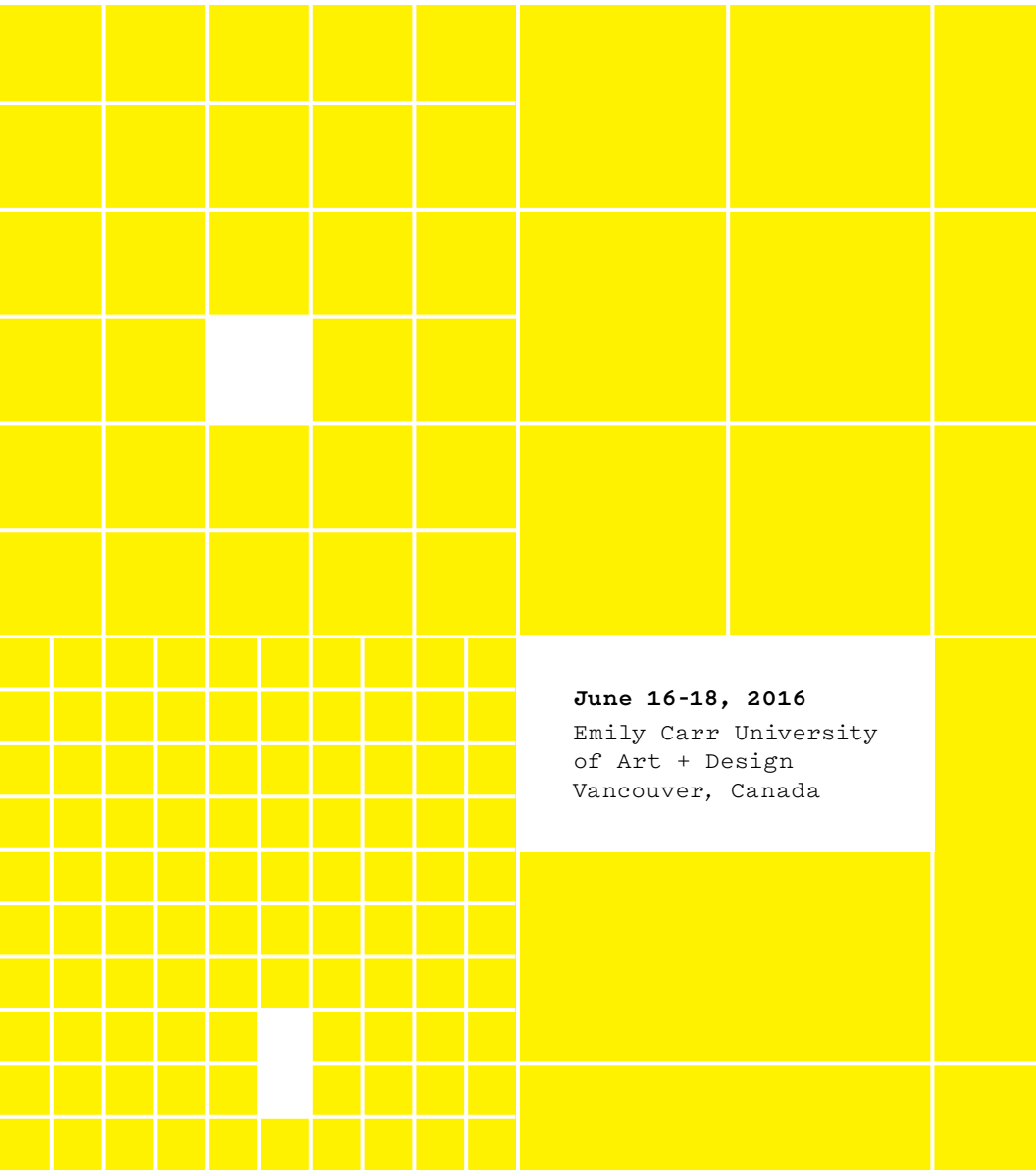
Information+

interdisciplinary practices in information design & visualization



June 16-18, 2016

Emily Carr University
of Art + Design
Vancouver, Canada

Introduction

Information+ is an interdisciplinary conference, workshop, and exhibition aimed at bringing together researchers, educators and practitioners to discuss opportunities and challenges in information design and information visualization. Our goal is to encourage collaboration and knowledge sharing in these rapidly changing fields while nurturing research that is relevant to academia, industry and government.

The two-day single track **conference** includes 2 keynotes, 4 invited speakers, and 29 contributed presentations selected using a peer review process with three independent reviewers per abstract. The acceptance rate for paper presentations was 22% and 44% for lightning talks. Speakers come from both academia and industry in 8 countries, 45% of whom are women. We are indebted to our distinguished interdisciplinary Program Committee of 31 members from 10 countries, who ensured the quality and substance of the conference.

Led by a team of designers and data journalists, the one-day **workshop** provides a forum for sharing the latest best practices in information design and visualization. Practitioners, educators, researchers and students will come together to ideate, prototype and generate responses to Vancouver's water conservation challenges. Underlying this effort is the notion of bringing to practice what was discussed in the conference that preceded it.

Curated by an interdisciplinary team, the *Information Everything* **exhibition** is on view at the Concourse Gallery, Emily Carr University of Art + Design, from June 6-July 3. The work includes information design and visualization projects from 6 countries, covering themes as diverse as science, culture, society, and technology, in media ranging from small screen-based graphics to large-scale installation.

Knowledge generated during the events will be shared via a series of printed and online outcomes: oral presentations will be publicly available online along with respective abstracts, included in this booklet; a selection of papers will appear in the international peer-reviewed, *Information Design Journal* (John Benjamins); and the print exhibit catalogue will be freely available in the gallery and online.

The Information+ conference, workshop, and exhibition would not have been possible without the generous financial support from our home institutions—Emily Carr University of Art + Design and OCAD University—and from the Social Sciences and Humanities Research Council of Canada. We owe thanks to the endorsement received from the IIID-International Institute of Information Design, the IDA-Information Design Association in the U.K., the SBDI-Brazilian Society for Information Design, and the International Council of Design, ico-D. We gratefully acknowledge the effort of many people, including a dedicated team of volunteers and our amazing research assistants: Juliana Forero, Diana Law, Taysia Louie, Gillian Russell, and Shaheer Tarar.

Isabel Meirelles & Katherine Gillieson
Information+ Organizers
informationplusconference.com

June 2016

Contents

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The University of Reading

8:00AM	**REGISTRATION & BREAKFAST**	
9:00AM	**OPENING REMARKS**	
9:20AM	*Keynote* **Tamara Munzner**	Visualization Analysis and Design
10:10AM	*Invited Speaker* **Scott Murray**	Designing Online Learning Experiences for People
10:40AM	**COFFEE BREAK**	
11:10AM	**Andy Kirk**	Developing Visualization Literacy: Experiences from the Front Line
11:35AM	**Mary Anne Beecher** **Peter Chan**	Crowbar, Shoe Horn or Butterfly Net? Designing a Vision for Information Visualization in the Large Research University
12:00PM	**Michele Mauri**	Why Designers Should Care about Wikipedia
12:25PM	*Lightning Talks (5 minutes each)*	
	Angela Norwood	Taking the Systems View
	Marjan Eggermont	Information Visualization with a Focus on Biomimetic Visualization
	Heather Bradbury	Finding the Balance Teaching Information Visualization: A Critical Examination
12:40PM	**LUNCH**	

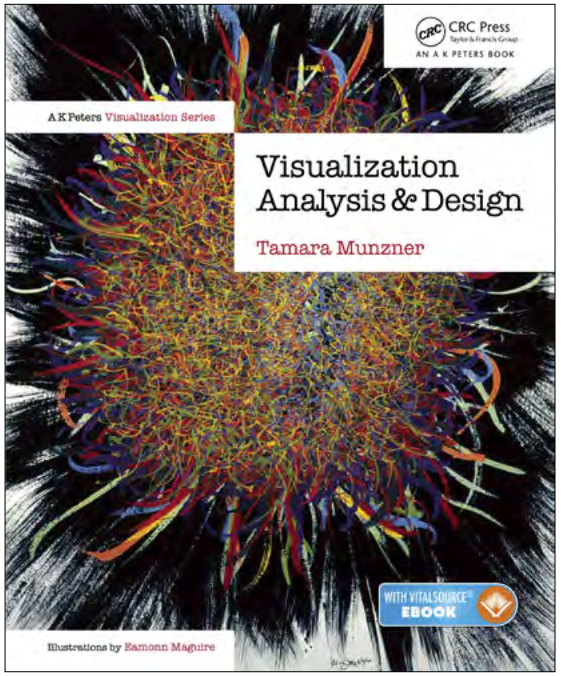
2:10PM	**Carmen Dyck** **Janet Joy** **Guillermina Noël**	Health Quality Improvement Data Collection and Visualization: The Potential of Visual Communication Design
2:35PM	**Will Stahl-Timmins**	Health Data Graphics: An Academic Publishing Perspective
3:00PM	**Karen Cheng**	Proving the Value of Visual Design in Scientific Communication
3:25PM	**COFFEE BREAK**	
3:50PM	*Invited Speaker* **Chad Skelton**	How to Think like a Data Journalist
4:20PM	**Jonas Parnow**	The Impact of Storytelling and the Responsibility of Designers
4:45PM	**Alice Thudt**	Subjectivity in Personal Storytelling with Visualization
5:10PM	*Lightning Talks (5 minutes each)*	
	Lena Groeger	Meat Charts: Visualizing Data with the Human Form
	Lisa Charlotte Rost	Goals in Data Visualization for Journalism
	Johanna Fulda	What's Up with Data Journalism in Canada?
5:25PM	**DAY ONE SUMMARY**	
6:00PM	**EXHIBITION OPENING RECEPTION** *(Concourse Gallery, North Building)*	

Friday June 17

8:00AM	**REGISTRATION & BREAKFAST**	
9:00AM	**OPENING REMARKS**	
9:10AM	*Keynote* **Colin Ware**	Visual Thinking about Data: The Cognitive Thread, Interaction and the Visual Query
10:00AM	*Invited Speaker* **Catherine D'Ignazio**	Creative Data Literacy: Bridging the Gap Between the Data Haves and Have-nots
10:30AM	**COFFEE BREAK**	
11:00AM	**Yanni Loukissas**	Local Data: Learning to Look at Big Data as Aggregates
11:25AM	**Robert Kosara**	Pie Charts–Unloved, Unstudied, and Misunderstood
11:50AM	*Lightning Talks (5 minutes each)*	
	James March	The Statistical Overshoot: Principles to Keep Data in Check
	Heather Krause	Designing Across Cultures: Ethics and Examples When Collecting and Communicating Data Globally
	Georges Hattab	A Mnemonic Card Game for your Amino Acids
12:05PM	**LUNCH**	
1:40PM	**Drew Hemment** **Moritz Stefaner**	Project Ukko: Visualizing Future Weather Conditions for Decision Making
2:05PM	**Klaus Kremer**	Anticipative Interfaces for Emergency Situations
2:30PM	**Patricio Davila**	Visualization as Assemblage: A Case Study in Critical Visualization Practice
2:55PM	*Lightning Talks (5 minutes each)*	
	Ricardo Castañeda Quebrado	Territorial Conflicts and Information Design. A Proposal to Empower People Around This Social Phenomena
	Manuela Garreton	The Revolving Door of Power
	Barbara Sudick **Frank Armstrong**	Understanding California's Groundwater: Using Storytelling and Interactive Data Visualization to Facilitate Systems Thinking
	Dominikus Baur	Subspotting: Mapping Available Cell Phone Reception on the New York Subway
3:15PM	**COFFEE BREAK**	
3:45PM	**María González de Cossío**	Writing a History of Mexican Railways through its Information Design
4:10PM	**Kim Albrecht**	Unfolding the Design Process
4:35PM	**Marian Dörk**	One View is Not Enough: High-level Visualizations of Large Cultural Collections
5:00PM	*Invited Speaker* **Gregor Aisch**	Data Visualization and the News
5:30PM	**DAY TWO SUMMARY**	
5:50PM	**CLOSING REMARKS**	

Tamara Munzner

Visualization Analysis and Design

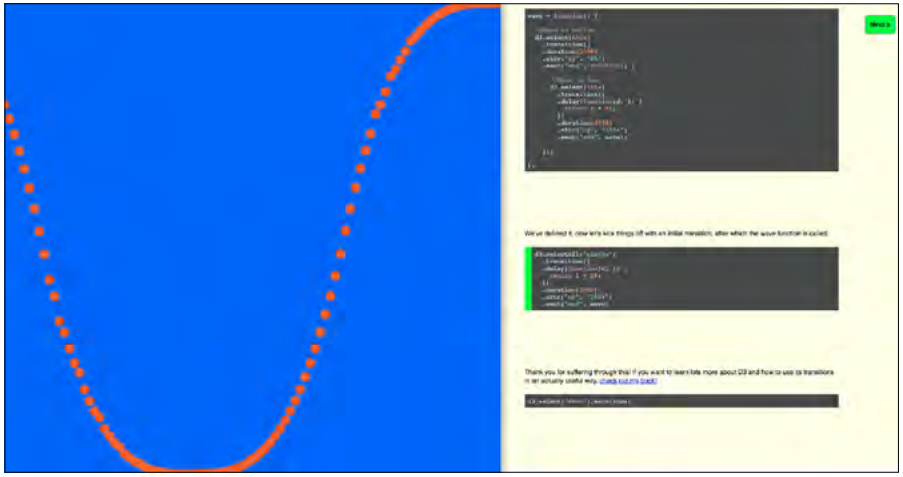


Computer-based visualization (vis) systems provide visual representations of datasets designed to help people carry out tasks more effectively. Visualization is suitable when there is a need to augment human capabilities rather than replace people with computational decision-making methods. The design space of possible vis idioms is huge, and includes the considerations of both how to create and how to interact with visual representations. Vis design is full of trade-offs, and most possibilities in the design space are ineffective for a particular task, so validating the effectiveness of a design is both necessary and difficult. Vis designers must take into account three very different kinds of resource limitations: those of computers, of humans, and of displays. Vis usage can be analyzed in terms of why the user needs it, what data is shown, and how the idiom is designed. I will discuss this framework for analyzing the design of visualization systems.

T. Munzner Professor, Department of Computer Science. University of British Columbia, BC, Canada

Scott Murray

Designing Online Learning Experiences for People



Online learning is a hot topic, but discussions often either fetishize new technologies or go weak-kneed at dreams of "scaling up" to reach audiences of thousands or millions. Yet learning is a fundamentally personal and human experience; it is more valuable (and easier) to connect real people to each other than to attempt automating topic-specific instruction and evaluation. Most designed environments for online learning are exercises in frustration; we need new platforms with interfaces that get out of the way, supporting a natural, collaborative "flow" attainable in physical classrooms but so far absent online. Drawing on my own experiences of online teaching as well as recent research, I'll demonstrate several recent experiments in new media for learning and outline a vision for the first great human-to-human online learning experience.

