Activity Report 2015

Project-Team AVIZ

Analysis and Visualization

RESEARCH CENTER
Saclay - Île-de-France

THEME
Interaction and visualization

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Project-Team AVIZ

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Keywords:

Computer Science and Digital Science:

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3.1.7. - Open data
3.3. - Data and knowledge analysis
3.5.1. - Analysis of large graphs
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Other Research Topics and Application Domains:

1.1. - Biology
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9.5.10. - Digital humanities
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1. Members

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Petra Isenberg [Inria, Researcher]

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2. Overall Objectives

2.1. Objectives

Aviz (Analysis and VIsualiZation) is a multidisciplinary project that seeks to improve visual exploration and analysis of large, complex datasets by tightly integrating analysis methods with interactive visualization.

Our work has the potential to affect practically all human activities for and during which data is collected and managed and subsequently needs to be understood. Often data-related activities are characterized by access to new data for which we have little or no prior knowledge of its inner structure and content. In these cases, we need to interactively *explore* the data first to gain insights and eventually be able to act upon the data contents. Interactive visual analysis is particularly useful in these cases where automatic analysis approaches fail and human capabilities need to be exploited and augmented.

Within this research scope Aviz focuses on five research themes:

- Methods to visualize and smoothly navigate through large datasets;
- Efficient analysis methods to reduce huge datasets to visualizable size;
- Visualization interaction using novel capabilities and modalities;
- Evaluation methods to assess the effectiveness of visualization and analysis methods and their usability;
- Engineering tools for building visual analytics systems that can access, search, visualize and analyze large datasets with smooth, interactive response.

2.2. Research Themes

Aviz's research on Visual Analytics is organized around five main Research Themes:

Methods to visualize and smoothly navigate through large data sets: Large data sets challenge current visualization and analysis methods. Understanding the structure of a graph with one million vertices is not just a matter of displaying the vertices on a screen and connecting them with lines. Current screens only have around two million pixels. Understanding a large graph requires both data reduction to visualize the whole and navigation techniques coupled with suitable representations to see the details. These representations, aggregation functions, navigation and interaction techniques must be chosen as a coordinated whole to be effective and fit the user's mental map.

Aviz designs new visualization representations and interactions to efficiently navigate and manipulate large data sets.

Efficient analysis methods to reduce huge data sets to visualizable size: Designing analysis components with interaction in mind has strong implications for both the algorithms and the processes they use. Some data reduction algorithms are suited to the principle of sampling, then extrapolating, assessing the quality and incrementally enhancing the computation: for example, all the linear reductions such as PCA, Factorial Analysis, and SVM, as well as general MDS and Self Organizing Maps. Aviz investigates the possible analysis processes according to the analyzed data types.

Visualization interaction using novel capabilities and modalities: The importance of interaction to Visualization and, in particular, to the interplay between interactivity and cognition is widely recognized. However, information visualization interactions have yet to take full advantage of these new possibilities in interaction technologies, as they largely still employ the traditional desktop, mouse, and keyboard setup of WIMP (Windows, Icons, Menus, and a Pointer) interfaces. At Aviz we investigate in particular interaction through tangible and touch-based interfaces to data.

Evaluation methods to assess their effectiveness and usability: For several reasons appropriate evaluation of visual analytics solutions is not trivial. First, visual analytics tools are often designed to be applicable to a variety of disciplines, for various different data sources, and data characteristics, and because of this variety it is hard to make general statements. Second, in visual analytics the specificity of humans, their work environment, and the data analysis tasks, form a multi-faceted evaluation context which is difficult to control and generalize. This means that recommendations for visual analytics solutions are never absolute, but depend on their context.

In our work we systematically connect evaluation approaches to visual analytics research—we strive to develop and use both novel as well as establish mixed-methods evaluation approaches to derive recommendations on the use of visual analytics tools and techniques. Aviz regularly published user studies of visual analytics and interaction techniques and takes part in dedicated workshops on evaluation.

