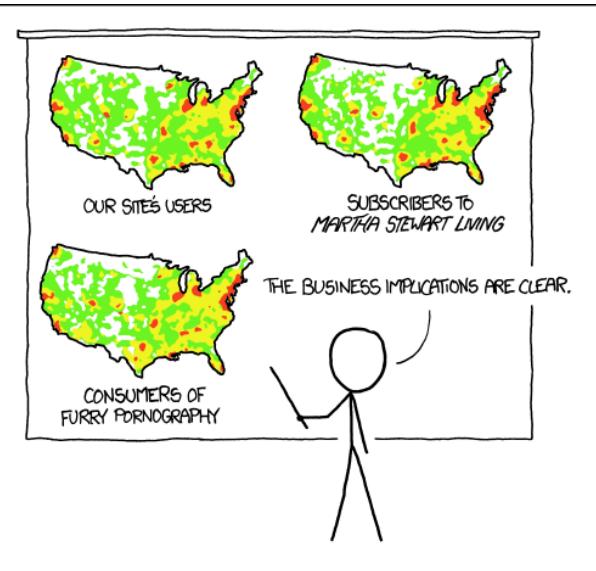
One of the challenges of telling compelling, effective data-driven stories is how a group organizes their teams, skillsets, and workflow. In this chapter, we explore different approaches to working with data and visualizing data in three sectors: design studios, media, and non-profits and non-governmental organizations. This chapter explores what teams, tools, and organizational structures these groups use to work with data and tell narrative stories. Their experiences and lessons-learned can provide valuable insight for other organizations as they seek to develop their own workflow to effectively visualize and communicate their data, analysis, and stories.

Chapter 9: Communicating Data to an Audience

Communicating data in an effective and efficient story requires the content author to recognize the needs, goals, and knowledge of the intended audience. Do we, the authors, need to explain how a chart works? It depends on the audience. Does the data need to be traced back to its source? Depends on the audience. Can we skip obvious patterns and correlations and dive right into the deeper points? Depends on the audience. And so on. Thus, to effectively communicate ideas and concepts, content authors need to think carefully about how their work best fits the needs of the audience. This chapter explores design considerations relating to audience knowledge and goal contexts, and considers the difference between the theory of what we might know and the reality of what we can know.



Chapter 10: Ethics in Data-Driven Visual Storytelling

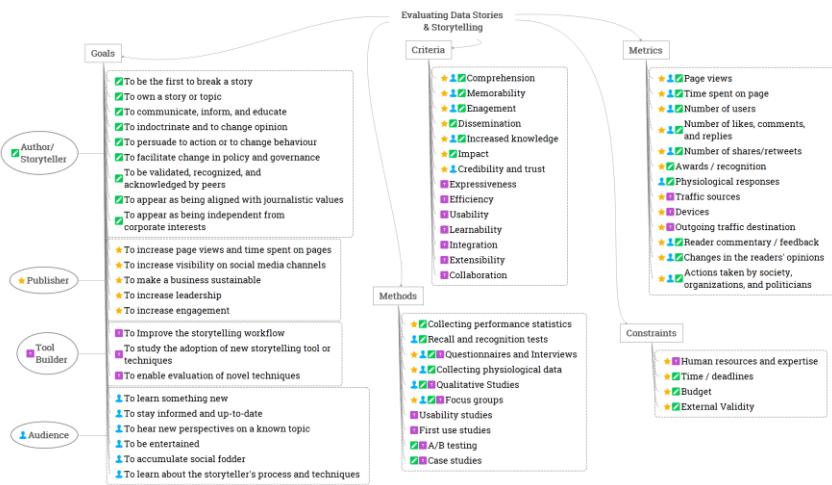


PET PEEVE #208:
GEOGRAPHIC PROFILE MAPS WHICH ARE
BASICALLY JUST POPULATION MAPS

Many questions that relate to ethics arise in data-driven story telling. Is the sample representative, have we thought of the bias of whoever collected or aggregated the data, can we extract a certain conclusion from the dataset, is it implying something the data doesn't cover, does the visual device, or the interaction, or the animation affect the interpretation that the audience can have of the story? These are questions that anyone that has produced or edited a data-driven visual story has, or at least should have, been confronted with. After introducing the reasons and implications of ethics in this space, this chapter looks at the risks, caveats, and considerations at every step of the process, from the collection/acquisition of the data, to the analysis, presentation, and publication, with many points illustrated through an example of an ethical consideration.

Chapter 11: Evaluating Data-Driven Stories & Storytelling Tools

This chapter provides a review of how data-driven stories and the tools used to produce them are evaluated. Evaluation is a far-reaching concept; among the topics discussed in this chapter include the evaluation of a data-driven story in a newsroom context as well as the evaluation of novel storytelling tools and techniques in academic research settings. The discussion spans a diverse set of goals, acknowledging the different perspectives of storytellers, publishers, readers, tool builders, and researchers. It also reviews possible criteria for assessing whether these goals are met, as well as evaluation methods and metrics that address these criteria. This chapter is intended to serve as a guide for those considering whether and how they should evaluate the stories they produce or the storytelling tools or techniques that they develop.



Dagstuhl spirit



Monday	Tuesday	Wednesday	Thursday	Friday
9.00am - Hall 1 THE BEGINNING	9.00am Hall 1 - sync up	9.00am Hall 1 - sync up	9.00am Hall 1 - sync up	9.00am Hall 1 - sync up
Intro <i>Coffee break</i> Invited talks	Small Groups <i>Coffee break</i> Small Groups	9am - 9.30am Lightning talks Brainstorm 2 <i>Coffee break</i> Small Groups	Small Groups <i>Coffee break</i> Small Groups	Groups report back <i>Coffee break</i> Wrap up
12.15 – 2pm Lunch				
2pm – 2.30 pm Lightning talks (Hall 1)	2pm – 2.30 pm Lightning talks (Hall 1)	Social event	2pm – 2.30 pm Lightning talks (Hall 1)	THE END
Brainstorming	Small Groups		Small Groups	
3.30pm cake				
Small Groups	Groups report back	Social event	Small Groups	
6pm Dinner				