S. Murray Learning Group, O'Reilly Media, United States

Andy Kirk

Developing Visualization Literacy: Experiences from the Front Line

The purpose of this talk will be to share personal insights emerging from experiences teaching data visualization literacy. The talk will explore my pursuit of the most effective didactic methods for teaching the subject in academic and non-academic settings, reflecting on the successes, the failures and the enduring challenges.

Since becoming a freelance data visualization specialist in 2011, I have delivered 160+ public and private training workshop events, in 17 countries to over 3250 delegates. On the academic side, I have designed and delivered teaching for brand-new modules for two post-graduate programmes: one for the 'MPS in Information Visualization' at MICA (Maryland Institute College of Art, USA) since 2013 and the 'MSc Business Analytics' at Imperial College (London, UK) starting 2016. I have also authored two books on data visualization design and so finding the most articulate way to impart my convictions about this subject has been and continues to be an ever-present challenge.

The talk will be structured around five general themes, each representing a different dimension of influence that has shaped my approach to teaching data visualization.

THE FIELD: The challenge of keeping abreast of the ever-changing face of data visualization as it becomes increasingly popular and maybe even mainstream, reflecting on some of the relationship between academia and practice, the new techniques and the tensions between visualization and infographics.

THE STUDENTS: Considering the diverse nature and demands of academic (post-graduate students) vs. non-academic (public workshop attendees and private event delegates) students to whom I design and deliver teaching. Looking at handling the different requirements introduced by the variation in delegate backgrounds, location, culture, industry, level, and prior skills or knowledge.

THE ROLES: I will look to tie in some of the findings emerging from my work on the 'Seeing Data' research project (http://seeingdata.org) which reveals the importance of visualization literacy for all: not just for creators but also for consumers, commissioners and coordinators. Visualization literacies are not just for makers; they are necessary across many other roles and indeed across society.

THE SETTINGS: Looking at the influencing conditions of format, duration and circumstances has on the most effective approaches to teaching data visualization: in person vs. online, large vs. small class, short vs. longer durations, compact vs. modular.

THE TEACHER: Reflecting on my personal and professional development and, specifically, my changing convictions about what I should teach and by what methods (content, structure, exercises). I will discuss ongoing dichotomies presented by balancing theory vs. practice, critical thinking vs. tutorial instruction, and inspiration vs. pragmatism.

A. Kirk Data visualization specialist, Visualizing Data Ltd, United Kingdom

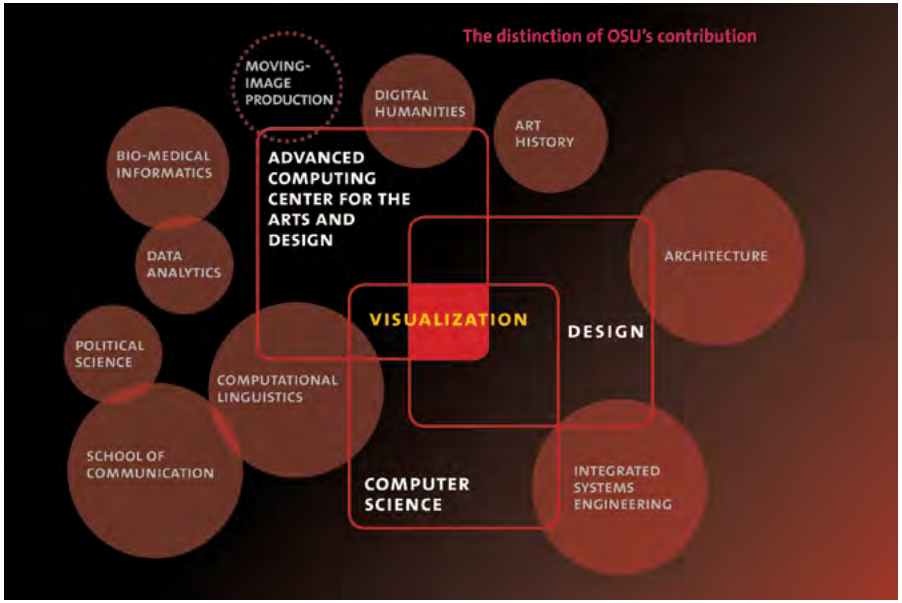
Mary Anne Beecher & Peter Chan

Crowbar, Shoe Horn or Butterfly Net? Designing a Vision for Information Visualization in the Large Research University

Information visualization is often taken for granted as a vehicle for communication in many disciplines and practices. At the same time, it is frequently over-looked as a process that enables discovery. It is therefore beneficial to examine the challenge of creating educational programs that fit the needs of a diverse and complicated range of disciplines in the arts, sciences, and professional programs as found in the large research university. Differences found in disciplinary methods, languages, and sometimes preconceived notions, account for much of the challenge to integrating information visualization as a theoretical subject, a process and a product. In the large research university, interest in information visualization is found across the full spectrum of disciplines from the Digital Humanities, Engineering, Business, Medicine, and Geography to more predictable areas of the Arts/Design. Often it is the disciplinary vantage point on the role of visualization that is the basis for conflict and misunderstanding.

At The Ohio State University, the experience of proposing a series of interdisciplinary information visualization programs exemplifies the challenge of consulting with widely varying stakeholder groups that have different methods, vocabularies and languages. In addition to engaging in critical conversations about the potential for visualization to enable the interrogation and understanding of complex data, visualization also plays a central role in facilitating the consideration of models and relationships that can provide common ground for planning new interdisciplinary areas of study. Strategies for grounding conversations that lead to effective approaches to educational programming have been examined critically as part of the challenge of exploring, proposing, vetting, and synthesizing perspectives on how to integrate visualization as a knowledge area that crosses boundaries and connects disparate disciplines. One of the keys to success in this process is the use of visualization to conceptualize; to discover possibilities; and to communicate with widely varying stakeholder groups from all corners of the institution will be demonstrated.

Although linguistic metaphors have their limits, they can serve as a useful means of explaining the strategies used to structure various arguments in support of an interdisciplinary approach to information visualization that blends design and science in the context of the large and (somewhat) territorial institution. In some cases, our approach has been that of a crowbar; a device that uses leverage to make movement possible. Despite the fact that crowbars wreck and pry, they are also effective tools for helping small units move or lift heavy weights (and ideas) or to shift seemingly fixed obstacles. Sometimes a shoe horn has provided the needed approach, as a diplomatic device that enables fit and maintains form by guiding newly introduced material into an existing “container” while helping to ensure its longevity. On other occasions, the best metaphorical tool has been the butterfly net; a fine-meshed framed bag that gathers, exposes, and protects. Because of its translucency, the net also instructs and informs, revealing the process of collection as it goes. With accompanying visuals, these metaphorical strategies have informed our ability to develop ideas and to attempt to negotiate and build the necessary consensus.



Visualization Program as butterfly net gathering relevant academic units into a cohesive collection of stakeholders.

M. A. Beecher Professor, Department of Design, The Ohio State University, United States

M. Palazzi Professor, Department of Design & Director, The Advanced Computing Center for the Arts and Design, The Ohio State University, United States

P. Chan Associate Professor, Department of Design, The Ohio State University, United States

Michele Mauri

Why Designers Should Care about Wikipedia

The creation of a diagram on a given topic is a common assignment in information visualization courses. Students spend lots of time and effort in doing it, but few times they have the opportunity to test their work 'in vivo', gathering feedback from a larger public. Inspired by the WikiEdu Program, we proposed our students to create a diagram for a Wikipedia article. The WikiEdu Program is as simple as effective: as assignment, students need to improve a Wikipedia page related to the course's topic. By doing so, the students develop writing skills and critical thinking, and at the same time they produce something valuable for the whole community. We saw a great potential in bringing this kind of assignment in graphic design education, specifically in information visualization design.

The exercise has been proposed as an assignment in two editions of the course. The students had to upload their diagrams on Wikipedia and engage with the community for their inclusion in the article. Since Wikipedia allows full access to its databases, we followed for about one year the reactions of Wikipedia users, both in term of discussion, usage, and improvements. This experience highlighted how images and diagrams are considered in a different way than texts on the online encyclopedia. Images are often seen as 'black boxes', not as easy to edit as text. Another emerging issue was also to define if information visualizations should be considered 'original research' or not, as some diagrams were rejected by the community, deemed a visual synthesis of different sources. This discussion allowed a reflection on the role of the designer within the knowledge production process, as well as on the meaning of producing "open" contents, which are meant to be improved by other people.

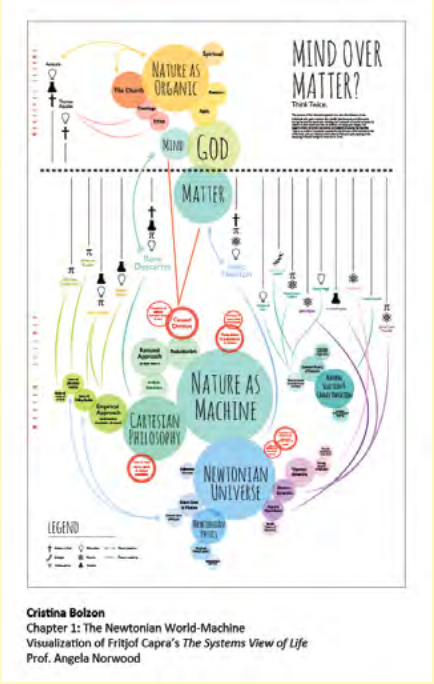
M. Mauri Research Fellow, DensityDesign Research Lab, Politecnico di Milano, Italy

A. Pini Research Fellow, DensityDesign Research Lab, Politecnico di Milano, Italy

P. Ciuccarelli Scientific Director, DensityDesign Research Lab, Politecnico di Milano, Italy

Angela Norwood

Taking the Systems View



Cristina Bolzon
Chapter 1: The Newtonian World-Machine
Visualization of Fritjof Capra's *The Systems View of Life*
Prof. Angela Norwood

Many design programs are in the midst of major shift in mindset from teaching design—particularly graphic design—as a series of discrete artifacts intended to solve easily identifiable communications problems to approaching design as a practice of understanding integrated systems, that include artifacts, but that encompass complex social, cultural, technological networks.

Concurrently, universities are promoting exposure to "real-world" scenarios and experiences as key to student success. A recent item on *Inside Higher Ed* titled "In Defense of Essays", listed "…read critically, ask questions, perform meaningful analysis, marshal arguments, draw conclusions and communicate complex ideas—the most "real-world" skills of all…"

To provide an introduction to systems thinking, challenge students to dismantle entrenched conceptual models, and engage the skills listed above visually, we required our second year Information Design 1 students to read Fritjof Capra's *The Systems View of Life: A Unifying Vision.* Students were to select one chapter from which they would generate visualizations. Their options for approaching the project included extracting the data from the text (chronology of scientists, movements), using the text as data (word counts, paragraph structures), or diagramming key concepts (mechanistic worldview, reductionism). Exploring each approach to visualization introduced the students to a range of information design skills and principles, while also giving them the opportunity to learn from each other.

The widely variable results of student work from this project revealed gaps, in curricular content, teaching strengths and students' skills acquisition. This brief presentation will highlight key successes and challenges from the course.

References

Capra, Fritjof. *The Systems View of Life: A Unifying Vision*. Cambridge University Press. 2014.

Schulman, Martha and Hymen, Gwen. "In Defense of Essays" on Inside Higher Ed at https://www.insidehighered.com/views/2016/02/19/colleges-should-invest-more-teaching-students-how-write-essay accessed February 19, 2016.

A. Norwood Associate Professor, Department of Design, York University, Canada

Marjan Eggermont

Information Visualization with a Focus on Biomimetic Visualization

In the course *Advanced Topics in Visualization* with a Focus on Biomimetic Visualization we explored forms, functions, and processes underlying natural systems and investigated techniques for abstraction and application. The exploration into bio-inspired design or 'nature's networks' for data visualization is a recent one. Large amounts of data in some cases are not just like living systems: they are living systems.

In *What Technology Wants* Kevin Kelly describes the move from a "clockwork logic to a complex 'bio-logic' that is capable of developing thinking, living systems that our complex world demands." We examined how bioinspired design/bionica/biomimicry can be used to expand the way we think about visualizations: Does it merely apply to visual representations? Can it expand the way we think about interactions? Are there generalizations and guidelines that can be created or is useful advice obtainable from this explorations?

The Winter 2016 course looked beyond visualization basics and fundamentals and introduced bio-inspired design as a tool. As global interest in visualization expands exciting new research is emerging in many facets of visualization. One of these new directions draws from the incredible successes in engineering, where improvements in many directions including forms, functions and processes are resulting from leveraging the examples from biology. This has become known as biomimicry or bio-inspired design. Multiple examples of biomimicry can be found in Zygote Quarterly (http://zqjournal.org), a journal co-founded by the author to explore this rich area. The core of this course was focused on the idea of making use of a biomimetic approach in visualization. The course was set in examples of advanced visualization topics from a broad range of visualization applications so students could draw from multiple disciplines. This 5-minute lightening talk will report on the course exploration.