Engineering tools: for building visual analytics systems that can access, search, visualize and analyze large data sets with smooth, interactive response.

Currently, databases, data analysis and visualization all use the concept of data tables made of tuples and linked by relations. However, databases are storage-oriented and do not describe the data types precisely. Analytical systems describe the data types precisely, but their data storage and computation model are not suited to interactive visualization. Visualization systems use in-memory data tables tailored for fast display and filtering, but their interactions with external analysis programs and databases are often slow.

Aviz seeks to merge three fields: databases, data analysis and visualization. Part of this merging involves using common abstractions and interoperable components. This is a long-term challenge, but it is a necessity because generic, loosely-coupled combinations will not achieve interactive performance.

Aviz's approach is holistic: these five themes are facets of building an analysis process optimized for discovery. All the systems and techniques Aviz designs support the process of understanding data and forming insights while minimizing disruptions during navigation and interaction.

3. Research Program

3.1. Scientific Foundations

The scientific foundations of Visual Analytics lie primarily in the domains of Visualization and Data Mining. Indirectly, it inherits from other established domains such as graphic design, Exploratory Data Analysis (EDA), statistics, Artificial Intelligence (AI), Human-Computer Interaction (HCI), and Psychology.

The use of graphic representation to understand abstract data is a goal Visual Analytics shares with Tukey's Exploratory Data Analysis (EDA) [60], graphic designers such as Bertin [49] and Tufte [59], and HCI researchers in the field of Information Visualization [48].

EDA is complementary to classical statistical analysis. Classical statistics starts from a *problem*, gathers *data*, designs a *model* and performs an *analysis* to reach a *conclusion* about whether the data follows the model. While EDA also starts with a problem and data, it is most useful *before* we have a model; rather, we perform visual analysis to discover what kind of model might apply to it. However, statistical validation is not always required with EDA; since often the results of visual analysis are sufficiently clear-cut that statistics are unnecessary.

Visual Analytics relies on a process similar to EDA, but expands its scope to include more sophisticated graphics and areas where considerable automated analysis is required before the visual analysis takes place. This richer data analysis has its roots in the domain of Data Mining, while the advanced graphics and interactive exploration techniques come from the scientific fields of Data Visualization and HCI, as well as the expertise of professions such as cartography and graphic designers who have long worked to create effective methods for graphically conveying information.

The books of the cartographer Bertin and the graphic designer Tufte are full of rules drawn from their experience about how the meaning of data can be best conveyed visually. Their purpose is to find effective visual representation that describe a data set but also (mainly for Bertin) to discover structure in the data by using the right mappings from abstract dimensions in the data to visual ones.

For the last 25 years, the field of Human-Computer Interaction (HCI) has also shown that interacting with visual representations of data in a tight perception-action loop improves the time and level of understanding of data sets. Information Visualization is the branch of HCI that has studied visual representations suitable to understanding and interaction methods suitable to navigating and drilling down on data. The scientific foundations of Information Visualization come from theories about perception, action and interaction.

Several theories of perception are related to information visualization such as the "Gestalt" principles, Gibson's theory of visual perception [53] and Triesman's "preattentive processing" theory [58]. We use them extensively but they only have a limited accuracy for predicting the effectiveness of novel visual representations in interactive settings.

Information Visualization emerged from HCI when researchers realized that interaction greatly enhanced the perception of visual representations.

To be effective, interaction should take place in an interactive loop faster than 100ms. For small data sets, it is not difficult to guarantee that analysis, visualization and interaction steps occur in this time, permitting smooth data analysis and navigation. For larger data sets, more computation should be performed to reduce the data size to a size that may be visualized effectively.