Monday	Tuesday	Wednesday	Thursday	Friday
9.00am THE BIG Hall 1	9.00am Hall 1	9.00am Hall 1	9.00am Hall 1 - sync up	9.00am Hall 1 - sync up
Introductions Coffee break Invited talks	Small Groups Coffe break Small groups	9am Light Brainstorming Coffee break Small groups	Small Groups Coffee break Small groups	Group work Coffee break Wrap up

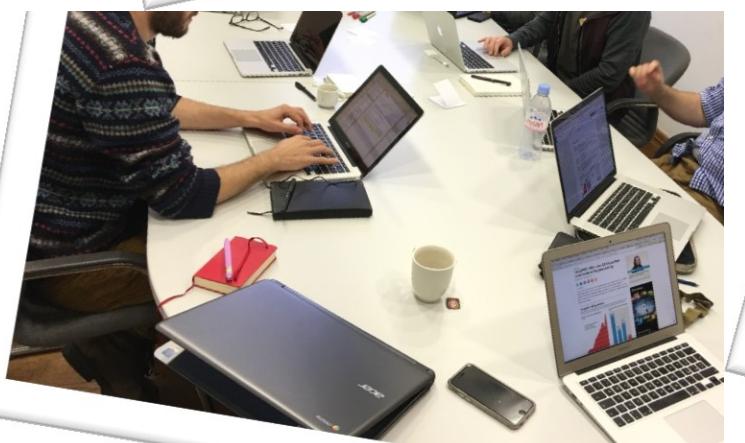
12.15 – 2pm Lunch

2pm Lipstick talk	2pm Lipstick talk	2pm Lipstick talk	Social Sightseeing	2pm Lipstick talk	THE END
Brainstorming	Small Groups	Small Groups	Half-timbered house Porta Nigra	Small Groups	

3.30pm coffee

Small Groups	Get support back	6pm Dinner	Small Groups
Snooker	Chess	Food	Table Tennis





26 Lightning talks



John Stasko

School of Interactive Computing
Georgia Institute of Technology
Atlanta, GA

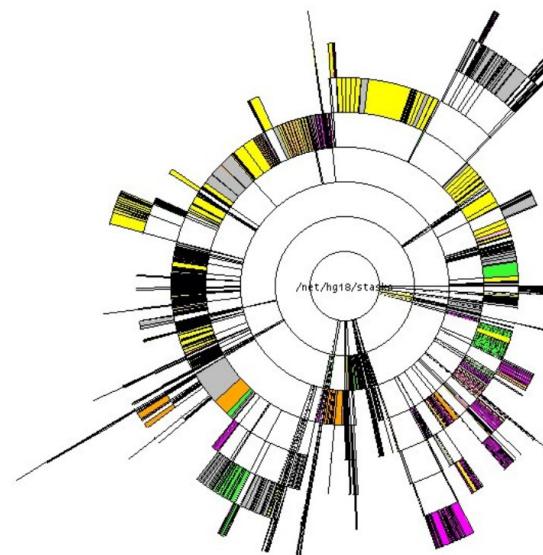
stasko@cc.gatech.edu

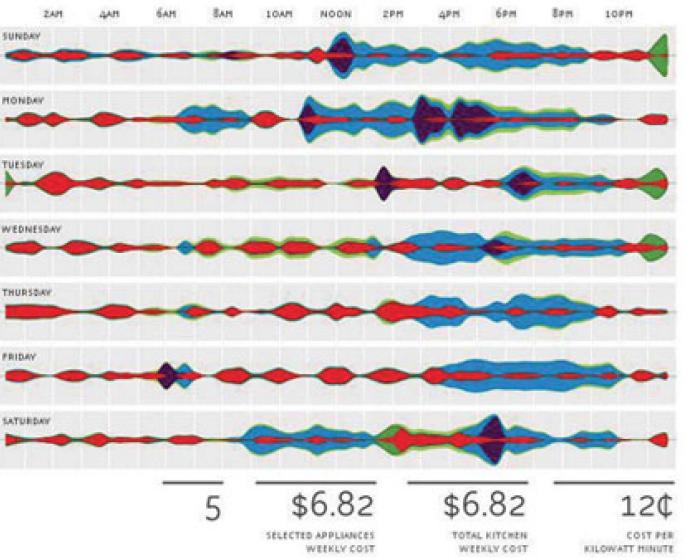


Research interests: information visualization, visual analytics, & HCI

Done work across five paper types: techniques, theory, domain studies, systems, evaluation