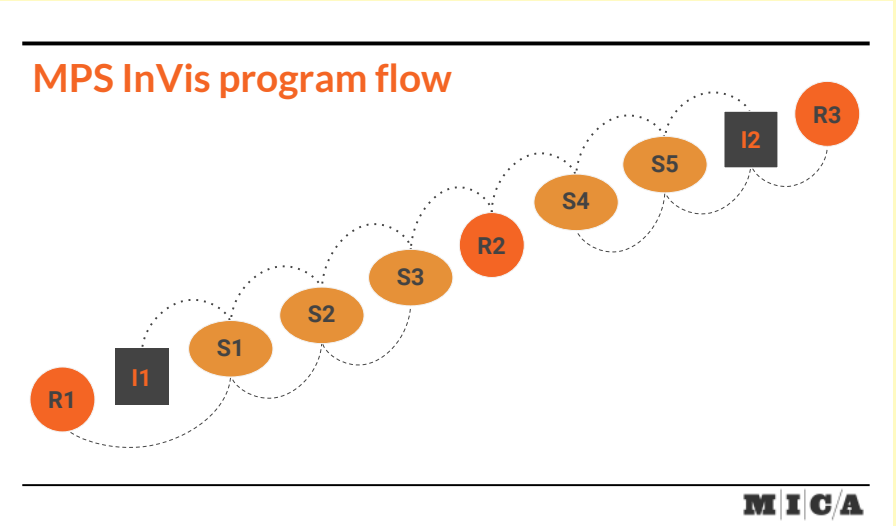
M. Eggermont Associate Dean and Senior Instructor, Schulich School of Engineering. PhD Student, Computational Media Design Program, University of Calgary, Canada

S. Carpendale Professor, Department of Computer Science, Director InnoVis Lab, University of Calgary, Canada

C. Perin Post-doctoral researcher, Department of Computer Science, InnoVis Lab, University of Calgary, Canada

Heather Bradbury

Finding the Balance Teaching Information Visualization: A Critical Examination



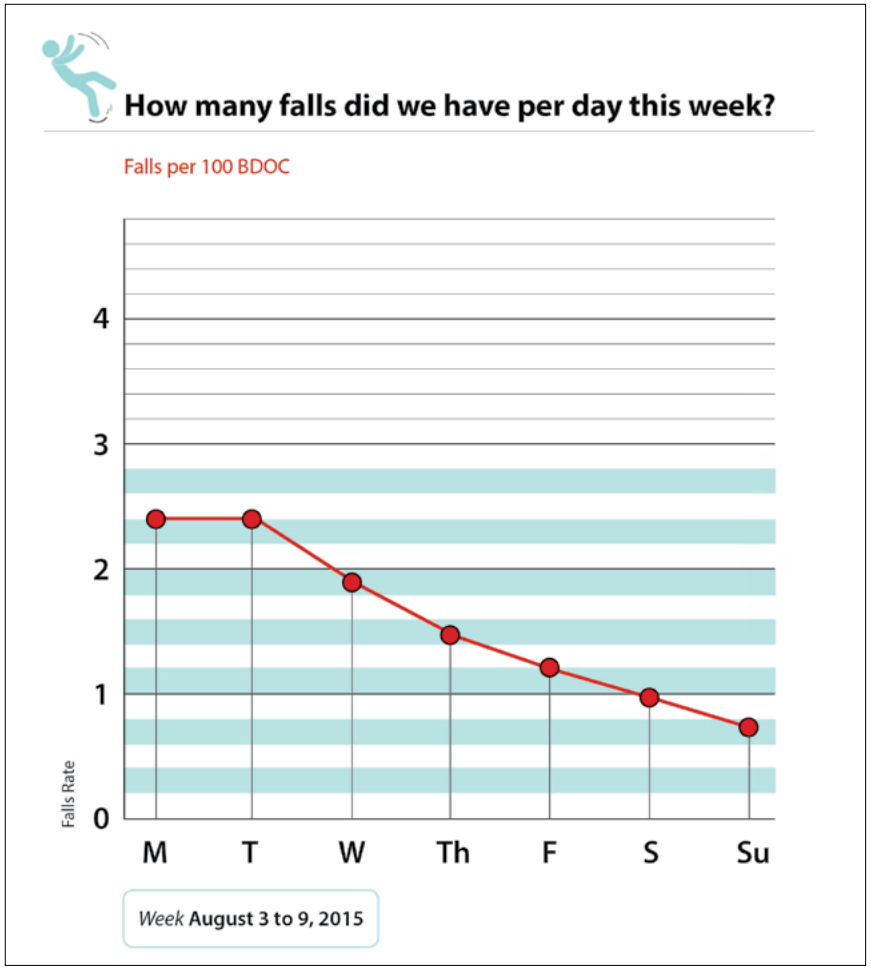
Looking toward 21st Century academics and industry, the Maryland Institute College of Art (MICA) began launching a series of Masters of Professional Studies (MPS) graduate programs in 2011 which integrate art and design background and education with interdisciplinary professional practices. The Information Visualization program is MICA's second MPS program and is unique on several fronts—it is primarily based in applied skills and knowledge; it is delivered primarily online; there are three mandatory on-campus residencies; and it attracts a broad range professionals (from designers to research professionals, statisticians, and analysts) and industries (from private and public sectors). Now in it's fourth year, MICA's Information Visualization graduate program has become a balance between academic theory and industry application, and online coursework and on-campus residencies, with design as the fulcrum. I will discuss the evolution of the program, particularly how the on-campus residencies have transformed from a series of workshops and team building exercises into pre-engagement and assessment opportunities for the program; how residencies integrate into the online coursework and professional development of the students; and how the cohort becomes a community during the program and beyond.

H. Bradbury Director of Master of Professional Studies Programs, Maryland Institute College of Art, United States

Carmen Dyck, Janet Joy & Guillermina Noël

Health Quality Improvement Data Collection and Visualization: The Potential of Visual Communication Design

Quality improvement (QI) initiatives aimed at improving patient care are a constant feature of healthcare. These initiatives typically involve collecting data to measure whether intended changes have been made and whether those changes achieve the expected goals. In principle, the data allow frontline care providers to measure the success of the QI initiative and make further changes if needed. In practice, usable data for QI are often not readily available in a format easily understood by frontline staff. Most healthcare data reports and scorecards are designed for executive oversight and not for staff who provide direct patient care. This paper describes a study conducted at Vancouver Coastal Health (VCH), Canada, to determine the QI data needs, wants and information perceptions of VCH managers, directors and staff. Seventeen discussion groups, two focus groups and five interviews were held. These investigations revealed a number of factors that impede real-time data collection and reporting, such as limited access to computer technology due to public sector budgets and the slow technology adoption, and inadequate staff resources. Lack of user involvement in the visualization design process, as well as confusing visual simplicity with cognitive simplicity, results in data visualizations that frontline care providers cannot interpret with ease. Current ways of visualizing data at VCH often do not give frontline care providers the information they need to improve patient care. QI data is often shown as rates (such as fall rates per 1,000 occupied bed days) and charts with no clear connection to the work of point-of-care staff, who reporting needing QI data that is timely, actionable, meaningful (in a “per patient” format), and that is unit/ward specific (unaggregated data). Data management personnel expressed the need for standardization, but given the different needs of each audience (executive leaders, managers, directors, and point of care staff), standardization might be achieved for certain types of questions and initiatives, but one data visualization solution will not fit all the needs of the different audiences for QI data. Our investigations generated rich and complex material. However, despite the centrality of data reporting in QI, there is almost no research on differences in the information and data needs of different actors within the health system. While a few articles on QI initiatives show how data collected was presented to users, none of them discusses the users’ understanding and opinions about the visualizations. Data collection and visualization is a complex human communication process that requires diverse skills. The interpretation of information is influenced by the users’ interests, expectations, knowledge about the content, numeracy and data skills, and by the quality of the visualization; as well as, by the users’ previous experience with the information. In this presentation we explore and problematize possible ways of visualizing the data according to the objectives that frontline care providers might have at different times depending on the QI initiative they are working on.



A graph showing falls in a unit as a rate x/100 occupied bed days (obd). Notice the difficulty that it presents for interpreting the number of patients that fell per day.

C. Dyck VCH Quality Improvement Advisor, Vancouver Coastal Health, Canada

J. Joy VCH Director of Innovation and Evaluation, Vancouver Coastal Health, Canada

G. Noël Visual Communication Design, Frascara-Noël

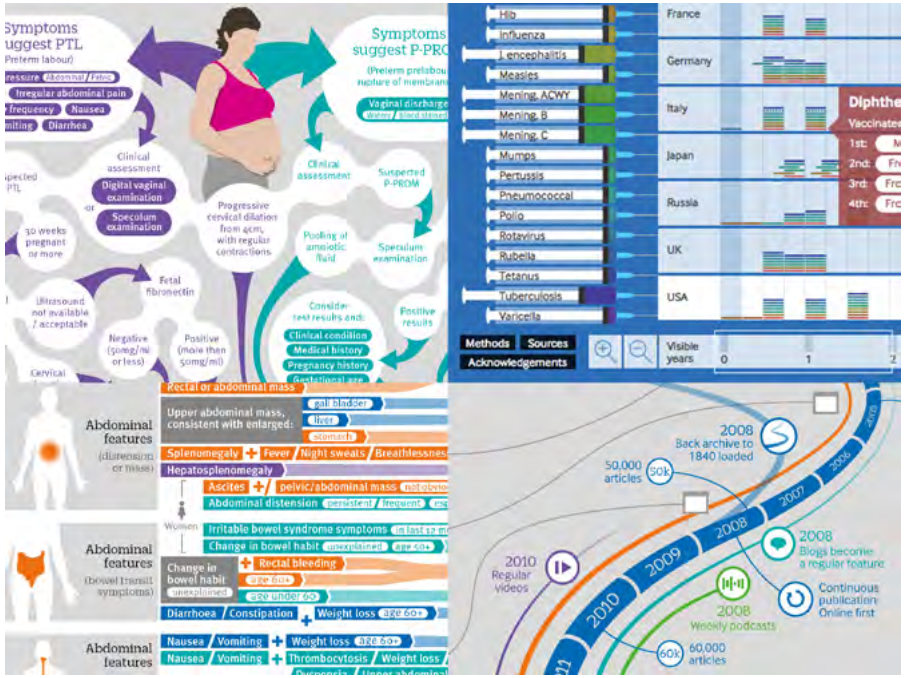
Will Stahl-Timmins

Health Data Graphics: An Academic Publishing Perspective

As the world of scientific publishing is more and more driven by impact of research, new methods of presenting findings become increasingly important. Scientists themselves have long used charts and graphs to analyse and communicate research data. While these are entirely appropriate for transferring data to other scientists, research findings can also have significant benefits for other audiences. Professional researchers often lack access to trained communication specialists, and rely on scientific journals to help them transfer this knowledge to other researchers, policy makers and professional who can make use of it. Visual communication such as infographics and data visualization can be very effective method of making research findings more available.

The BMJ (formerly the *British Medical Journal*) has recently employed me as their first full-time data visualization and infographics specialist. The role was created to help time-pressured doctors to understand key messages from increasingly data-rich and complex health research articles. In the first year, around 30 dataviz projects were completed, transforming data from research papers, investigative journalism and policy guidelines into rich, often interactive visual pieces. These graphics have been published on The BMJ website, which has more than a million monthly visitors online, in a weekly printed journal with a circulation of 120,000 UK doctors, and the journal's social media feeds, where they are routinely seen by tens of thousands of people.

Successful data visualization requires skills from a wide range of disciplines—visual design, computer science, statistics and user experience. In academic publishing, the knowledge provided by scientific experts is also necessary. This talk will examine the design process used at The BMJ to bring these skills and knowledge together—from raw copy submitted by academic authors and journalists, through roughs and ideation, negotiation with authors, to realisation, coding interactivity and publishing the graphics. It will also examine some of the technologies available for producing data graphics for web and print, and discuss their relative advantages and disadvantages.



W. Stahl-Timmins Interactive Data Graphics Designer, *The BMJ*, BMJ Publishing Group, United Kingdom

Karen Cheng

Proving the Value of Visual Design in Scientific Communication

Many images created by scientists are visually stunning. From the moons of Saturn drawn by Galileo, to the double helix of DNA modeled by Watson and Crick, scientific discoveries of all ages are associated with memorable, iconic visuals. These images communicate in ways that text cannot. Well-designed scientific graphics are highly informative yet compact; they make difficult, complex concepts accessible to other scientists as well as the general public.

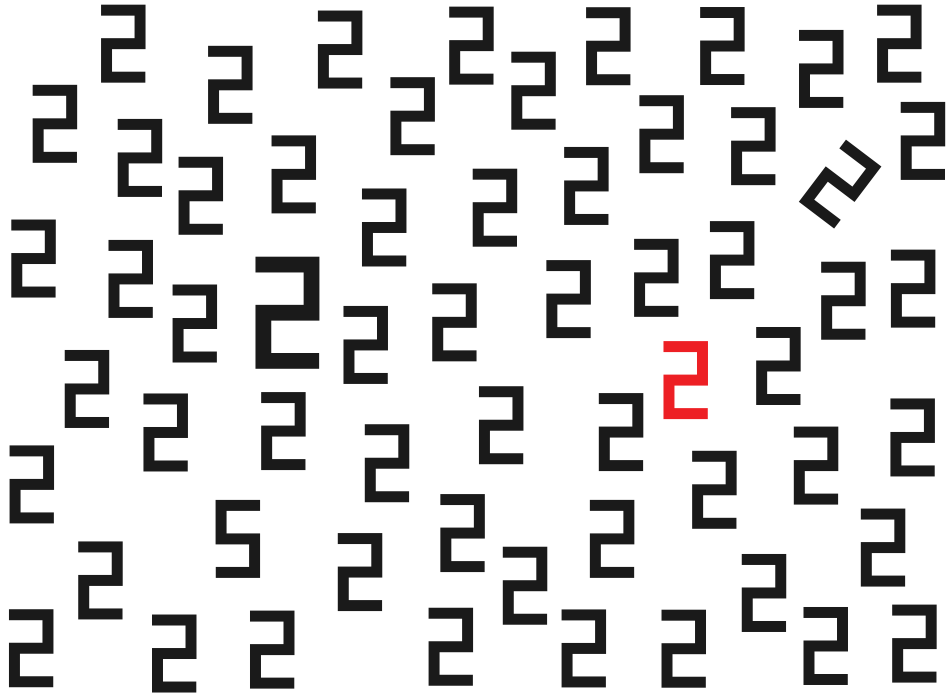
However, despite broad agreement that visualizations can be a powerful way to share information, scientists typically receive little to no formal education in creating visuals. Therefore, many scientists lack the drawing skills and basic visual literacy that would enable them to create effective scientific graphics. This gap in knowledge further affects scientific attitudes towards visual design. Scientists without design education may view visual communication as a subjective, superficial and style-driven activity, rather than understanding design as an intelligent activity guided by principles of visual perception.

As a result, it is unsurprising that a number of scientific visualizations—even those in high caliber journals—demonstrate significant visual flaws: clashing colors, poorly chosen typefaces and disorganized compositions. These problems are more than cosmetic. In this context, design failure means that important new scientific concepts are not being adequately communicated, understood or advanced.

Given these high stakes, our multidisciplinary research team (comprised of a designer, two material scientists and a cognitive psychologist) sought to better understand how scientists respond to visual design in scientific communications. Specifically, we wanted to determine what impact, if any, visual design has on a particularly important scientific visualization: the overview figure.

The overview figure is a “graphical abstract” intended to attract potential readers and visually summarize what a paper is about. In many editorials, publishers have encouraged scientific authors to create overview figures that are simple, easy to understand and visually attractive. This criteria is based on the common observation that researchers tend to browse papers online by looking very briefly at the title of a paper along with the accompanying overview figure.

Despite the clear impact of overview figures on scientific communication, to our knowledge there are no existing studies on how visual design influences a scientist’s choice to read a research paper. Therefore, our team selected and re-designed ten overview figures from a leading journal of nanotechnology. We showed the original and redesigned figures to 50 study participants who were scientific researchers at an academic nanotechnology center.



The results show that overview figures that followed classic visual communication design principles significantly enhanced scientists’ first impression of a paper. Redesigned figures made their associated papers seems more interesting, more clearly written, and more scientifically rigorous. These results confirm the value of visual design, and establish that aesthetic appeal enhances rather than detracts from the perception of intellectual and scientific competence.