In 2002, we showed that the practical limit of InfoVis was on the order of 1 million items displayed on a screen [51]. Although screen technologies have improved rapidly since then, eventually we will be limited by the physiology of our vision system: about 20 millions receptor cells (rods and cones) on the retina. Another problem will be the limits of human visual attention, as suggested by our 2006 study on change blindness in large and multiple displays [50]. Therefore, visualization alone cannot let us understand very large data sets. Other techniques such as aggregation or sampling must be used to reduce the visual complexity of the data to the scale of human perception.

Abstracting data to reduce its size to what humans can understand is the goal of Data Mining research. It uses data analysis and machine learning techniques. The scientific foundations of these techniques revolve around the idea of finding a good model for the data. Unfortunately, the more sophisticated techniques for finding models are complex, and the algorithms can take a long time to run, making them unsuitable for an interactive environment. Furthermore, some models are too complex for humans to understand; so the results of data mining can be difficult or impossible to understand directly.

Unlike pure Data Mining systems, a Visual Analytics system provides analysis algorithms and processes compatible with human perception and understandable to human cognition. The analysis should provide understandable results quickly, even if they are not ideal. Instead of running to a predefined threshold, algorithms and programs should be designed to allow trading speed for quality and show the tradeoffs interactively. This is not a temporary requirement: it will be with us even when computers are much faster, because good quality algorithms are at least quadratic in time (e.g. hierarchical clustering methods). Visual Analytics systems need different algorithms for different phases of the work that can trade speed for quality in an understandable way.

Designing novel interaction and visualization techniques to explore huge data sets is an important goal and requires solving hard problems, but how can we assess whether or not our techniques and systems provide real improvements? Without this answer, we cannot know if we are heading in the right direction. This is why we

have been actively involved in the design of evaluation methods for information visualization [57], [56], [54], [55], [52]. For more complex systems, other methods are required. For these we want to focus on longitudinal evaluation methods while still trying to improve controlled experiments.

3.2. Innovation

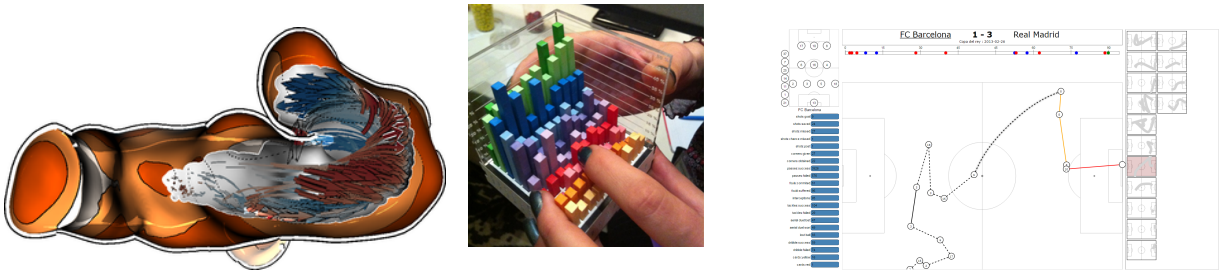

Figure 1. Example novel visualization techniques and tools developed by the team. Left: a non-photorealistic rendering technique that visualizes blood flow and vessel thickness. Middle:a physical visualization showing economic indicators for several countries, right: SoccerStories a tool for visualizing soccer games.

We design novel visualization and interaction techniques (see, for example, Figure 1). Many of these techniques are also evaluated throughout the course of their respective research projects. We cover application domains such as sports analysis, digital humanities, fluid simulations, and biology. A focus of Aviz' work is the improvement of graph visualization and interaction with graphs. We further develop individual techniques for the design of tabular visualizations and different types of data charts. Another focus is the use of animation as a transition aid between different views of the data. We are also interested in applying techniques from illustrative visualization to visual representations and applications in information visualization as well as scientific visualization.