Recent foci: interaction (touch & tablet), text & document v.a., value of vis





Personal Visualization: Visualization for How and Where we Live

Lyn Bartram

School of Interactive Arts + Technology
Simon Fraser University



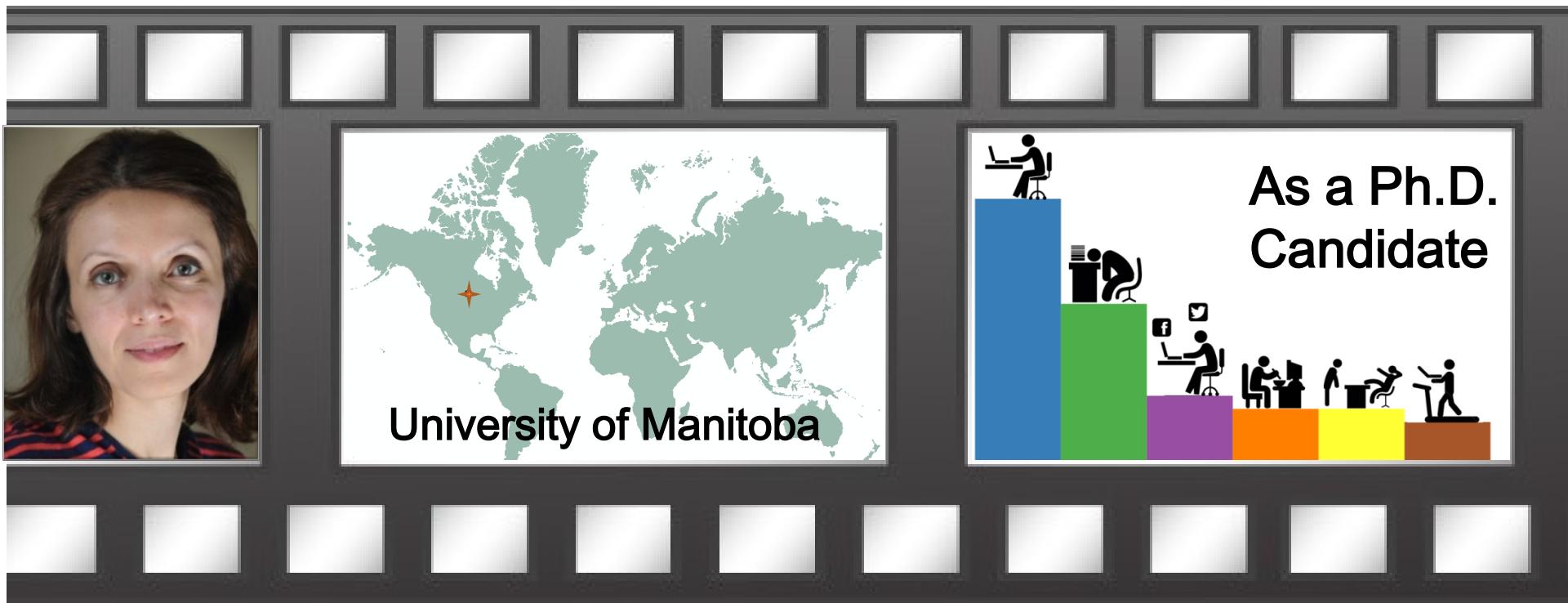
Fereshteh Amini

Microsoft

Supervisor: Dr. Pourang Irani

Data Video Storytelling

Communicating visual analytics results through data stories

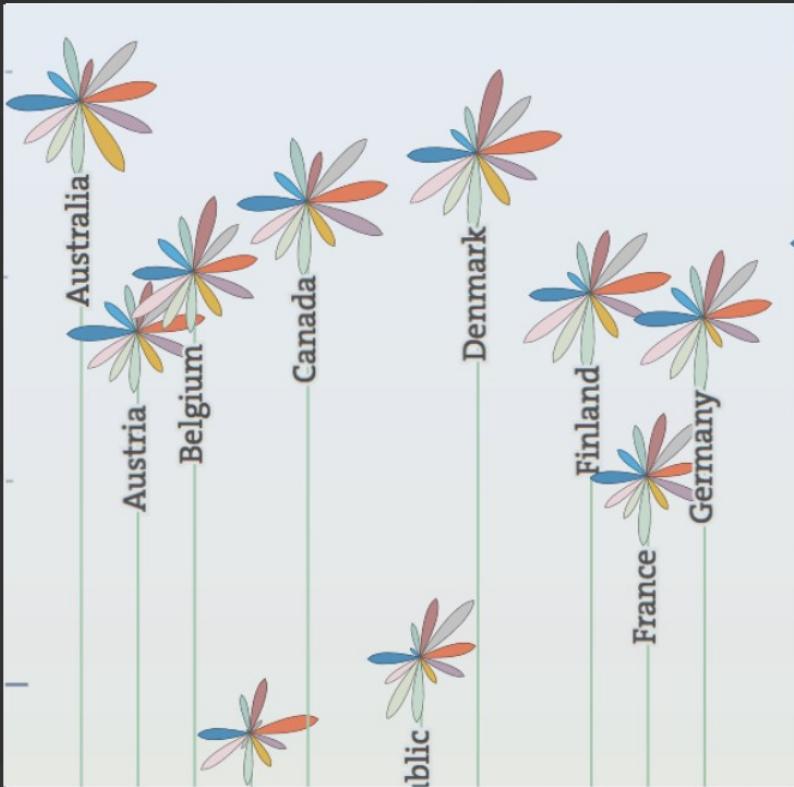


Moritz Stefaner

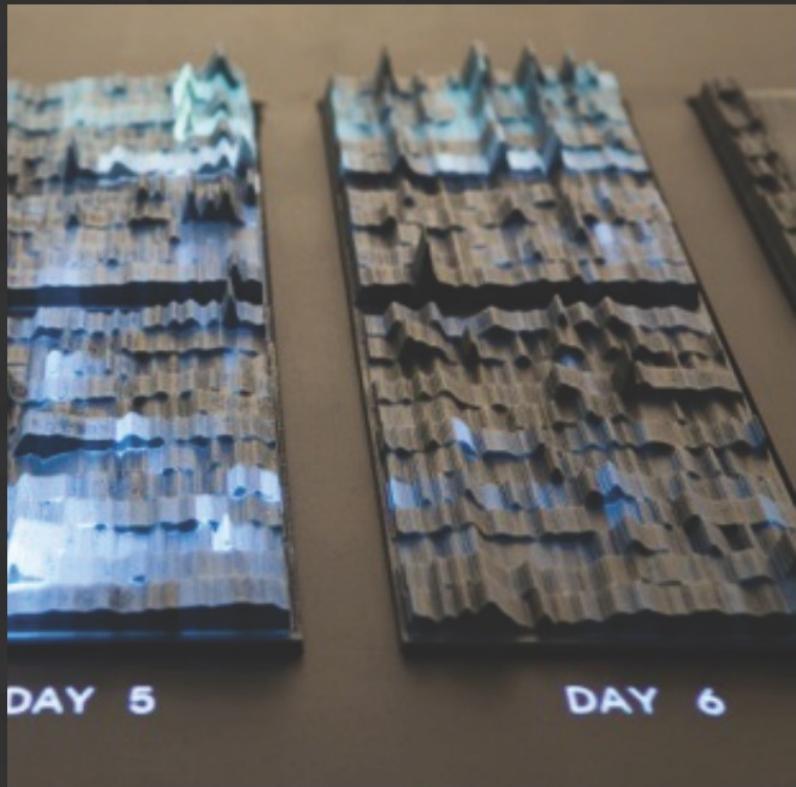
Independent data vis practitioner for 10+ years