K. Cheng Donald E. Petersen Endowed Professor, Visual Communication Design, School of Art, Art History + Design, University of Washington, United States

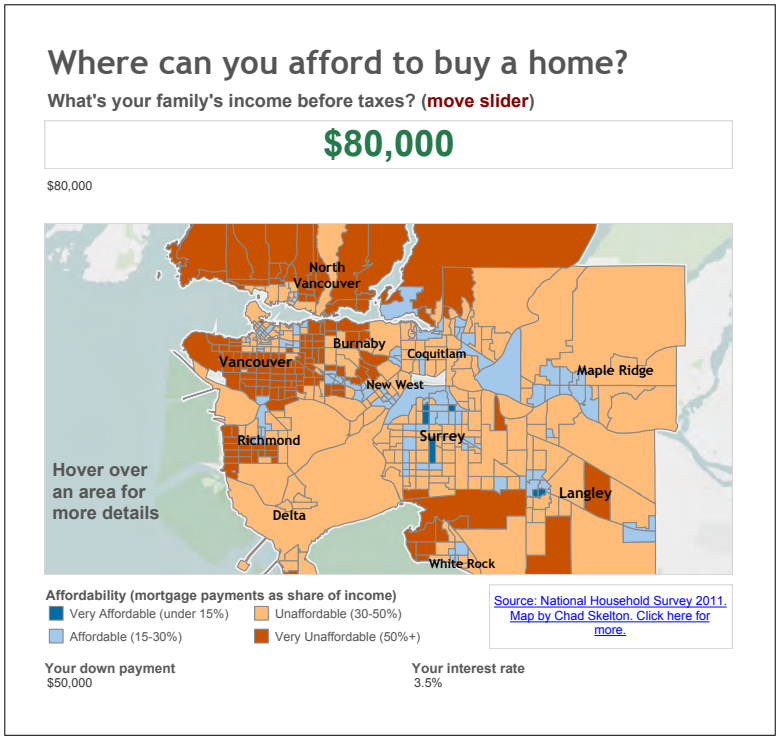
Y. Chen Post-doctoral Researcher, Center for Nanotechnology, University of Washington, United States

K. Larson Researcher, Advanced Reading Technologies, Microsoft Corporation, United States

M. Rolandi Associate Professor, Electrical Engineering, University of California Santa Cruz, United States

Chad Skelton

How to Think like a Data Journalist



In this talk, award-winning data journalist Chad Skelton will explain how to design interactive maps and charts that engage and excite your audience. Chad will discuss the process behind visualizations he has created on topics as diverse as crime, income inequality and organ donation. He will show how news principles—like the "lead" on a news story—can be applied to designing data visualizations. And how letting users see themselves in a data visualization is one of the best ways to help them care about the data display.

C. Skelton Journalism instructor, Kwantlen Polytechnic University. Data journalist, consultant and trainer. Vancouver, BC, Canada

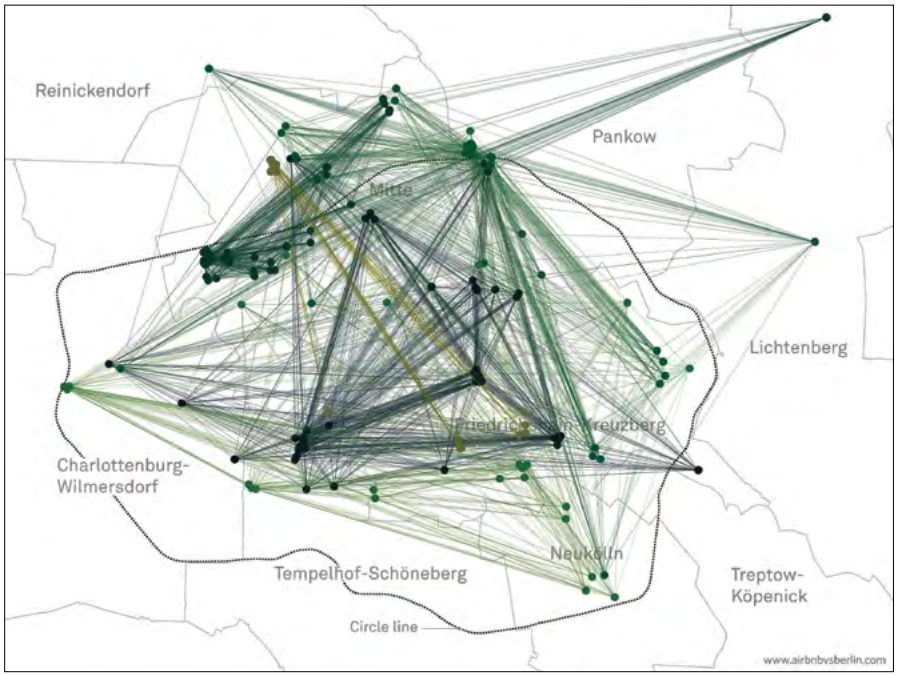
Jonas Parnow

The Impact of Storytelling and the Responsibility of Designers

As data plays an increasingly important role in our world, journalists gain insights from its analysis and can use visualizations to communicate their findings. Data journalism is a chance to explain novel, mostly quantitative, and abstract processes. A company whose business model is strongly based on data is Airbnb. We started a project analysing the data Airbnb provides and found ourselves concerned that a crucial debate—whether Airbnb affects the supply and price structure of the housing market—has been held without any reliable data sources. Based on these premises, we saw the need to make this data and its analysis publicly available, accessible and comprehensible to a broader audience. Our goal was to provide a foundation for the ongoing debate.

Combining design and journalistic methods during the process of creation, we decided to use Airbnb's API to gather the data, create a website (www.airbnbvs-berlin.com) with modular visualizations that are embedded within an explanative article. Interactive elements enable the users to individually explore the situation around their home. We concluded that a mix of specific thematic aspects and a simple visualization style would help people understand this novel approach to storytelling.

With the release of the website we experienced an unexpected course of events: Within a few hours time, the project went viral in Germany and we were contacted by news agencies and also by Airbnb themselves. The website did not only attract many, but also very diverse visitors. People with a broad range of backgrounds were interested in this topic. Through this, we met many people who contacted us explaining their opinions, fears, thoughts, and experiences. All of a sudden, we were approached as experts in the field of housing, targets of pro-Airbnb parties, and hope of anti-share economy formations. We soon realised how emotional the topic is for many people and how many people have an opinion on the topic. What our report seemed to offer was a resource both for criticism and support of Airbnb. But what most people wished for was a clear, simple statement, whether Airbnb would cause rising house rents or not. This has been the case with the general press and media coverage as well: Despite the interactive visualizations that allow you to freely explore the data yourself, our personal option seems to be more attractive. The project helped us in forming a new perspective on the role of data visualization and the designer. Not only does the transformation, selection, and presentation of the data affect the message, but also does the creator of the graphic become subject of interest. While you might praise



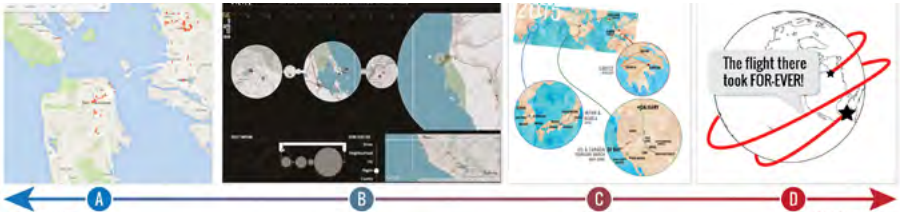
visualizations for the possibilities of individual explorations, a personal statement is easier to comprehend and apparently what most people ask for.

With this talk, we would like to share our thoughts, practical solutions, and concerns we had during the process of transforming the results of the data investigation into a website, our experiences with the release of our findings, and the results of the ongoing engagement with the topic.

J. Parnow Information designer and data visualist, Golden Section Graphics, Germany

Alice Thudt

Subjectivity in Personal Storytelling with Visualization



Four different visualizations of personal location histories. Raw plots of location history (A) accurately communicate sensor data, but give little authorial control. Tools like visits (B) semiautomatically curate data into time oriented stories. Manually created representations (C, D) are less beholden to the original data, and provide opportunities for subjective expression, exaggeration, and irony.

In this paper we are exploring the importance of subjectivity in personal data-driven storytelling. Many people now use applications and devices that capture enormous amounts of data about themselves. This personal data supports self-reflection and creates opportunities to tell data-driven personal stories. Personal informatics and visualization research has focused on using this data to support behaviour change—promoting fitness, improving eating habits, and reducing environmental footprints [1]. More broadly, journalists and researchers have explored data-driven storytelling on the web, in the media, and in data journalism [4]. Yet these approaches—both for public and personal data—assume a high level of objectivity and aim to use data to truthfully and accurately illustrate events.

However, personal narratives are often much more subjective [5]. Storytellers may omit, invent, or embellish specific details in order to craft an engaging story or communicate a perspective. Rather than being strictly truthful, these stories mediate an experience and may use humor, irony, and other narrative tools to communicate the narrator's value system [2,3].
We therefore explore the following question: As new tools allow us to leverage *data* to build and enrich our personal stories, can they still support this kind of subjectivity?

Subjectivity can be introduced into personal visual narratives during three stages of the process: (1) during *data collection* through omission, invention of data points or selective capturing, (2) during *data processing* through omission, invention or correction of data points, (3) in the *representation* through exaggeration, embellishments, emphasis/de-emphasis, hiding, obscuring data (e.g. through aggregation), annotation, layout and flow as well as through adjusting the style. The style can be adjusted to match the personal aesthetic preferences of the narrator, but also to convey a specific experience or feeling. For each of these techniques for introducing subjectivity we describe the motivation for using them in personal visual storytelling and how they can be supported.

Personal narrative visualizations can incorporate more or less of these techniques from a purely algorithmic mapping, over simple customization of the view or the data to a completely free form representation "inspired by data", rather than a traditional representation of the data. We illustrate this spectrum by discussing different examples of personal narrative visualizations from our own work as well as other visualization designers. Using the example of a visualization of different data streams that tell the story of a crunch time before a deadline, one day as a mosaic of pictures from a SenseCam, a travel memory based on movement data and handcrafted postcards telling the story of one year. In each example we discuss how subjective interpretations were integrated and what problems we encountered.
Our contributions include: (1) Identifying unique challenges of personal visual storytelling (2) introducing ways to incorporate subjectivity in personal visual narratives and (3), showing examples of integrating subjectivity in visualizations for personal storytelling. We conclude by providing future directions that open up visualizing subjectivity as new research area for visualization including how to integrate exaggeration, omission or irony.

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A. Thudt PhD candidate, Department of Computer Science, InnoVis Lab, University of Calgary, Canada

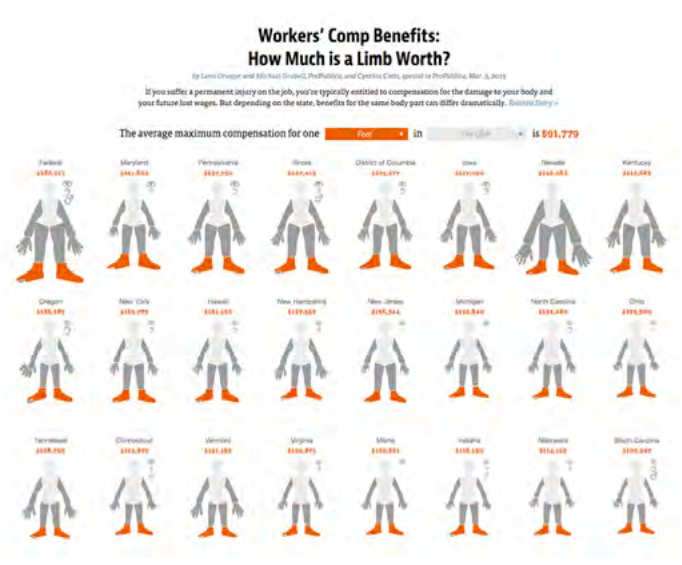
C. Perin Post-doctoral researcher, Department of Computer Science, InnoVis Lab, University of Calgary, Canada

W. Willet Assistant Professor, Department of Computer Science, Director Data Experience Lab, University of Calgary, Canada

S. Carpendale Professor, Department of Computer Science, Director InnoVis Lab, University of Calgary, Canada

Lena Groeger

Meat Charts: Visualizing Data with the Human Form



The concept was simple: where you live determines how much your arm is worth. But the data was anything but: 50 states, 13 body parts, a different dollar amount assigned to each arm, leg, or big toe that is seriously injured on the job. While the system of workers compensation in the United States is disjointed and complex, we wanted our data visualization to be clear, intuitive, and effective.

Our solution was to take advantage of the most ready metaphor and something our brains are wired to distinguish easily: the human body. For each state we built a human figure, visually similar to the chart of beef cuts sometimes shown in butcher shops. By allowing people to quickly scan rows and rows of human forms—each body part sized according to how much the state pays in compensation benefits—the interactive graphic conveys at a glance the arbitrary and preposterous discrepancies in state benefits. Lose a thumb in Kentucky? You're entitled to a maximum of almost $200,000. Happen to live in Rhode Island? The top payout is $13,500.

In this short talk Lena Groeger will explain the imagining, designing and building of a data visualization on insurance that became an unlikely viral hit.

L. Groeger Journalist + Developer, *ProPublica*, United States

Lisa Charlotte Rost

Goals in Data Visualization for Journalism

The more specific your goal, the more laser-focused you can try to achieve it. But what are your goals, exactly? And how should you prioritize them? The field of journalism suffers from having ambiguous goals. Generally speaking, institutions in the field combine answering the questions "In which kind of world do we live?" and "What's new?". In my opinion, answers to the first question help us—the audience—if they let us build useful believes and emotions about the world: Believes and emotions that help us navigate the world. This second goal, newness, is a dangerous one: it favors current information over important ones and therefore works against the first goal of building useful believes.

Data visualization can help us with creating a new perspective on current news: The more forms of media (like text, photo, video) a news piece uses, the more understandable and memorable it is. But besides enhancing these "anecdotes", the actual super power of data visualization is to set them into context. Famous examples are recent terror attacks in Europe. These days, lots of people fear a death through terror attacks, although it is extremely unlikely. This irrational fear is an emotion that is build up through news coverage, but useless for navigating the world. It won't change behaviors in a constructive way. Only if we understand that anecdotes can be outliers or can be occurrences of an actual decreasing trend, we can start to weight their importance for our believes about the world. Data Visualization is an important tool for destroying useless believes and creating useful ones, and we should use it as such—to get closer to answering the question "In which kind of world do we live?" than answering "What's new?" can bring us.

L. C. Rost Knight-Mozilla OpenNews Fellow, NPR Visuals Team, United States

Johanna Fulda

What's Up with Data Journalism in Canada?

When I use a bar chart inside an article, is that data journalism? No? What if it is an interactive bar chart? How much data has to be inside journalism to be classified as data journalism? Though there isn't one final definition, there are several guidelines by famous names in the scene. Simon Rogers, Amanda Cox, Jonathan Stray, Paul Bradshaw, Scott Klein, and more. And who are the most active participants in data journalism? It's not only the *New York Times, ProPublica,* and the *Guardian.* But it seems that for small publishers it is not feasible to put time and money into those projects, whereas in bigger companies sometimes there are special departments for that.