3.3. Evaluation Methods

Evaluation methods are required to assess the effectiveness and usability of visualization and analysis methods. Aviz typically uses traditional HCI evaluation methods, either quantitative (measuring speed and errors) or qualitative (understanding users tasks and activities). Moreover, Aviz is also contributing to the improvement of evaluation methods by reporting on the best practices in the field, by co-organizing workshops (BELIV 2010, 2012, 2014, 2016) to exchange on novel evaluation methods, by improving our ways of reporting, interpreting and communicating statistical results, and by applying novel methodologies, for example to assess visualization literacy.

3.4. Software Infrastructures

We want to understand the requirements that software and hardware architectures should provide to support exploratory analysis of large amounts of data. So far, "big data" has been focusing on issues related to storage management and predictive analysis: applying a well-known set of operations on large amounts of data. Visual Analytics is about exploration of data, with sometimes little knowledge of its structure or properties. Therefore, interactive exploration and analysis is needed to build knowledge and apply appropriate analyses; this knowledge and appropriateness is supported by visualizations. However, applying analytical operations on large data implies long-lasting computations, incompatible with interactions, and generates large amounts of results, impossible to visualize directly without aggregation or sampling. Visual Analytics has started to tackle these problems for specific applications but not in a general manner, leading to fragmentation of results and

difficulties to reuse techniques from one application to the other. We are interested in abstracting-out the issues and finding general architectural models, patterns, and frameworks to address the Visual Analytics challenge in more generic ways.

3.5. Emerging Technologies

Figure 2. Example emerging technology solutions developed by the team for multi-display environments, wall displays, and token-based visualization.

We want to empower humans to make use of data using different types of display media and to enhance how they can understand and visually and interactively explore information. This includes novel display equipment and accompanying input techniques. The Aviz team specifically focuses on the exploration of the use of large displays in visualization contexts as well as emerging physical and tangible visualizations. In terms of interaction modalities our work focuses on using touch and tangible interaction. Aviz participates to the Digiscope project that funds 11 wall-size displays at multiple places in the Paris area (see http://www.digiscope.fr), connected by telepresence equipment and a Fablab for creating devices. Aviz is in charge of creating and managing the Fablab, uses it to create physical visualizations, and is also using the local wall-size display (called WILD) to explore visualization on large screens. The team also investigates the perceptual, motor and cognitive implications of using such technologies for visualization.

3.6. Psychology

More cross-fertilization is needed between psychology and information visualization. The only key difference lies in their ultimate objective: understanding the human mind vs. helping to develop better tools. We focus on understanding and using findings from psychology to inform new tools for information visualization. In many cases, our work also extends previous work in psychology. Our approach to the psychology of information visualization is largely holistic and helps bridge gaps between perception, action and cognition in the context of information visualization. Our focus includes the perception of charts in general, perception in large display environments, collaboration, perception of animations, how action can support perception and cognition, and judgment under uncertainty.

4. Application Domains

4.1. Application Domains

Research in visual analytics can profit from the challenges and requirements of real-world datasets. Aviz develops active collaboration with users from a range of application domains, making sure it can support their specific needs. By studying similar problems in different domains, we can begin to generalize our results and have confidence that our solutions will work for a variety of applications.

We apply our techniques to important medical applications domains such as bioinformatics and brain studies. In particular, we are interested in helping neuroscientists make sense of evolving functional networks, in the form of weighted and/or dynamic graphs.

Other application domains include:

- Digital Humanities in general, with the Cendari European project with historians from most European countries, the project "Interactive Network Visualization" with Microsoft Research-Inria Joint Centre on Graph Visualization, and with our work on Word-Scale Visualizations;
- Many traditional scientific research fields such as astronomy, fluid dynamics, structural biology, and neurosciences;
- Scientific illustration that can benefit from illustrative visualization techniques for scientific data;
- Personal visualization and visual analytics in which we develop solutions for the general audience.