Clean, analytic information design



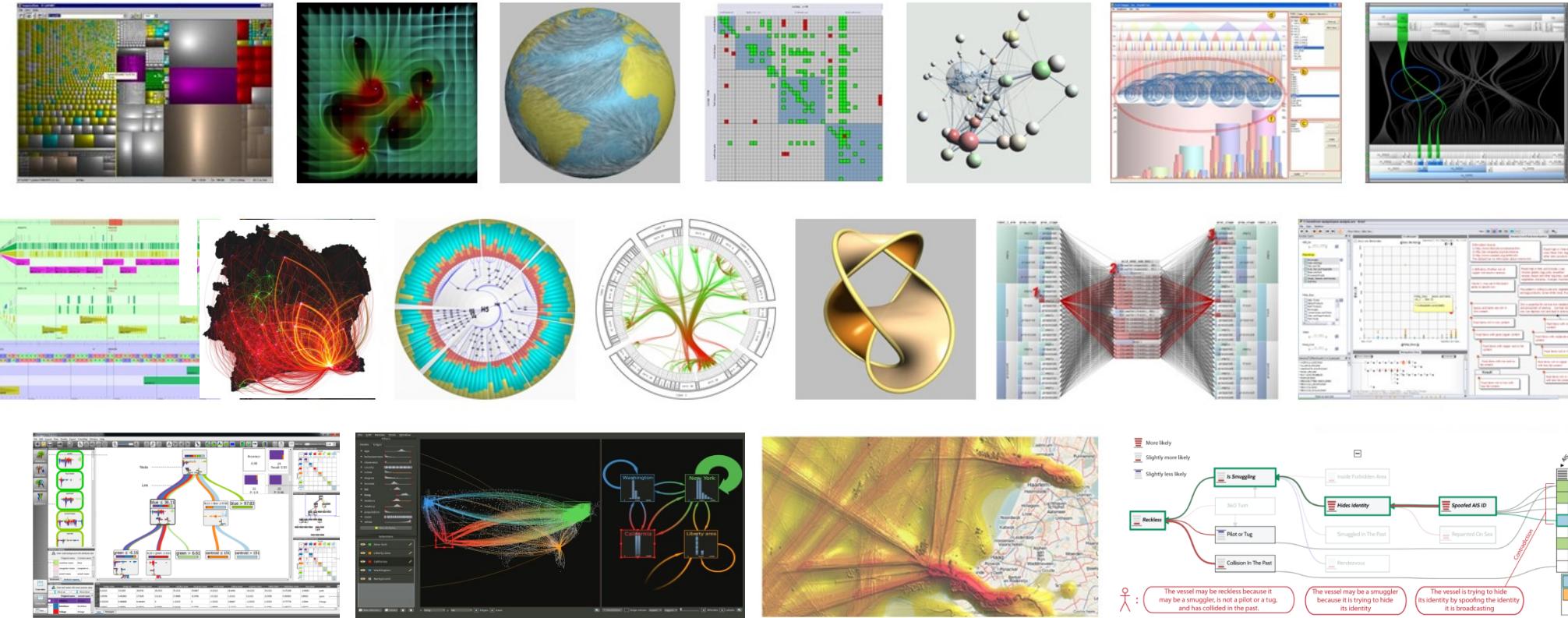
High-end custom visualizations



Experimental data art

Jarke (Jack) van Wijk

– software visualization – perception – geographic visualization
scientific visualization – math vis – human computer interaction – – parallel

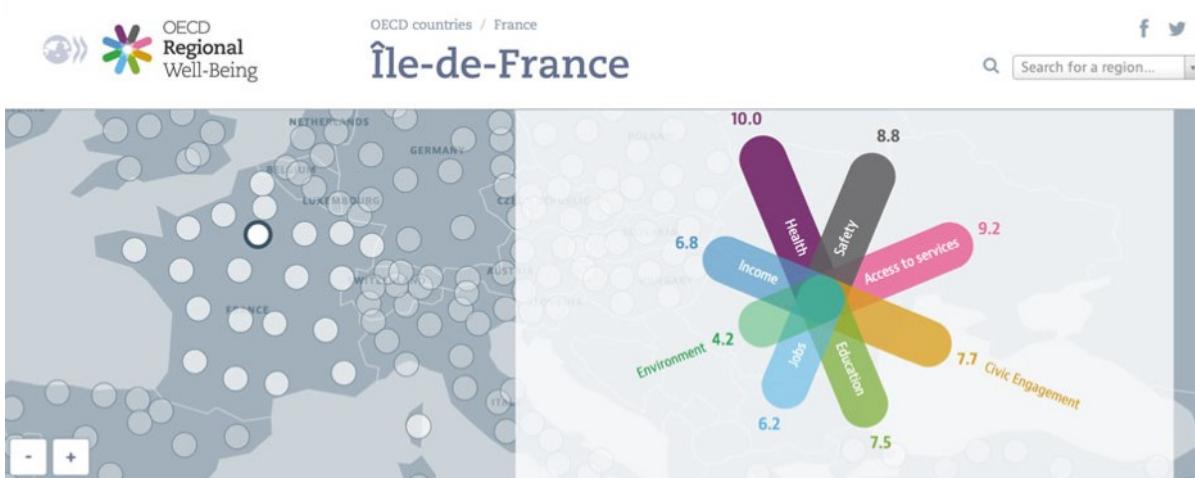


: flow fields – trees – graphs – tables – mobile data – events – images – geospatial ...

: health – business – forensics – bioinformatics – sports – security – workflow ...