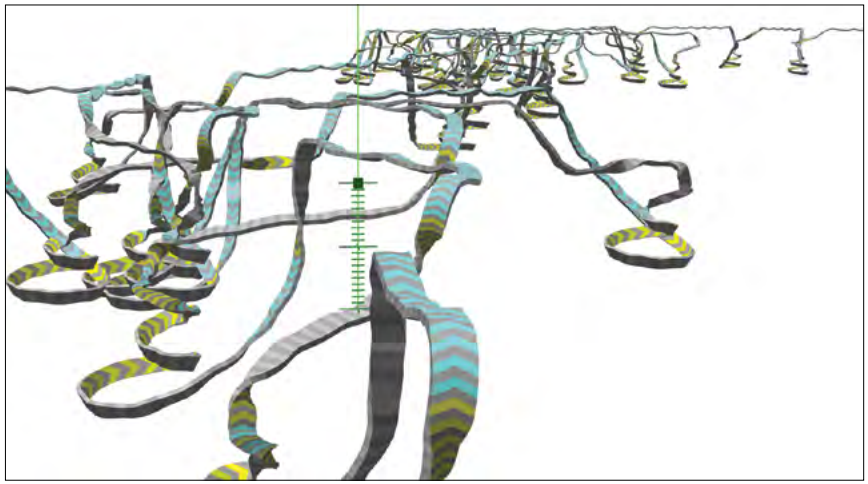
I worked with researchers at the UBC School of Journalism to explore the current state of data journalism in Canada. To get an idea of what is considered to be outstanding data journalism, we analyzed data projects that were finalists of three big national and international journalism awards (the Online News Association, the Global Editors Network and the Canadian Association of Journalists). We looked at how teams are assembled—is it only editorial people or are there data analysts,

designers, developers, or project managers involved? In which genre do data projects appear most often, what's their topic, and is it rather local or world topics? Also what techniques do they use most often? (Spoiler alert: it's maps.) How can the readers interact and where does the underlying data come from? All in all we found that Canada, like most other countries in the world, still has a way to go to catch up with the scope and ambitions of projects that come from the major players in the US.

J. Fulda Former Master student with the InfoVis group, University of British Columbia, Canada

Colin Ware

Visual Thinking about Data: The Cognitive Thread, Interaction and the Visual Query



This talk introduces a design method built on three concepts: The cognitive thread, interaction and the visual query. The cognitive thread refers to the sequence in which ideas occur and what determines this sequence. When we watch a compelling visual presentation, our attention is being carefully lead by the presenter so that the patterns we see and the words we hear lead us to a series of planned conclusions; the presenter is controlling the thread of our cognition. When we explore a static data visualization we are (mostly) cognitively in the driver's seat, we set the goals and control the cognitive thread. We decide which information leads to follow. When we explore data interactively we intermittently give control to the computer and let a piece of software control the thread. In this case the cognitive thread is distributed, as in a conversation between two people.

A visual query is a visual pattern search designed to advance an analysis. Visual queries are embedded in the cognitive process, the results of a pattern search will often alter the cognitive thread. In this talk, I will argue that a way of optimizing graphic design (how data is transformed to graphical marks) is to optimize for visual queries. A way of optimizing the design of an interactive visualization system is to think of the best division of cognitive labor between human analysis and computer calculations and how the transitions between them can be achieved through user interactions.

C. Ware Director of the Data Visualization Research Lab. Center for Coastal and Ocean Mapping, University of New Hampshire, NH, United States

Catherine D'Ignazio

Creative Data Literacy: Bridging the Gap Between the Data Haves and Have-nots

Communities are swimming in data—demographic data, participation data, government data, social media data—but very few understand what to do with it. Though governments and foundations are creating open data portals and corporations are creating APIs, these rarely focus on use, usability, building community or creating impact. So although there is an explosion of data, there is a significant lag in data literacy at the scale of communities and individuals. This creates a situation of data-haves and have-nots. But there are emerging technocultural practices that combine participation, creativity, and context to connect data to everyday life. These include citizen science, data journalism, novel public engagement in government processes, and participatory data art. This talk surveys these practices both lovingly and critically, including their premises, aspirations and the challenges to creating citizens that are truly empowered with data.

C. D'Ignazio Assistant Professor of Civic Media and Data Visualization Storytelling, Journalism Department, Emerson College, Boston & Research Affiliate, MIT Media Lab Center for Civic Media, Cambridge, MA, United States

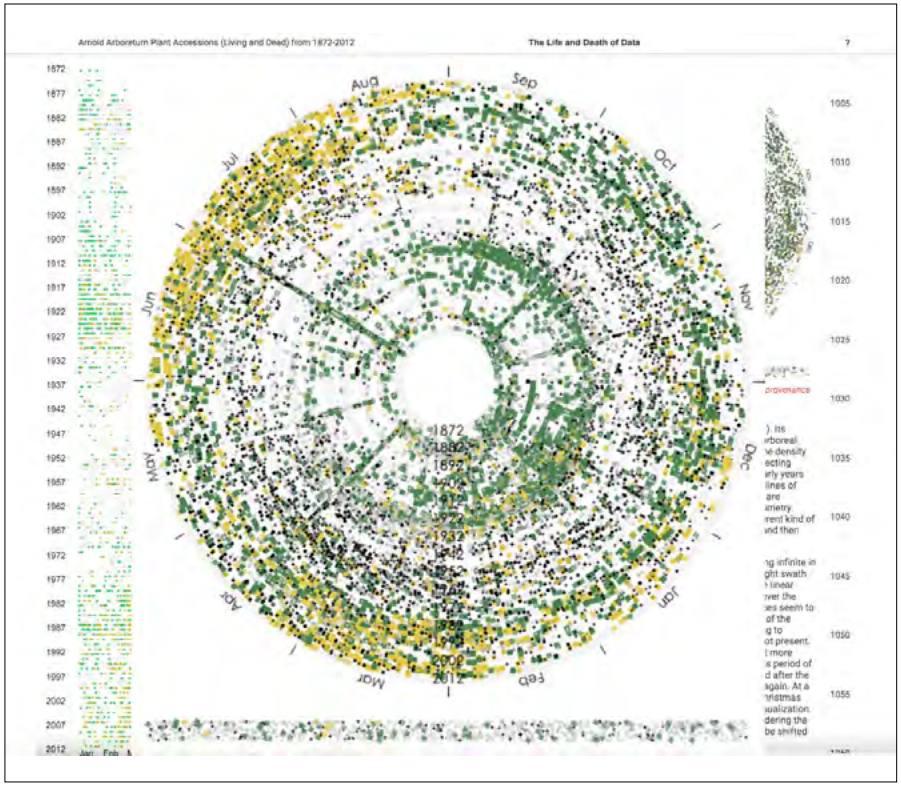
Yanni Loukissas

Local Data: Learning to Look at Big Data as Aggregates

Data are local: made by people and their dutiful machines, at a time, in a place, with the instruments at hand, using limited resources, to reach disciplined audiences. (Bowker and Star 1999, Edwards 2010) Although they are reliably transferred across digital communication networks, everywhere data remain marked by local artifacts: traces of the conditions and values that are particular to their origins. (Battles and Loukissas 2013) Even big data—a term that valorizes the scale and perceived autonomy of today's data practices—are no more than aggregations of local knowledge, grounded in and inseparable from their social and material beginnings. This paper argues that we should learn to look at big data as data aggregates: collections of local data with varied and discordant infrastructural ties. In other words, if we are to fully understand the opportunities and pitfalls of big data, we must begin to see both the forest and the trees.

This paper will explain how to look for the local in large aggregated collections of media-related data, such as museum accessions, library catalogs, news feeds and real estate listings. A locale is more than a geolocation. Indeed, there are many ways in which the local is manifest: situated errors, regional terminologies, historical constraints, legacy classifications and community rituals. Such ties to the local can range from the implicit to the explicit as well as from the material to the semiotic. Local markers are particularly relevant when grappling with big data. For although the term suggests a departure from the local, the rise of the Big data phenomenon has ironically made the local qualities of data more significant. Under big data, local data are increasingly brought together from heterogeneous sources and presented to audiences other than those first intended. Big data are typically aggregated to construct views of the past (retrospective), present (panoramic) or future (speculative). However, when seen as assemblages of local data, big data can be used for comparative studies of cultures of data collection.

Local Data is an agenda for research and teaching that critically engages big data, not as large homogenous sources of information, but as sites of 'ontological politics' where multiple realities come into material conflict. (Mol 1999) The paper concludes with a set of principles for research and pedagogy: treat all data as aggregates, be dirty, take a comparative approach, show context, use data to connect people, and create opportunities for the collection of counter data. In summary, this work responds to an emergent need: for new discourses that



act as publicly accessible alternatives to the hegemonic mythology that currently surrounds big data and infuses it with an 'aura of truth, objectivity and accuracy' (Boyd and Crawford 2012, 663). Data never offer unobstructed views of the past, present or future; but they can connect us to people with strategic vantage points other than our own.

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Y. Loukissas Assistant Professor of Digital Media, School of Literature, Media and Communication. Georgia Institute of Technology, United States

Robert Kosara

Pie Charts—Unloved, Unstudied, and Misunderstood

Many of the rules we talk about in the visualization community are based on hunches and personal taste, rather than science. A good example is the common wisdom about pie charts. How do we read pie charts? Look at any number of books, and they will tell you that we read the central angle of a slice. That is important, because it means that removing the center (i.e., a donut chart) will lead to less accuracy.

But it's not true. And not only that, this assertion is made without any science to base it on. The only work we could find that even asked the question of how we read pie charts is from 1926—ninety years ago!

We have recently conducted experiments to look into how we actually read pie charts [1]. We designed deconstructed charts—only angle, only arc length, or only area (and also some combinations)—, and asked people to tell us what value they thought they represented. Angle alone turned out to be the least reliable, producing the largest error. Area and arc length were both more precise by themselves, and the combination of all three (in a complete pie chart) worked the best. What is more, donut charts turned out to be no worse than pie charts.

We then wondered how this would impact common design variations of pie charts: exploded pie charts, charts where one slice is larger (often done for emphasis), and charts whose shape was not round (common in infographics, e.g. pie charts in the shape of a head) [2]. Based on our previous results, we expected that increasing area in the chart with the larger slice would lead people to overestimate the value, even though the central angle was unchanged. And that is exactly what happened. We also found that even the exploded pie chart, which does not change angle, area, or arc length, led to higher error than the basic pie chart. Unusually-shaped charts also created considerably more error, as expected.

The reason for doing this work is to come to better recommendations for designers who want to use pie charts. And more than that, to base those recommendations on actual research. Some of our findings are not surprising, but now there is actual science behind them. Others, however, are. We believe that there is a lot of opportunity to find these hidden gaps in our knowledge and test whether what we believe to be true actually is true, and to add depth and nuance to our understanding.

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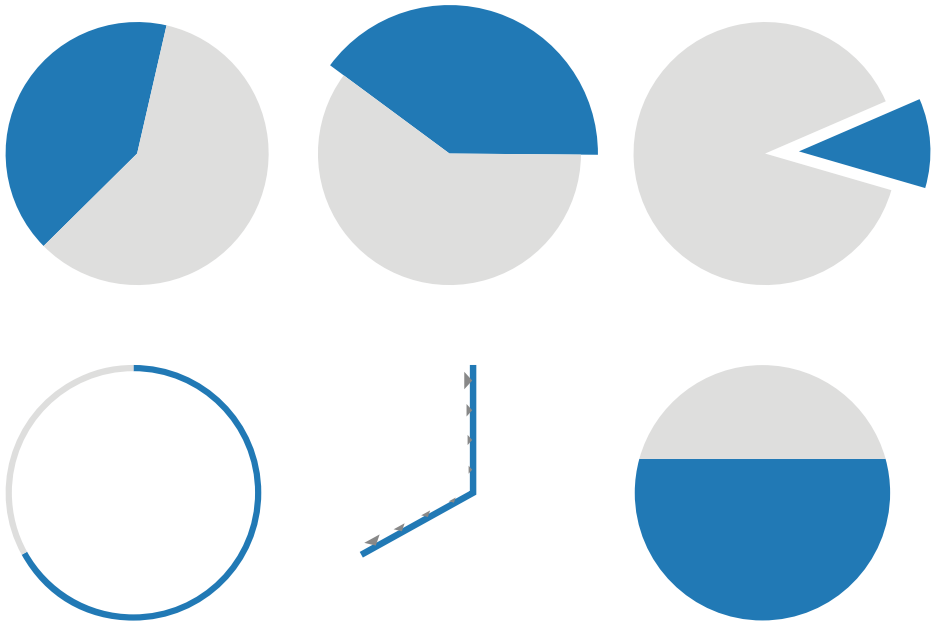
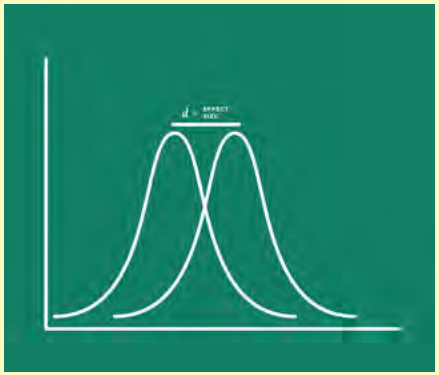


R. Kosara Senior Research Scientist, Tableau Software, United States

D. Skau Program Manager, ScribbleLive, United States

James March

The Statistical Overshoot: Principles to Keep Data in Check



In the seminal article, “The Earth is Round (p < .05)”, Jacob Cohen (1994) criticized the nature of statistical probability and the methods in which it is presented to other researchers and society at large. The author put into question the (still) dominant procedure of null hypothesis significance testing, as well as the syllogistic reasoning behind maintaining that widespread adoption across empirical studies. Cohen and his successors championed for dynamic visualizations that would allow interactive exploration and engagement with data, rather than approaching statistics in a purely passive manner.

The proposed paper wishes to address the complex and confounding nature of statistical literacy in the now maturing area of information design through the lens of active (e.g., data visualizations, information graphics) and passive (e.g., statistics calculations, power estimates, effect sizes) transfers of data. As the total volume of information in the world grows exponentially each year, designers will increasingly play a role in visualizing and presenting data sets. However, not all designers are capable of presenting complicated data stories and insights in a way that accurately portrays the limitations and shortcomings of the empirical data.

As per Cohen’s concerns of limiting statistical analyses to a singular mode of interpretation, how can information designers ensure that their methods of visualization (i.e., active modes) also subject themselves to multifaceted levels of scrutiny, ensuring that the data is presented equitably and justly to an audience? Creative works involving data should make even greater attempts to deemphasize statistical assumptions, and utilize descriptive visualization strategies that limit the assumptions the audience may encounter when interacting with information design artifacts.

The proposed paper examines a multi-faceted method of addressing these issues, through an integration of statistical literacy in educational curriculum to modes of engaging critically in quantitative data.

J. March Professor, Sheridan College, Canada

Heather Krause

Designing Across Cultures: Ethics and Examples When Collecting and Communicating Data Globally

Working with data analysis and visualization in multi-cultural settings across the globe has shown me many examples of the cross-cultural sensitivity that is necessary when collecting, analyzing and communicating data across cultures. Data visualization and data analysis hold a lot of power in the current context. Both are expanding rapidly in the field. More and more designers are working with data and increasing numbers of analysts are working with data visualization. However, with the growing availability of online tools for both, there is not enough discussion about the ethics and embedded world views that are involved in these tools.