5. Highlights of the Year

5.1. Highlights of the Year

We had a number of highlights this year:

- Aviz researchers contributed 29 publications this year. Amongst these seven papers were presented at IEEE VIS, the largest international Visualizations and Visual Analytics conference. Four full papers were presented at CHI, the largest international conference on human computer interaction;
- Aviz researchers organized two workshops and one tutorial at international conferences (ACM ITS, and IEEE VIS);
- Eight awards were won by Aviz researchers for papers, service contributions, and PhD theses (see below);
- We welcomed three international researchers and students to our lab for research visits;
- Aviz researchers taught four lectures at various French and international universities.

Awards

- Samuel Huron won the best thesis award at the IEEE VGTC Vis Pioneer Group Best PhD Dissertation Award for his thesis "Constructive Visualization: A Token-based Paradigm Allowing to Assemble Dynamic Visual Representation for Non-experts" [11]
- Jeremy Boy got an honorable mention award at the IEEE VGTC Vis Pioneer Group Best PhD Dissertation Award for his thesis "Engaging the People to Look Beyond the Surface of Online Information Visualizations" [10]
- Jean-Daniel Fekete received an IEEE TVCG service award for organizing VIS'14 in Paris
- Petra Isenberg and Tobias Isenberg received a IEEE Computer Society Certificate of Appreciation for co-chairing the http://beliv-2014.cs.univie.ac.at/index.php2014 BELIV Workshop on "Beyond Time And Errors: Novel Evaluation Methods For Visualization"
- Wesley Willet, Tobias Isenberg, and Pierre Dragicevic received a best paper award from the ACM Conference on Human Factors in Computing Systems (CHI) for their paper "Lightweight Relief Shearing for Enhanced Terrain Perception on Interactive Maps" [34].
- Charles Perin, Jeremy Boy and Frédéric Vernier received an honorable Mention (2nd prize) for "Le Tour de France at a Glance" visualiation in the IEEE VGTC/VPG International Data Visualization Contest.
- Jeremy Boy won the World Statistics Day 2015 Data Visualization Contest with his "Is the World a Better Place Today" online visualization platform.

BEST PAPERS AWARDS:

[11]
S. HURON. *Constructive Visualization*, Univeristé Paris-Saclay, September 2015, Samuel Huron received the best thesis award at the IEEE VGTC Vis Pioneer Group Best PhD Dissertation Award for his thesis "Constructive Visualization: A Token-based Paradigm Allowing to Assemble Dynamic Visual Representation for Non-experts", https://hal.inria.fr/tel-01255116

[34]
W. WILLETT, B. JENNY, T. ISENBERG, P. DRAGICEVIC. *Lightweight Relief Shearing for Enhanced Terrain Perception on Interactive Maps*, in "Proceedings of the Conference on Human Factors in Computing Systems (CHI)", New York, United States, ACM, April 2015 [*DOI :* 10.1145/2702123.2702172], https://hal.inria.fr/hal-01105179

6. New Software and Platforms

6.1. Bertifier

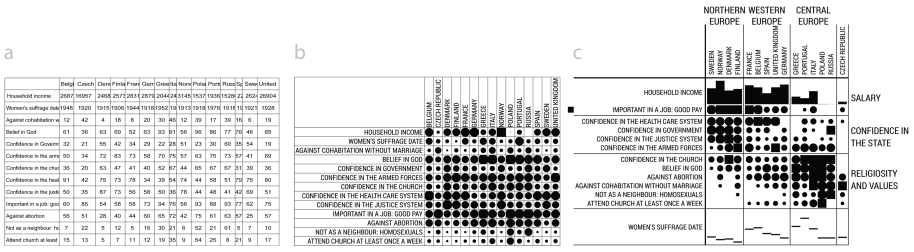

Figure 3. Image of Bertifier, a web application for creating tabular visualizations from spreadsheets.