DOMINIKUS BAUR

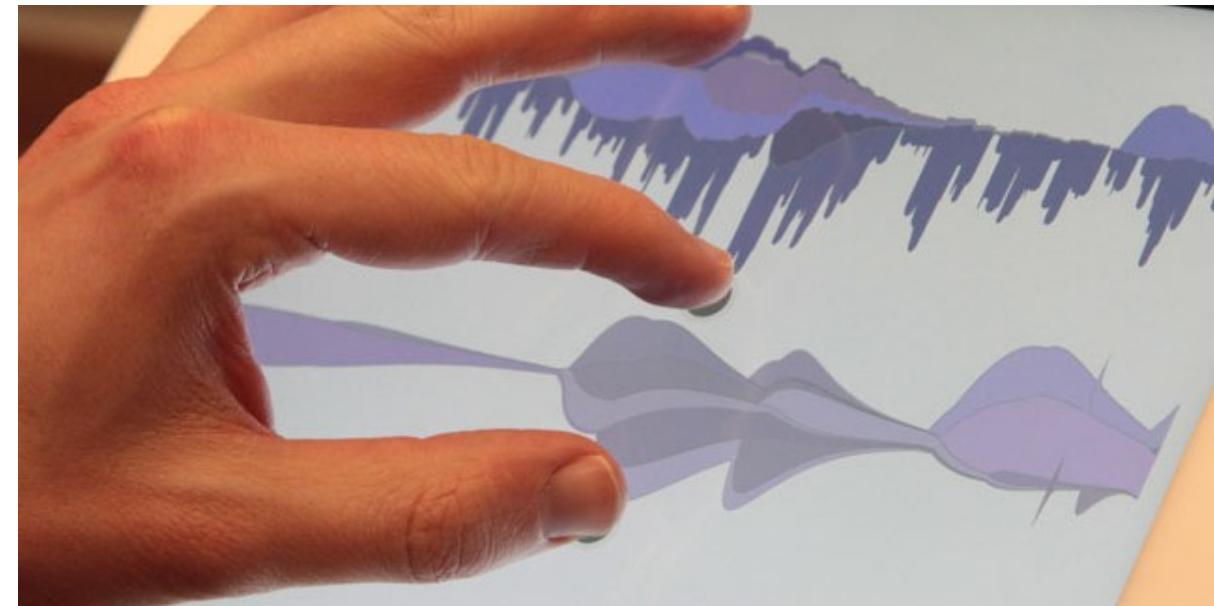
*mobile interaction design
visualization engineering*



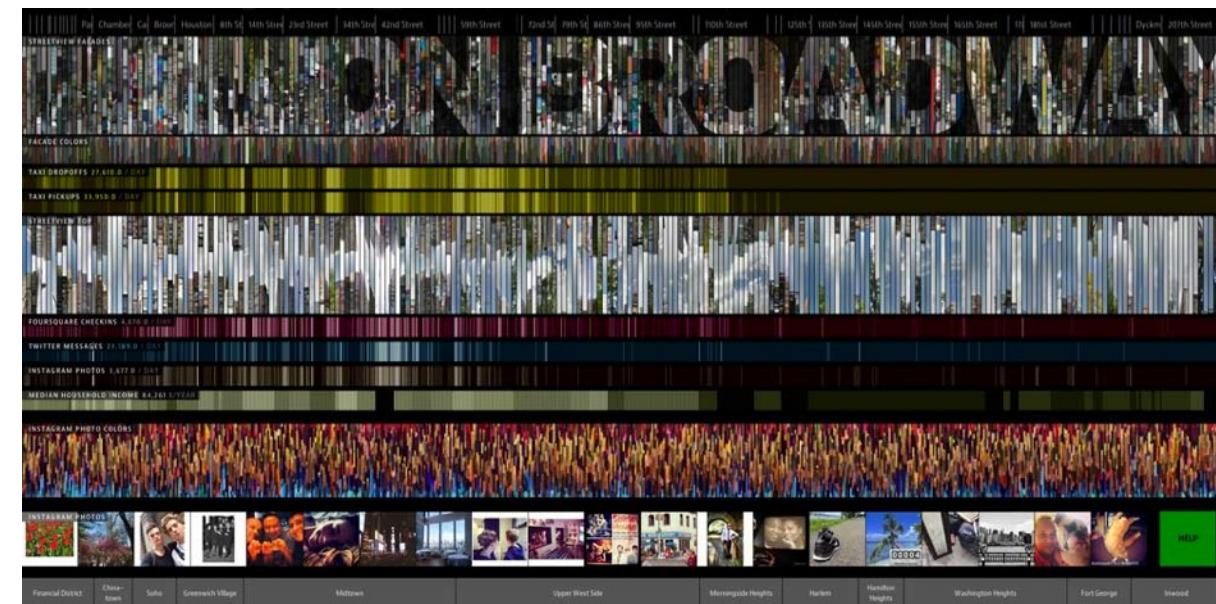
Explore the map to find out how life is across OECD regions and discover regions with similar well-being.

Each region is measured in eight basic important factors.

Client work (OECD Regional Well-Being)



Research projects (TouchWave)



Data-based installations (ON BROADWAY)



Dr. Steven M. Drucker

Principal Researcher
Microsoft Research

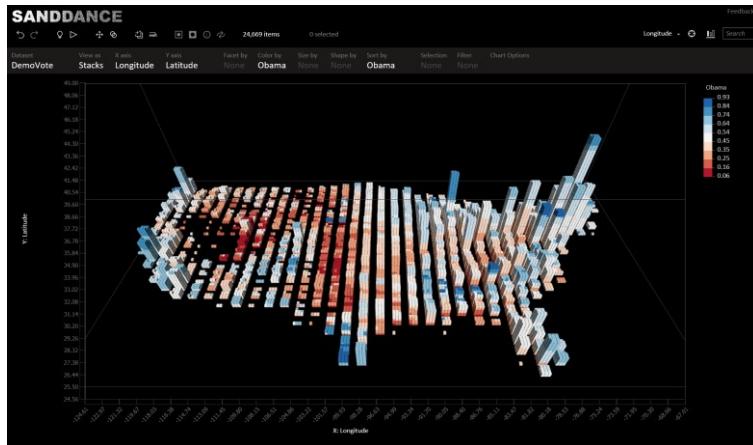
sdrucker@microsoft.com

<http://research.microsoft.com/~sdrucker>

Areas of Interest:

Information Visualization, Human Computer Interaction Computer Graphics, Sense-making, Machine Learning, Visual Communication, Natural Interaction

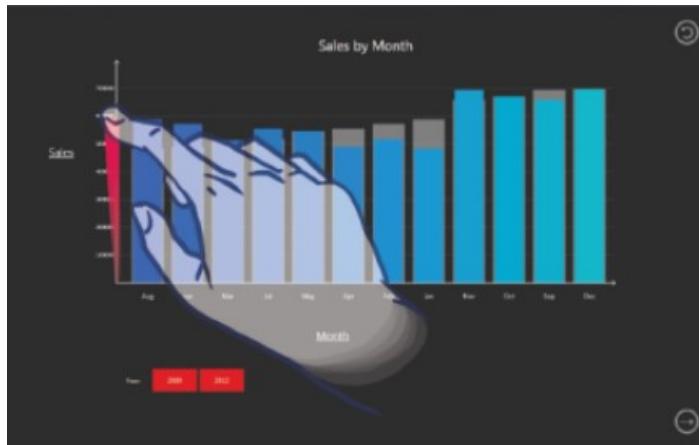
Some Recent Projects of interest:



SandDance

(To be released February, 2016)

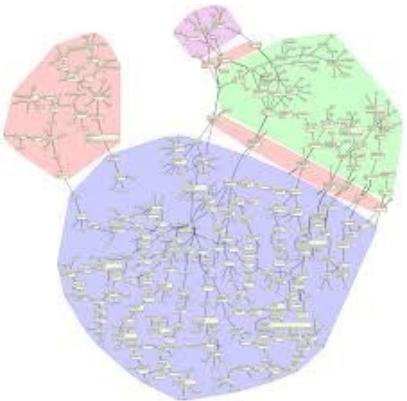
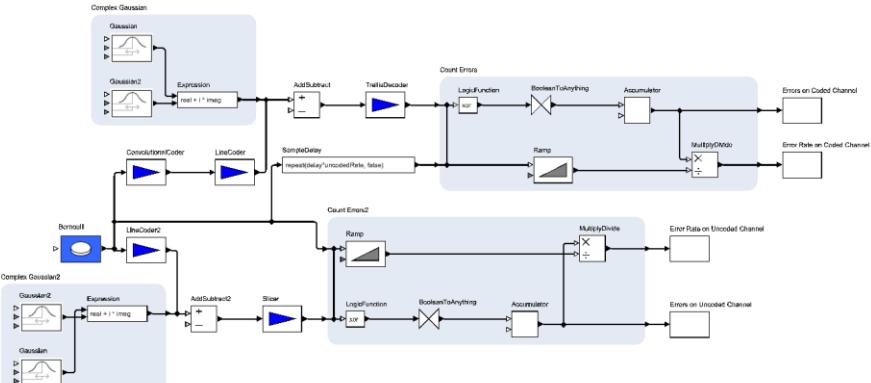
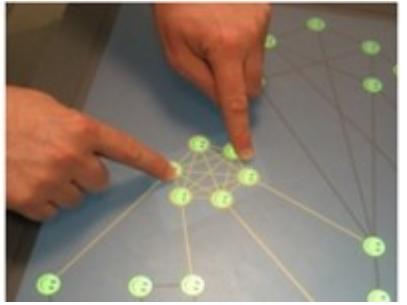
<http://research.microsoft.com/projects/sanddance>



TouchVis
SIGCHI, 2013

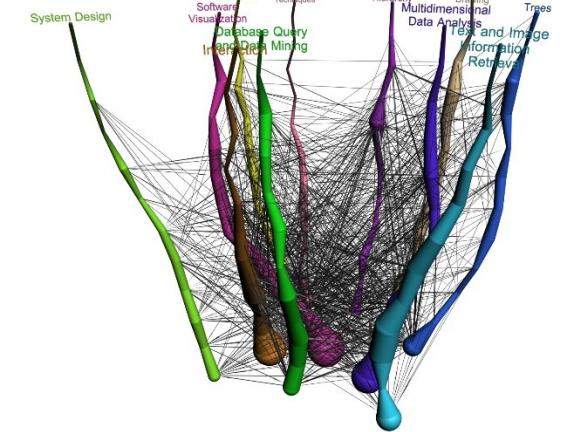
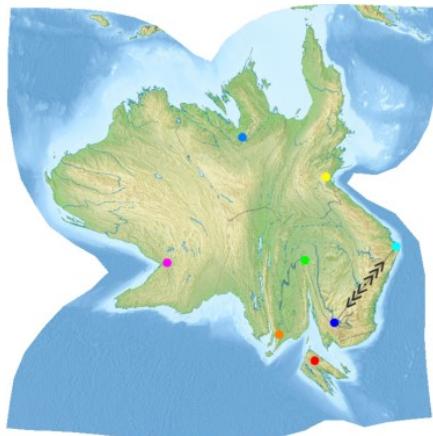
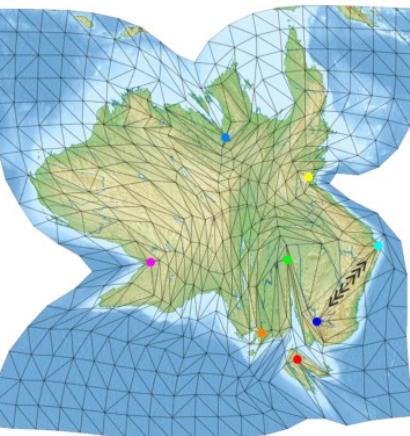
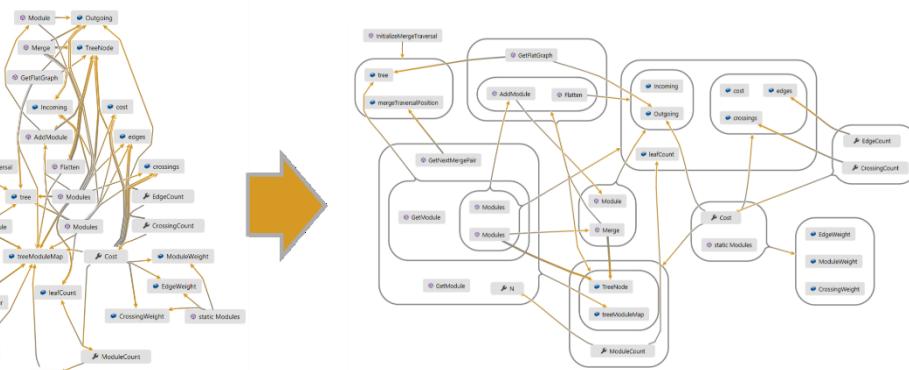