Making implicit cultural assumptions about what is included in the data and the visualization can lead to serious problems when the assumptions go unchecked. The design and communication can end up being biased, incorrect or disempowering to the intended audience.

Understanding the context that gives rise to the data at hand is an essential first step. What I think the data means may not be what you think the data means. Then, when designing a visual expression of the data, cultural assumptions about the direction of time, visualization of high or low, good or bad, misunderstanding of the complex nature of the data or information we may be working with, and basic issues of literacy can all get in the way of an effective and appropriate design.

In this talk, I’ll show you some of the lessons I’ve learned working with information design on projects in Bangladesh, Ghana, Papua New Guinea and others. I’ll demonstrate methods and show detailed examples directly from my work in the field how to design. I’ll show some successes and some real failures. Hopefully the lighting talk with plant the seeds for much deeper conversations on the cultural implications of data design.

H. Krause CEO, Datassist
Data Science for the Non-profit World, Canada

Georges Hattab

A Mnemonic Card Game for your Amino Acids

Since the 1980s the progression in Natural Sciences challenged educational institutions and media to keep the society on an appropriate level of knowledge and understanding. Two very prominent early developments were PUS(H): Public Understanding of Sciences (and Humanities) (Budmer 1985) and PEST: Public Engagement of Science and Technology (Wyne 2001).

One very prominent and diverse area is molecular Biology/Biochemistry with its large collection of Biomolecules. Although the feature representations are standardised to some extent depending on the used structural formula (e.g. skeletal formula, unspecified stereochemistry, Fischer projection, etc) learning to navigate in this knowledge domain takes years.

In this project, we investigate the potential of infographics, graphical design and game motivation for learning the features of a special group of biomolecules, the amino acids. We propose a mnemonic card game based on creative design to aid memory retain the biochemical amino acids. Each amino acid is composed of a number of features, which are often shared among more than one amino acid.

We developed an intuitive system to code these features into shapes, colours and textures, so to assist our abilities in interpreting visual stimuli, recognising such features, grouping them, noting relationships, and ultimately memorising the structural formulas (Bitterman 1965). This provides students with the possibility of using the cards for a card game to learn

the amino acid properties and formulas, respectively by simply having fun and challenging each others.

This approach would serve as a teaching tool for subject-oriented card game designs so to retain relevant information by using perceptual memory and fun. This work establishes a connection in such a way that design is at the service of the public.

G. Hattab and B. Brink Int. Research Training Group 1906, Computational Methods for the Analysis of the Diversity and Dynamics of Genomes (DiDy), Bielefeld University, Faculty of Technology, Biodata Mining Group, Germany

T. W. Nattkemper Bielefeld University, Faculty of Technology, Biodata Mining Group, Germany

Drew Hemment & Moritz Stefaner

Project Ukko: Visualizing Future Weather Conditions for Decision Making

Project Ukko is a visualization interface developed as a part of a design study on potential applications of seasonal to decadal (S2D) climate predictions, that presents a novel solution to the informational challenge of putting probabilistic information into usable form for decision makers in industry. The study was the design component of EUPORIAS, a project funded by the European Union to increase the resilience of society to climate change by supporting the emergence of a S2D climate services sector.

Climate services provide made-to-measure climate information, tailored to the specific requirements of different users and industries. In the wind energy sector, understanding of wind conditions in the next few months has high value, for instance, for wind farm managers and energy traders. In Project Ukko, an interactive visualization enhances the accessibility and readability of the latest advances in seasonal wind speed predictions developed as part of the RESILIENCE prototype of the EUPORIAS project. The overall goal was to raise awareness of recent advances in S2D climate predictions and their possible applications, and to support the emergence of a S2D climate services sector, through art and design practice.

To achieve this objective, an interdisciplinary team that included climate scientists, design researchers and a data visualization designer provided complementary perspectives to the conceptual design of the visualization interface. We developed an information-rich, but also highly scannable interactive map, showing prediction skill, wind speed, and change in wind speed world wide in the form of multi-dimensional glyphs. A tailored visual device *(probability cone)* presents a novel visual model to communicate distributions of probabilistic prediction values, and informed the development of a coherent visual language for the whole project.

In this paper, we account for and reflect on the design process and design decisions behind the visualization system. We draw on the Design Study Methodology (DSM) developed by Sedlmair, Meyer and Munzner (2012) and Munzner's (2009) 'nested model.'

The design approach was user-focused and iterative, and we describe what we call a *long tail* of domain characterisation. The process through which the domain and problem were characterised was iterative and cyclical, as well as prolonged. Each step sought to develop sharper understanding on the problem space, the feasible collaborations, and contributor roles. We would characterise the trajectory as a *bee line,* in which the domain and problem gradually came into focus, as promising questions and collaborations were explored, and ways forward were discounted or taken up. We reflect on the applicability of this approach to other complex visualization design projects, including where time and resource constraints limit the amount of user involvement during the design process.

Thanks to Albert Soret, Melanie Davis, Dominikus Baur, Stefanie Posavec, Laurent Dubois, Tom Rowlands and thewindpower.net. The research leading to these results has received funding from the European Union's Seventh Framework Programme [FP7/2007-2013] under Grant Agreement no 308291.

D. Hemment University of Dundee, United Kingdom

M. Stefaner Data visualization designer, Germany

S. Makri, and J. Dykes City University, United Kingdom

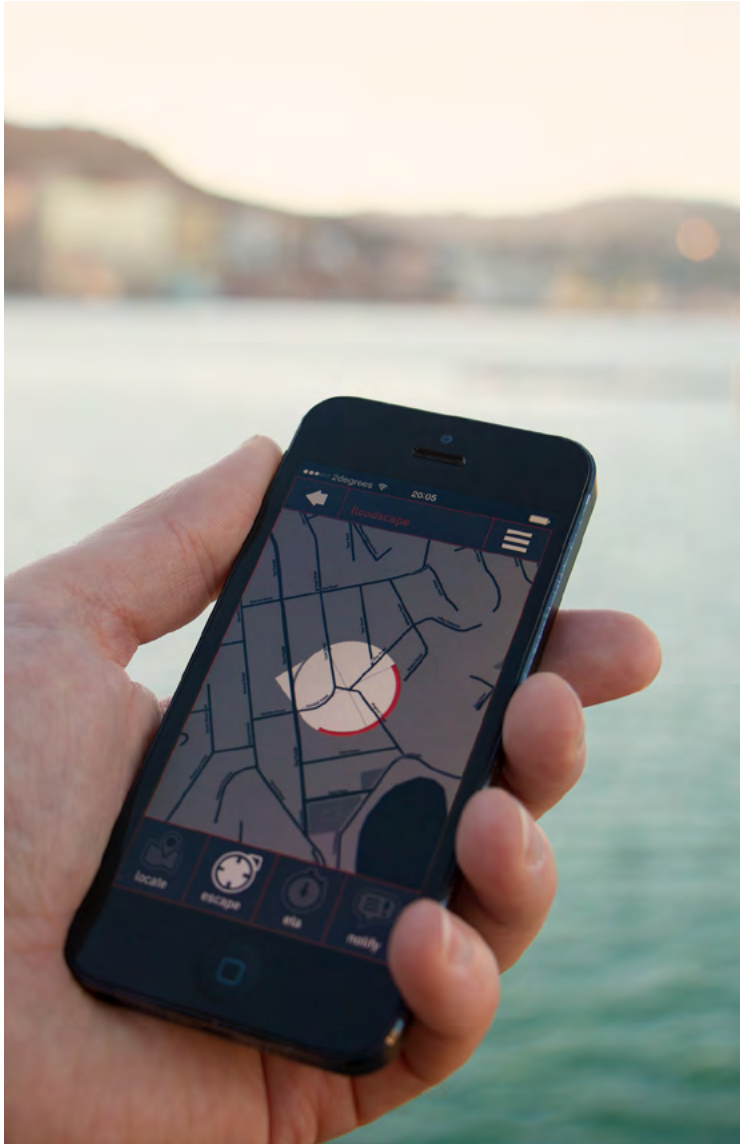
C. Buontempo Met Office, United Kingdom

I. Christel, V. Torralba, N. Gonzalez-Reviriego Barcelona Supercomputing Center, Spain

F. Doblas-Reyes Barcelona Supercomputing Center and Institució Catalana de Recerca i Estudis Avançats, Spain

Klaus Kremer

Anticipative Interfaces for Emergency Situations



Contemporary information and wayfinding design often disregard the changing personal circumstances / mental state of the user. This paper explores concepts and methodologies in user interface (UI) and user experience (UX) design to increase retention and memorisation through the inclusion of human centred design principles and a focus on the recipients' individual context, mental state and abilities.

In an emergency, visual perception and situation awareness may be restricted due to the impact of sensory symptoms (panic, tunnel vision or limited motor skills), thus calling for a linear course of action to enable the user to concentrate at the task at hand.

Current mobile devices offer a vast number of design opportunities and sensors for aiding in unusual situations and are equipped with enough processing power to collate, assess and contribute to a timely, contextual and personalised solution.

One exploration of these issues builds the foundation of the applied research project floodscape—a mobile application designed to educate its user about possible inundation zones resulting from a tsunami in their communities. Ongoing user engagement through interactive simulation is the prime focus of the initial (dormant) state of the app. In case of an actual tsunami the app registers the event and adapts its user interface accordingly. Crucial life-saving wayfinding information will be displayed in a contextual manner considering contrast, typography, limited user attention and ease of use. Estimated time of arrival, current location, escape routes and notifications to neighbours and relatives are all unambiguous in its usability, design and accessibility.

The presentation for Information+ introduces the finished project as a case study and speaks to how the app enabled the development of a new curriculum where students design emergency app prototypes capable of anticipating the mental and physical state of the user with focus on the context of its use in mind.

K. Kremer Senior Tutor Visual Communication Design, School of Design, College of Creative Arts, Massey University, New Zealand

Patricio Davila

Visualization as Assemblage: A Case Study in Critical Visualization Practice

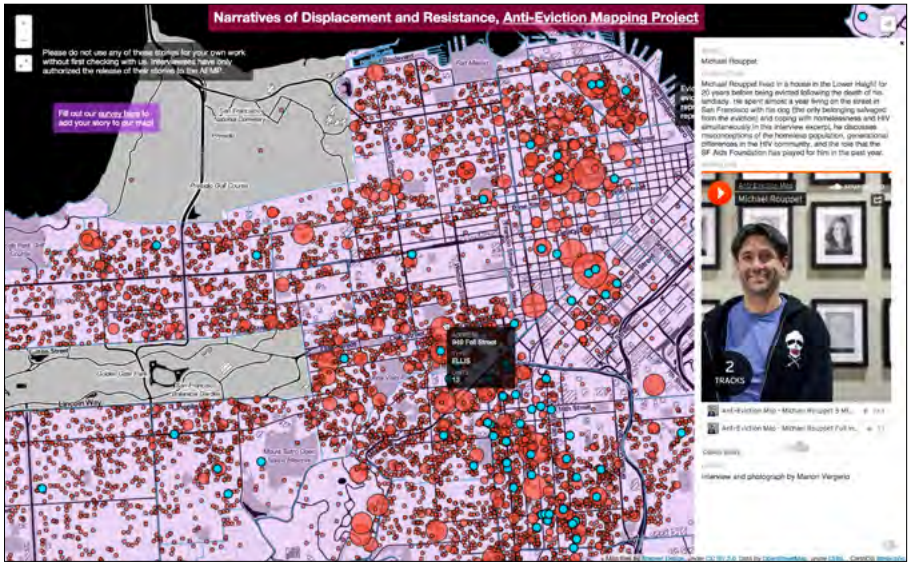
Over the past decade thousands of families have been evicted from downtown San Francisco to make room for investment properties that serve a growing clientele of tech-company employees. These evicted families, predominantly poor, immigrant, and racialized, continued to be displaced in order to fuel the officially-endorsed creative economy. Within this context the Anti-Eviction Mapping Project (AEMP) has developed a collection of visualizations and processes that advocate on housing rights for tenants in San Francisco.

The AEMP employs different modalities of visualization that attempt to describe this housing crisis, and in itself highlights the importance of paying attention to the networks and assemblages involved in collection, analysis, creation, presentation and dissemination. These aspects are especially important when considering projects that seek to advocate for social justice and produce counter-hegemonic messaging. This is a project where respect for participants, accurate representation and continued engagement are embedded in its mandate.

This paper will discuss several inter-related AEMP visualizations to show how the notions of *networks* and *assemblages* are complimentary concepts that can help us describe how visualizations are more than artifacts. A framework will be derived from a bridging of *actor-network theory* (e.g. Latour's work on navigational practice, inscriptions and immutable mobiles) with assemblage theory (e.g. Deleuze and Guattari's work on diagram, expression and assemblages of enunciation). We will see how visualizations are productions that involve affect, performance and multiplicity as well as cognitive and material dimensions. It will be argued that this way of describing visualizations offers a rich framework to look at info viz in general and *critical visualization practice* in particular.

Critical visualization practice, within this paper, aims highlight the similarities among a set of practices that aim both to show alternatives to dominant narratives (of society, environment, etc.) and to produce ethical forms of connections to the constituents in a given visualization (the actual people being represented, the territory, etc.)

P. Davila Assistant Professor, Faculty of Design, OCAD University, Canada



Anti-Eviction Mapping Project–Narratives of Displacement and Resistance (image used with permission by the Anti-Eviction Mapping Project) (www.antievictionmappingproject.net/narratives.html, accessed February 10, 2016)

Ricardo Castañeda Quebrado

Territorial Conflicts and Information Design. A Proposal to Empower People Around This Social Phenomena

Territorial conflicts are phenomena that demonstrate the involvement of civil society in defense of their interests and rights. Some of these are conceived when government infrastructure projects are announced to generate development, economic growth and increase competitiveness. However, sometimes these projects may cause individual damages, such as dispossession of land and homes, or may cause environmental detriment of the affected space.

As a result of a diagnosis, we detect lack of effective communication strategies territorial disputes and government control of public opinion, which we believe limits the understanding of the phenomenon holistically. On the other hand, the absence of territorial conflicts in the media make invisible an important process in the life of a territory. The demands around these are unknown to the society.

Our project consists of strengthening communication among diverse actors of territorial conflicts. We consider that information socialization is crucial, since conflicts are part of the social, democratic and political life of a country. Through this project, we are inviting civil society to understand the conflicts, manage their territory and take an informed posture.