FUNCTIONAL DESCRIPTION

Bertifier is a web application for rapidly creating tabular visualizations from spreadsheets (see Figure 3). Bertifier draws from Jacques Bertin's matrix analysis method, whose goal was to "simplify without destroying" by encoding cell values visually and grouping similar rows and columns. Although there were several attempts to bring this method to computers, no implementation exists today that is both exhaustive and accessible to a large audience. Bertifier remains faithful to Bertin's method while leveraging the power of today's interactive computers. Tables are formatted and manipulated through crossets, a new interaction technique for rapidly applying operations on rows and columns. Bertifier also introduces visual reordering, a semi-interactive reordering approach that lets users apply and tune automatic reordering algorithms in a WYSIWYG manner. We showed in an evaluation that Bertifier has the potential to bring Bertin's method to a wider audience of both technical and non-technical users, and empower them with data analysis and communication tools that were so far only accessible to a handful of specialists.

- Participants: Jean-Daniel Fekete, Charles Perin and Pierre Dragicevic
- Partner: Université Paris-Sud
- Contact: Jean-Daniel Fekete
- URL: http://www.bertifier.com

6.2. CENDARI Note-Taking-Environment

SCIENTIFIC DESCRIPTION

CENDARI (http://www.aviz.fr/Research/CENDARI) Is a European Infrastructure project funded by the EU for 4 years: 2012-2016. Aviz is in charge of the Human-Computer Interface for the project, and develops a tool to allow historians and archivists to take notes, enter them online, manage their images in relations with the notes and documents, and visualize the entities they find in the documents and notes. This system is an extension of the original EditorsNotes project, integrating several innovative components asked by the historians: visualizations, relations with the Semantic Web, and a management of access rights respecting the researchers' desire of privacy for their notes, as well as desire of sharing entities and relations gathered throught the notes and documents.

FUNCTIONAL DESCRIPTION

The Note-Taking-Environment [25] is an open-source, web-based tool for recording, organizing, preserving, and opening access to research notes, built with the needs of documentary editing projects, archives, and library special collections in mind.

- Participants: Evanthia Dimara, Nadia Boukhelifa Sari Ali, Emmanouil Giannisakis, and Jean-Daniel Fekete
- Contact: Jean-Daniel Fekete
- URL: https://github.com/CENDARI/editorsnotes

6.3. GraphCoiffure

SCIENTIFIC DESCRIPTION

Node-link infographics are visually very rich and can communicate messages effectively, but can be very difficult to create, often involving a painstaking and artisanal process. We have investigated node-link visualizations for communication, and have explored how to better support their creation. We have developed a set of techniques aimed at improving their creation workflow by bringing more flexibility and power to users, letting them manipulate all aspects of a node-link diagram (layout, visual attributes, etc.) while taking into account the context in which it will appear. We then implemented these techniques in a proof-of-concept prototype called GraphCoiffure, which we designed as an intermediary step between graph drawing/editing software and image authoring applications.

FUNCTIONAL DESCRIPTION

GraphCoiffure [22] is a proof-of-concept prototype designed to bridge the gap between graph editors and image authoring software by supporting graph beautification, i. e., the touching up of a node-link diagram to enhance its communicative power, or to make it conform to a desired aesthetics. GraphCoiffure is not meant to replace graph editors and graph drawing software, but rather to extend them by letting users import and beautify diagrams that have been created in these programs. GraphCoiffure does not itself enhance these diagrams, but it empowers users to do so. Its features include tools for interactive graph manipulation, a CSS-like stylesheet system, and a possibility of using page layout schemas to tailor a diagram for a specific context of use. Unlike graphics editors, it preserves visual mappings and makes it easier for users to make modifications based on the semantics of the graphs and their context of use.