(S|qu)eries: Visual
Regular Expressions
SIGCHI 2015



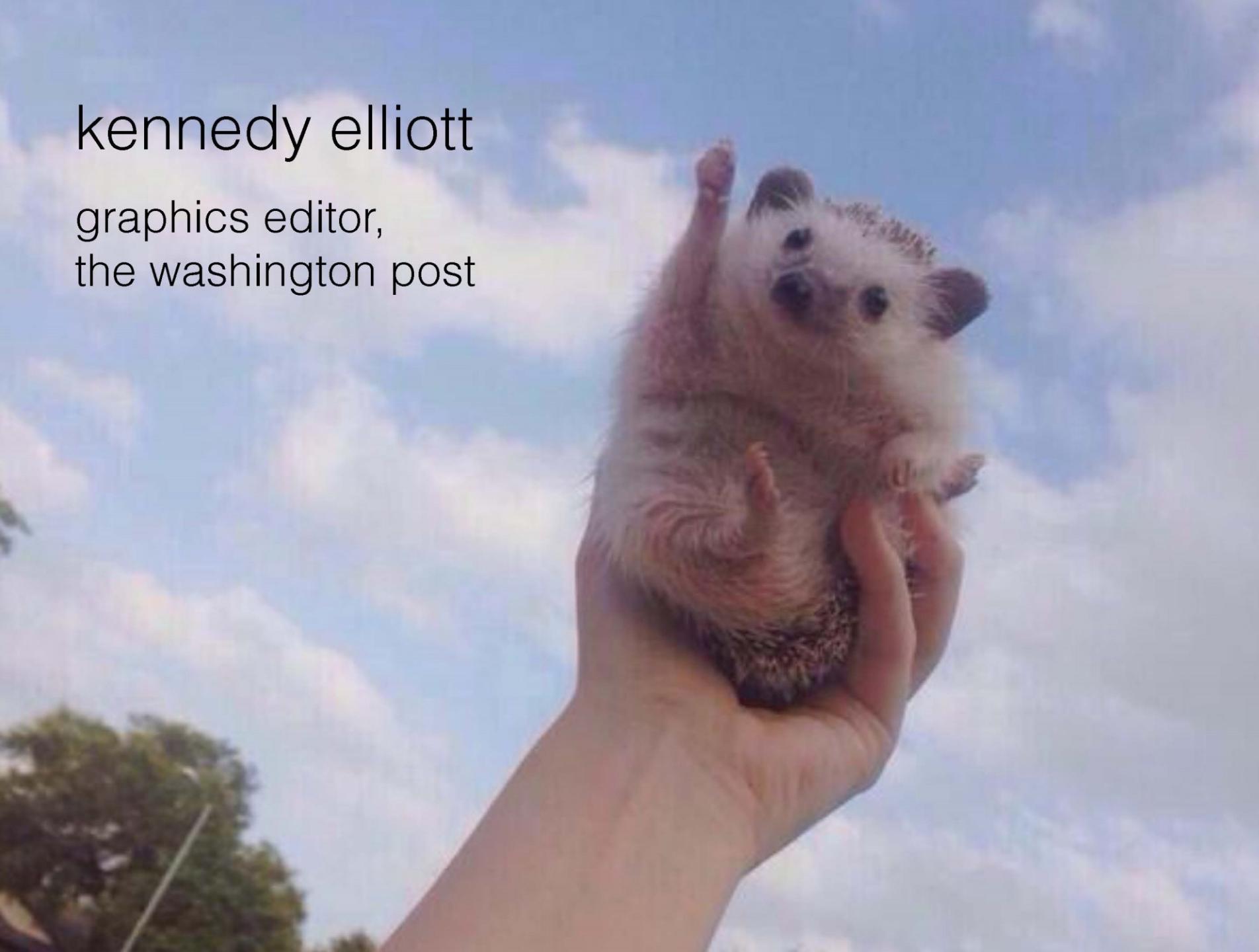
Tim Dwyer

Monash University, Australia

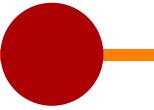


kennedy elliott

graphics editor,
the washington post



Christina Elmer

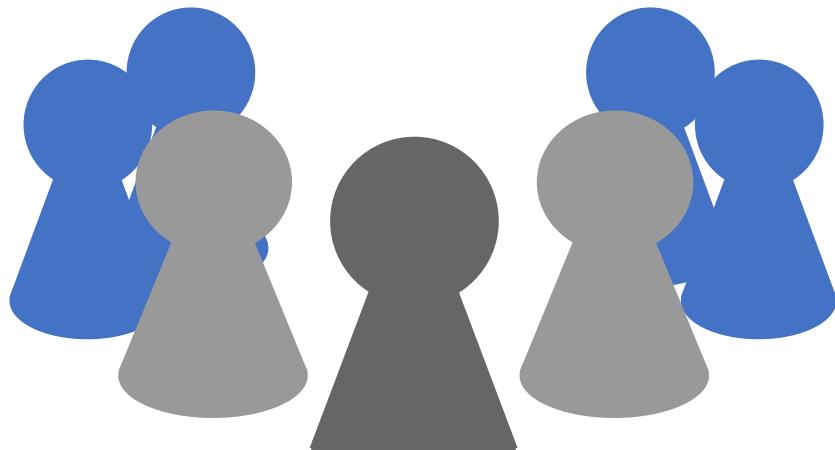


Team lead data journalism @ SPON

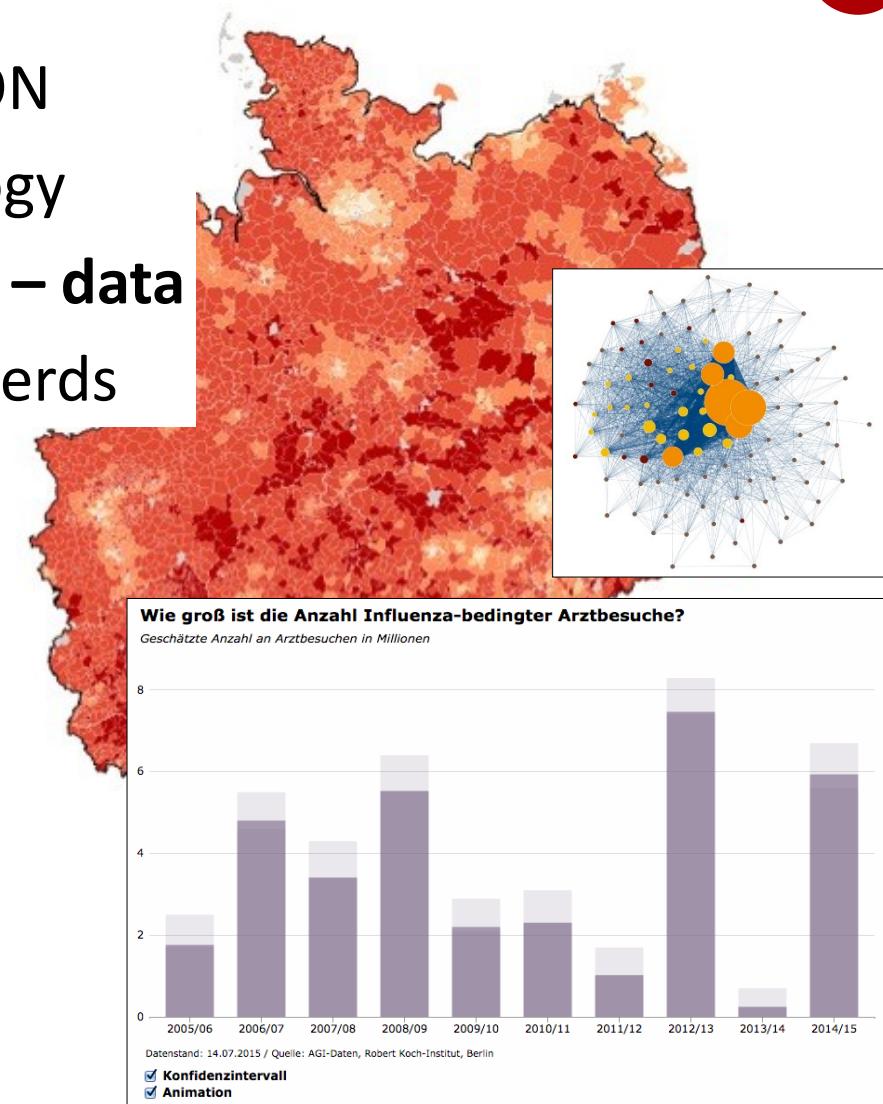
Background: journalism and biology

Translating data – storys | storys – data

Connecting journalists and data nerds



SPIEGEL ONLINE



Xaquín G.V. Editor of Visuals, The Guardian

Dad, Galician, cook and visual storyteller.

Formerly of NatGeo, NYT, Newsweek and elmundo.es

I used to edit and produce visual stories – lots of which were data-driven.

I now rejoice in guiding others, much smarter than me, in doing so.



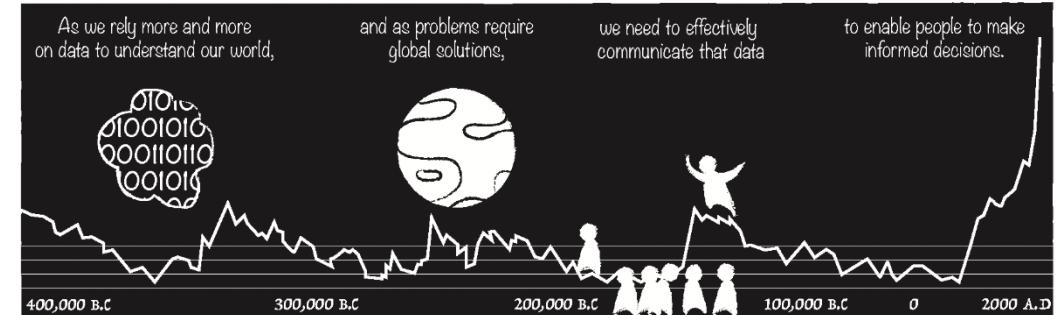
Yuri Engelhardt



Lightning talks



<http://aviz.fr/~bbach/datacomics/>





Alice Thudt, Dominikus Baur, Samuel Huron and Sheelagh Carpendale.

Visual Mementos: Reflecting Memories with Personal Data. In *Proceedings of the IEEE Transactions on Visualization and Computer Graphics*, 2015.

<http://alicethudt.de/visual-mementos/>





Constructive visualizationS Huron, S
Carpendale, A Thudt, A Tang, M Mauerer
Proceedings of the 2014 conference on
Designing interactive systems, 433-442



Authoring Data-Driven Videos with DataClips

Submission #222
InfoVis 2016

<http://hci.cs.umanitoba.ca/projects-and-research/details/dataclips>

Future directions

Many questions arise as interactive visualizations are used in situations beyond data exploration by data experts, such as the focus in this book on communication to a broader audience. Research on the understanding of static images in cognitive psychology and perception may need to be extended to encompass more advanced techniques (videos and interactive applications). **Visualization literacy**, or the ability to extract, interpret, and make meaning from information