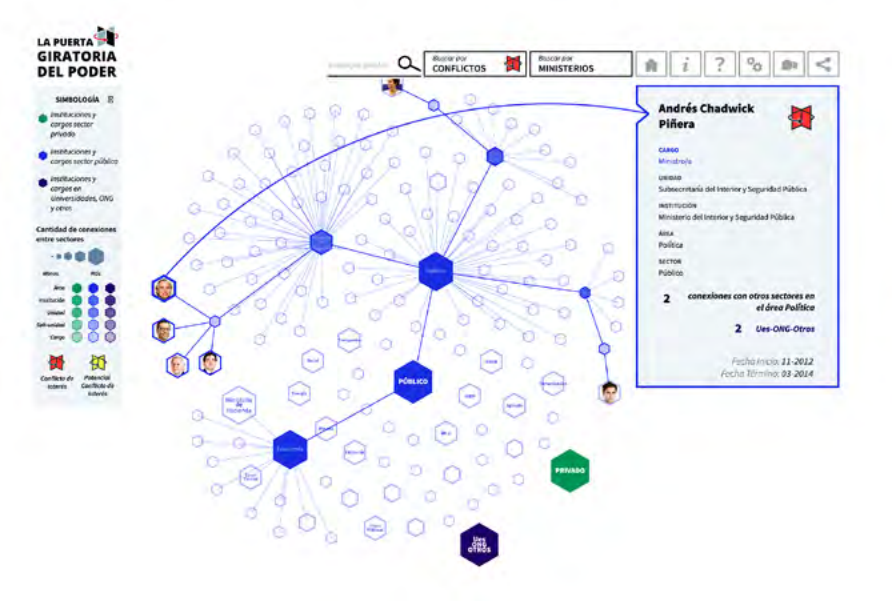
Territorial conflicts are organized opposition of parties that disagree on territorial issues and that can affect the social, cultural, economic, environmental or heritage aspects of life of a given community. The project that we are presenting is an Information System of Territorial Conflicts. The objective of our project is to concentrate, process, manipulate and organize data from different sources (such as people who is involved in conflict, media, official documents and social networks).

The System recognized four main information categories: geographic, chronological, contextual and argumentative, that are essential to represent territorial conflicts. The challenge is to integrate these categories in a digital environment that has to be accessible, relevant, understandable and usable for the different actors of the conflict.

R. C. Quebrado, K. J. G. Cortez and M. L.o Castillo Universidad Autónoma Metropolitana Unidad Cuajimalpa, Mexico

Manuela Garreton

The Revolving Door of Power



The Revolving Door of Power is an interactive data visualization about the executive power in Chile, its connections with the private sector and its conflicts of interest. The aim of this project is to visually describe the transit of public officials from and towards the private sector. It is grounded in a research by Ciper (Journalism Research Center in Chile) that built a database containing information from people working in sensitive areas of the public sector since 2010, including ministers, secretaries, mayors, etc. The labor records are categorized into three sectors; public, private and NGOs. The purpose of this visualization is that the information presented could be used to detect potential conflicts of interest together with showing which areas are more connected between different sectors and, therefore more exposed to conflicts.

The project has two visualization modes; a network showing how sectors, institutions and charges are organized in levels and a timeline for each person in the database that visualize all their employments since 2000. When a person has a conflict a red door icon pop up in the charge involved. A description about the conflict and different links to other sources about it, are also available. When there is a potential conflict a yellow door icon pop up with the same information.

Finally, the web platform enables to keep updated the database which constitutes this project in a tool of inquiry while it contributes to transparency in Chilean Governments.

M. Garreton Professor, Pontificia Universidad Catolica de Chile, Chile

Barbara Sudick & Frank Armstrong

Understanding California's Groundwater: Using Storytelling and Interactive Data Visualization to Facilitate Systems Thinking

The health of complex ecosystems, like groundwater, depends on balancing dynamic elements. Recognizing that these elements are not independent of one another, but that their behaviors and relationships are interconnected, is crucial to understanding how systems work and is essential to the sustainable management of one of our most important resources, water. Because water in California moves around in a man-made infrastructure that has effectively delinked natural availability from demand, it's especially difficult to understand these connections. The sheer number of related components and the amount and density of data only add to its complexity.

In this case study, we explore how aspects of interactive data visualization and storytelling, are being used to create tools to develop a sustainable groundwater management plan for California's Sacramento Basin.

Visualizing complex data over time reveals the patterns that emerge from the behaviors of natural systems. These patterns can help to expose the ill effects of human actions on the environment (like the occurrence of subsidence, the sinking ground that results from over-pumping groundwater, or the threat to the habitat of the giant garter snake when rice fields are fallowed). Simultaneously showing events that are separated by time and space, these visualizations can also explain how small catalytic events have the potential to cause significant changes in complex systems. Providing stakeholders with hands-on tools empowers them to become active participants. Allowing them to filter data and create new relationships that invite comparisons, raise new questions, and provide alternative solutions not only enhances collaboration, but has the potential to unite communities.

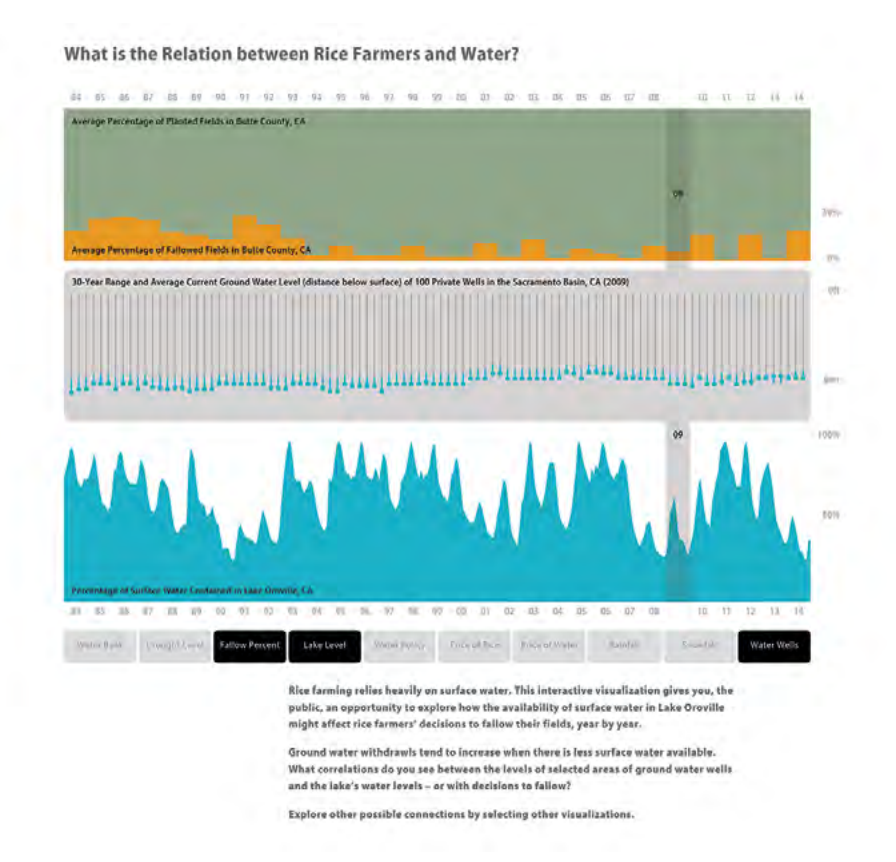
Stories are one of the easiest ways people can share complex information. Connecting peoples' experiences, thought processes and values, stories bring to life causal relationships that might otherwise remain hidden. Personalizing information and adding emotions make stories more memorable and can help motivate people into action.

B. Sudick Professor, Graphic Design, California State University, Chico, United States

F. Armstrong Lecturer, Graphic Design, California State University, Chico, United States

A. Chaudhry Associate Professor, Economics, California State University, Chico, United States

D. Fairbanks Professor, Geography and Planning, California State University, Chico, United States



Dominikus Baur

Subspotting: Mapping Available Cell Phone Reception on the New York Subway

The spotty cell phone reception on the Subway is a common problem for people living in New York City. While officially no reception whatsoever is available, stray signals from aboveground let people access the network at certain places on certain lines.

With the Subspotting project, we mapped this hidden phone network for the entire Subway and the four major carriers (AT&T, T-Mobile, Sprint, Verizon).

Using a custom iPhone logging app, we collected cell reception measurements in two second intervals and traversed the Subway network twice—once in either direction for every line. After enriching the resulting 1.6 million data points with contextual information (whether a train runs above or underground at a given point of the line, where boroughs end, at which stations public WiFi is available), we turned to visualization: the results are an iPhone app for quick offline access of the data and two posters—one providing a direct linear comparison of the various lines and providers and the other showing a geographic overview of the underground network.

In this lightning talk, I will give an overview of the project and present our lessons learned from going through the full data-driven process: collecting, cleaning and visualizing a unique dataset.

D. Baur Independent Researcher, Germany

D. Goddemeyer OFFC NY, United States

María González de Cossío

Writing a History of Mexican Railways through its Information Design

In this study I am looking into representative information design materials that were produced in the XIX century in Mexico when the railway system began its construction. It starts from the previous ways of transportation, such as the Mexican *litera* (bed) and the carriages, the first train inaugurated in 1873 that ran from Mexico City to Veracruz, and the extension of the system throughout the country.

The construction of the railway between these two cities went through several stages and changes of the route. It took 36 years to finish this line because of economic and technical reasons, which were complicated by winding territory and geographical obstacles. The construction also went through international turmoil because of two wars: the Reform war and the war between Mexico and France, which hindered its development. However, French military, then a British company and lastly, an American company helped in the construction of the railway. The main part of the existent Mexican Railway system was constructed between 1873 and 1900.

The government had to issue debt to raise money to cover the expenses. It also used taxes that were considered as tolls booth to pass between territories. The investors, on the other hand, published brochures that presented the scientific advances of the time, which described the railway net in Great Britain. All these communications require description, analysis, organization, and interpretation to find out the thoughts that were behind each piece of information.

The study explores three main facets:

1 The railway changed people's perception of time and space; this can be observed in trains' schedules and maps with particular content such as the presentation of various altitudes along the route.

2 The railway was a promoter of tourism; there were three main reasons to travel: participation in religious feasts and pilgrimage; know new historic, commercial and cultural places, and attend sporting events or health retreats.

3 The organization of graphic materials that workers created for the archive which now houses 214,000 documents. The archive includes construction plans and maps, machinery building specifications and other descriptions.

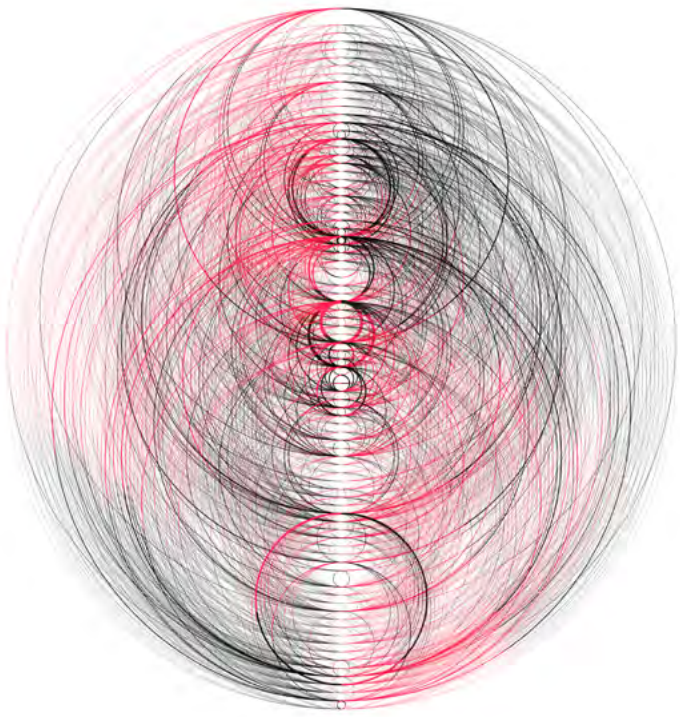
The study also includes the industrial development along the train path. This was the main concern for the first entrepreneurs, Antonio and Manuel Escandón who invested in railways to move their textiles and beer from one city to another.

Analysis and observations of information design materials will be presented, such as maps, bridges construction plans, bilingual training manuals, first printed guided tours from Chicago and New York to Mexico City, as well as train passes and schedules.

M. G. de Cossío Professor-researcher,
Universidad Autónoma Metropolitana
Cuajimalpa, Mexico

Kim Albrecht

Unfolding the Design Process



As a designer I am, and always was, interested in what design actually is. Over the years, I came to understand design rather as a process than an outcome. Contemporary philosophers like Bruno Latour and Peter Sloterdijk see design as 'drawing together'. A process of combining the already existing and by doing so creating something new (Latour, B., 2008, p.3). Vilem Flusser writes about similar concepts. For him, design does not only draw art, science and technology together but is also able to connect separated knowledge domains. Design as synthesis, the combination of two or more elements towards a new unity (Flusser, V., 1993, p.10–13). Once design is thought as synthesis, as the drawing together of different parts, the design process can be regarded as a network connecting materials, knowledge and tools but also generations, groups, individuals and frames of references. Networks in which material and non-material objects form connections over time.

Within the visualization community, there are also different design processes theories. For example Ben Fry's (2004) 'acquire - parse - filter - mine - represent - refine - interact' or Moritz Stefaner's 'Vision & Context - Data Exploration - Design - Produce - Analyse & Maintain' (2013). More generally Mike Bostock gave a talk on 'design as a search problem' (2014) and Scott Murray's 'The Keys to a Successful Data Design Process' (2014) shows many different approaches towards a visualization design process.

Throughout my talk, I would like to take a different perspective on the design process. Rather than looking at theoretical models of the design practice I would like to show the perspective of a practice-based design process. Throughout multiple projects I have been capturing and collecting my steps from first sketches to the final visualization. The projects I have collected range from one-month static visualizations to large-scale interactive projects which had over one year of development. For the talk, I would like to focus on two processes. One short project which was a cover design for the journal nature that never became a cover and as a second project the one-year development of our 'untangling tennis' project (2016). While the first was rather a graphic design project which goal it was to create aesthetic images the second project created insights through the visualizations which helped the scientific process.

One of the insights which emerge by showing this processes is how human-made these diagrams are. Visualizations are not truthful representations of reality but rather cultural artefacts which reflect the tools which we are using to create them but to a greater extent they show our world views that we convey through these images. The process of mapping, projecting and scaling does not have one optimal approach but rather many equal approaches with different viewpoints. For me as a designer working in a data science lab, the beauty of this insight is the tension between the scientific method of collecting, analysing and modelling data. A rigorous approach to creating fact-based insights and on the other hand visualization with its manipulativeness, its multiple readings, its vagueness. A tool which can create insights but we are the ones creating and shaping these insights.