presented in the form of an (interactive) data visualization, is also a crucial component in data-driven storytelling. Assessing the visualization literacy of an audience and developing techniques to better teach how to decode interactive visualizations has started to attract the attention of our research community. Still, there remains considerable exciting research that can be done to contribute to a well-informed society. For example, research on **how visualizations can lie** (Tufte, 1984) or at least how they may introduce **bias in the reader's mind** has focused on static visual representations. Now opportunities, that are perhaps essential, are developing for research on the process of understanding the **effects of interactivity on how interpretation emerges**. Similarly, it is crucial for advancing research in visualization to assess the role data-driven storytelling can play in easing the comprehension of messages or in increasing their **memorability**.

Another future direction for research regards the evolution of our society and the amount of everyday generated data. As such, our society has entered a data-driven era, in which not only enormous amounts of data are being generated every day, but also growing expectations are placed on their analysis (Thomas and Cook, 2005). Analyzing these massive and complex datasets is essential to making new discoveries, communicating them and creating benefits for people. In regards to this data deluge, what remains constant is our own **cognitive ability to make sense of the data** and make reliable, informed decisions. In the future, data driven story telling techniques will still be applicable even with growing data size. New devices, interactive visualization systems will provide tools to support big data storytelling.

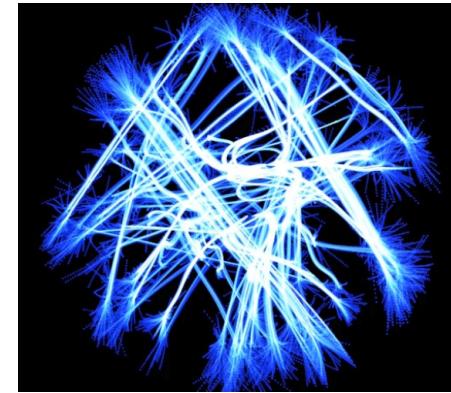




Contact

Christophe Hurter

<http://www.recherche.enac.fr/~hurter/>



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