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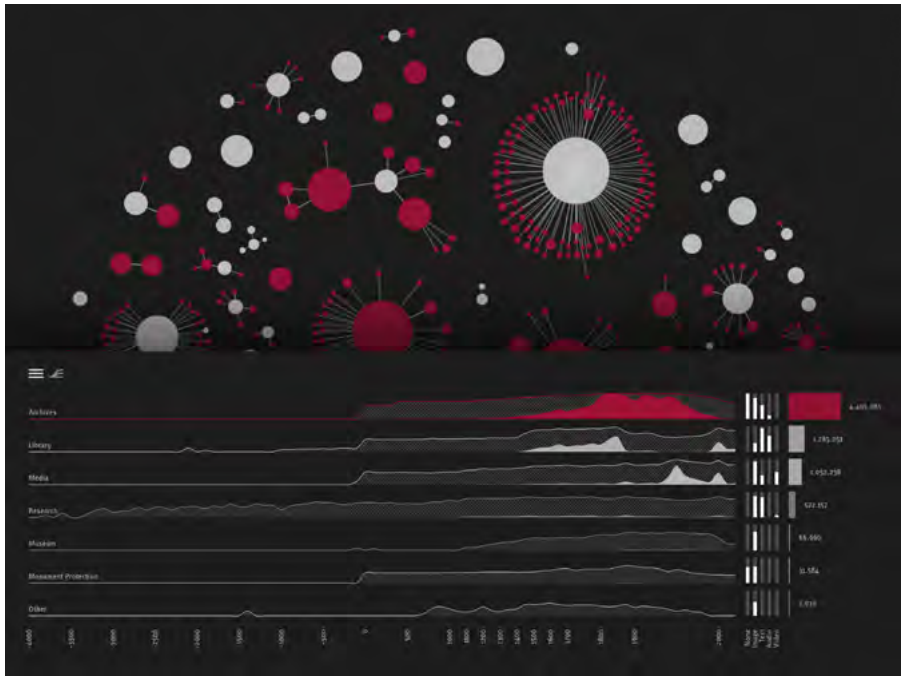
K. Albrecht Visualization researcher & information designer, Center for Complex Network Research, Northeastern University, United States

Marian Dörk

One View is Not Enough: High-level Visualizations of Large Cultural Collections



C. Pietsch, G. Credico and M. Dörk
University of Applied Sciences
Potsdam, Germany

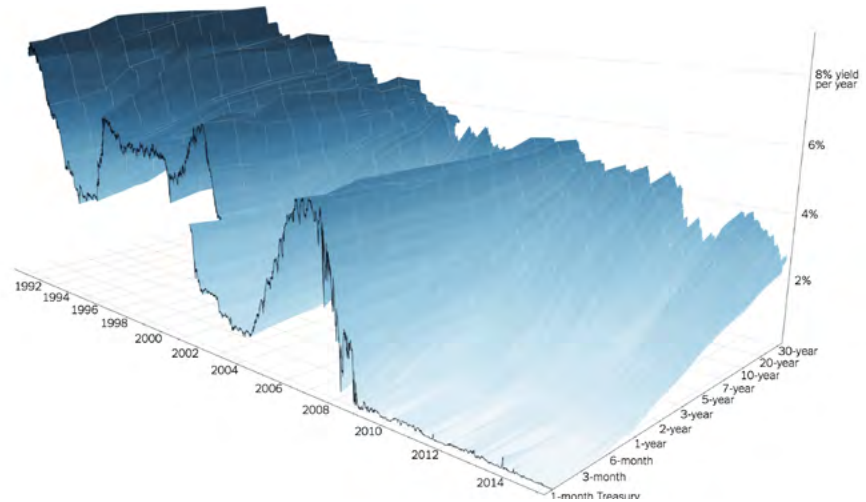
We present two design studies exploring the plurality of perspectives on large heterogenous collections of cultural artefacts. There is a growing interest in the fields of information visualization, digital humanities, and human-computer interaction in designing novel interfaces to our digital cultural heritage. As cultural institutions have been continuously digitizing their assets over the last years, there are great opportunities to engage with cultural content through novel means. On the one hand, portal websites such as Europeana, Digital Public Library of America, and German Digital Library aggregate these diverse collections to allow integrated search across a variety of sources. On the other hand, more specialized collections are being created that focus on the particular qualities of the contained artefacts. In both cases, it is the often comprehensive and complex nature of cultural collections that can make it difficult to get a sense of overview and orientation. There is growing need to find fruitful ways to make sense of the extent of collections and engage with this cultural heritage via their digital form.

We present the outcomes of two design studies, one engaging with a large aggregated collection from diverse cultural institutions, and the other focusing on the specific features of an international collection of school books. The first study involves an exploratory design process in close collaboration with the German Digital Library to examine how high-level visualizations can usefully represent an aggregation of diverse collections along several facets. The resulting representations are experimental and playful overviews of the temporal and spatial distribution of objects and the associated topics, people, and organizations. The second study focuses on the particulars of a large collection of school books published in various countries and time periods. In cooperation with a research institute specialized in the study of educational media the relevant dimensions are identified and integrated into a unified structure exposing multiple facets of the collection as coordinated visualizations.

Both design studies involved iterative design processes with the collection owners leading to prototypical implementations of multiple aesthetically and interactively coordinated visualizations. In our presentation we discuss our method of involving the collection owners into the design process, present the diverse resulting interactive visualizations, and discuss the two information architectures integrating the multiple views. We reflect on the iterative design processes that led to these representations and share our findings from the longitudinal deployment of the first case study as well as initial findings from the second study, and discuss directions for future research and design.

Gregor Aisch

Data Visualization and the News



With newsroom transitioning towards digital and 24-hour operations, there is increasing pressure to publish more and publish fast. The shift to mobile platforms confronts designers with limited display sizes and changing audience behavior. Consequently, visual journalists and newsroom developers often reject more sophisticated, information-dense, and interactive data visualizations in favor to quicker-to-produce static content forms. What might have been designed as interactive, animated visualization three years ago is now a simple list of static images, embedded in text. This talk walks through the situation and challenges of interactive data visualization displays in the news today.

G. Aisch Graphics editor, *The New York Times*, United States

Information+ Workshop

June 18, 2016

Emily Carr University
of Art + Design

In a city often referred to as “Raincouver”, there is a common perception that we have an abundance of water—yet last summer we saw major concerns rising over drought and the implementation of level 3 water restrictions in Metro Vancouver and BC. As population growth and climate change put greater pressure on our water resources, **how can information design and data visualization create the shift in perception needed to recognize our city’s water conservation challenge?** Vancouver’s Greenest City Action Plan calls for a reduction of per capita water consumption by 33% from 2006 levels. Meanwhile, many citizens lack water literacy and a basic understanding of where water comes from, how much we use, and how water shortages develop. As we enter into another hot summer for 2016, participants in the Information+ Conference Workshop will be asked to consider how data and information design can create civic impact and enable behaviour changes necessary to address these challenges.

Practitioners, educators, researchers and student are invited to participate in this one-day fast-paced workshop where participants will come together to ideate, prototype and generate responses to Vancouver’s water conservation challenge. This workshop will be **co-facilitated by Chad Skelton,** an award-winning data journalist and consultant, and **Caylee Raber,** Director, Health Design Lab, Emily Carr University. Conference speaker Catherine D’Ignazio, Assistant Professor of Civic Media and Data Visualization Storytelling at Emerson College, will also be offering her expertise. The workshop is an opportunity to engage in active learning, to connect with practitioners, students, and educators, and to spark the development of new projects and collaborations!

Information Everything

The Exhibition of Information+

June 6-July 3, 2016

Concourse Gallery
Emily Carr University
of Art + Design

Exploring the ways in which data is framed, expressed and understood

Historically, data has been presented as value-free, void of any emotional interpretation or subjective analysis. Through this form of address we are encouraged to believe that data hold universal truths. But on the ground, and in the minds of a vernacular imagination, it can be said that we are living through a crisis in data. That is, we are data rich, but information poor.

Curated by **Gillian Russell** (independent curator, PhD candidate in Design, RCA, London) and **Katherine Gillieson** (Associate Professor, Emily Carr University of Art + Design), *Information Everything* examines this paradox through the work of practitioners in information design and visualization who stretch and reshape data as material, focusing on its beauty and value from multiple perspectives. The works presented explore and investigate the qualitative dimensions of displays of information in compelling and complex ways. They challenge us to question our preconceived understanding of data as an ‘objective’ representation of the real in the context of themes as diverse as science, culture, society, and technology.

Featuring work by

Hyperakt and Ekene Ijeoma (USA)

Thomas Gaudin (CAN)

Paul Heinicker (GER)

Visual Agency (IT)

Milène Vallin (CAN)

Ernesto Peña, Omar Juárez
and Teresa Dobson (CAN)

David Bihanic and Thibault Jaillon (FR)

Amber Frid-Jimenez, Ben Dalton
and Joe Dahmet with Tim Waters (CAN)

Moritz Stefaner (GER)
with Drew Hemment (UK)

Kim Albrecht (GER)

Tommi (IT)

Orange Labs (FR)

Susan Verba, Yohei Kato,
Sumayyah Ahmed, Prerna Dudani
and Sarah Tinker Perrault (USA)

Heather Corcoran (USA)

Georges Hattab, Benedikt G. Brink
and Tim W. Nattkemperz (GER)

Map & Logistics

Granville Island

COFFEE & SNACKS

2 Blue Parrot Coffee

5 JJ Bean Coffee

9 GI Gelato & Coffee House

14 Off The Tracks

15 Emily Carr Cafeteria

NICE WALKS

4 Docks by the market

12 Duck Pond

16 Sea Village

18 Ron Basford Park

QUICK BITE & CASUAL

3 Granville Island Public Market (Food Court)

6 Tony's Fish & Oyster Cafe

13 Cats Social House

DINING

1 Bridges Restaurant

7 The Keg Steakhouse

8 The Vancouver Fish Company

10 Sandbar Seafood Restaurant

11 Edible Canada

17 Dockside Restaurant

Emily Carr University of Art + Design

NORTH BUILDING

19 Cafeteria

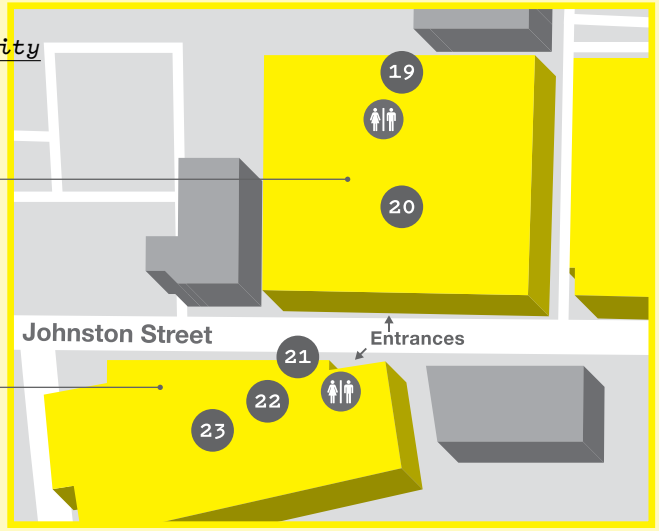
20 Concourse Gallery

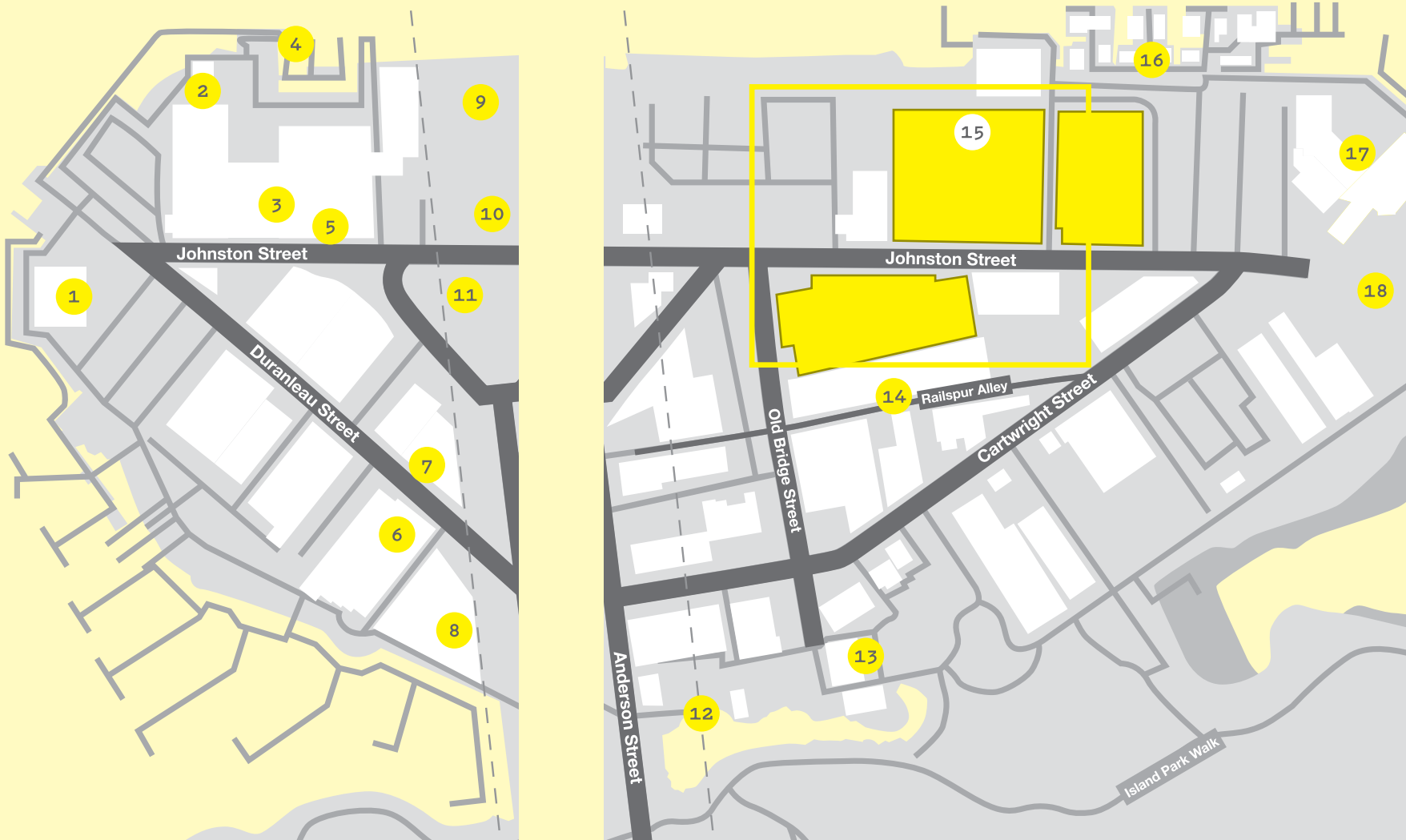
SOUTH BUILDING

21 Library

22 Atrium

23 Auditorium





Thank You

Special thanks go to the Information+ research assistants:

Juliana Forero Administrator of all the Information+ events

Diana Law Research assistant for the workshop and exhibition *Information Everything*

Taysia Louie Responsible for design including the conference guidebook, materials and wayfinding

Gillian Russell Curator of the exhibition *Information Everything*

Shaheer Tarar Responsible for website design and code (OCAD University)

Partners

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informationplusconference.com

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