- Participants: Andre Suslik Spritzer, Jeremy Boy, Pierre Dragicevic, Jean-Daniel Fekete, and Carla Maria dal Sasso Freitas
- Contact: Andre Suslik Spritzer

6.4. Hybrid Image Visualisation

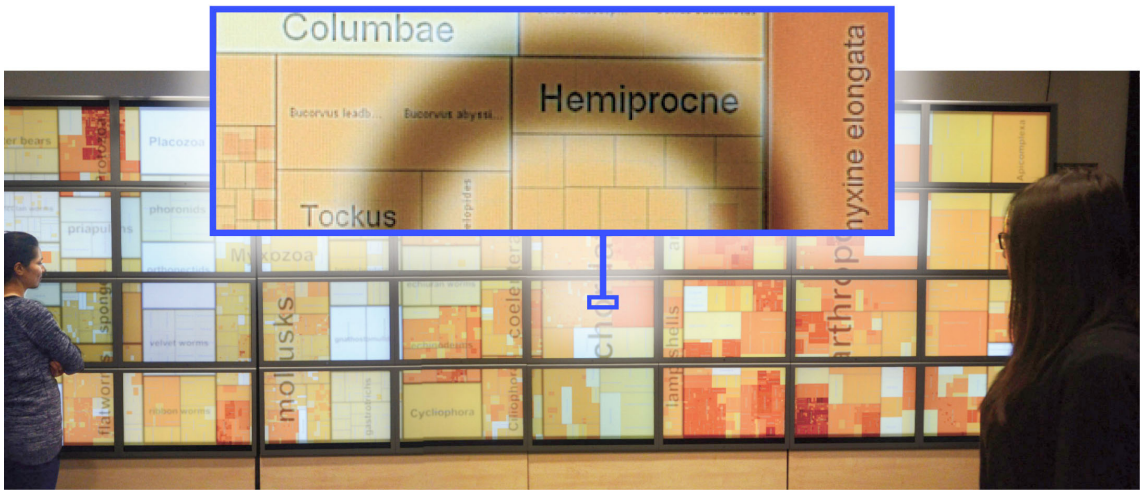

Figure 4. Hybrid image visualization software for the creation of visualizations for distant and close viewing on large displays.

Hybrid-image visualizations blend two different visual representations into a single static view, such that each representation can be perceived at a different viewing distance. Our work is motivated by data analysis scenarios that incorporate one or more displays with sufficiently large size and resolution to be comfortably viewed by different people from various distances. Hybrid-image visualizations can be used, in particular, to enhance overview tasks from a distance and detail-in-context tasks when standing close to the display. By taking advantage of humans' perceptual capabilities, hybrid-image visualizations do not require tracking of viewers in front of a display. Moreover, because hybrid-images use a perception-based blending approach, visualizations intended for different distances can each utilize the entire display. We contribute a design space, discuss the perceptual rationale for our work, provide examples and a set of techniques for hybrid-image visualizations, and describe tools for designing hybrid-image visualizations. An example can be found in Figure 4.

KEYWORDS: Wall-Sized Displays, Perception, Hybrid Images
FUNCTIONAL DESCRIPTION

- Participants: Jean-Daniel Fekete, Petra Isenberg, Pierre Dragicevic, Wesley Willett, Romain Primet.
- Contact: Petra Isenberg
- URL: http://aviz.fr/Research/HybridImageVisualizations

6.5. Small Multipiles

SCIENTIFIC DESCRIPTION

MultiPiles [12] is a visualization to explore time-series of dense, weighted networks (see Figure 5). The interface is based on the physical analogy of piling adjacency matrices, each one representing a single temporal snapshot. Common interfaces for visualizing dynamic networks use techniques such as: flipping/animation; small multiples; or summary views in isolation. Our proposed 'piling' metaphor presents a hybrid of these techniques, leveraging each one's advantages, as well as offering the ability to scale to networks with hundreds of temporal snapshots. While MultiPiles is applicable to many domains, our prototype was initially designed to help neuroscientists investigate changes in brain connectivity networks over several hundred snapshots. The piling metaphor and associated interaction and visual encodings allowed neuroscientists to explore their data,

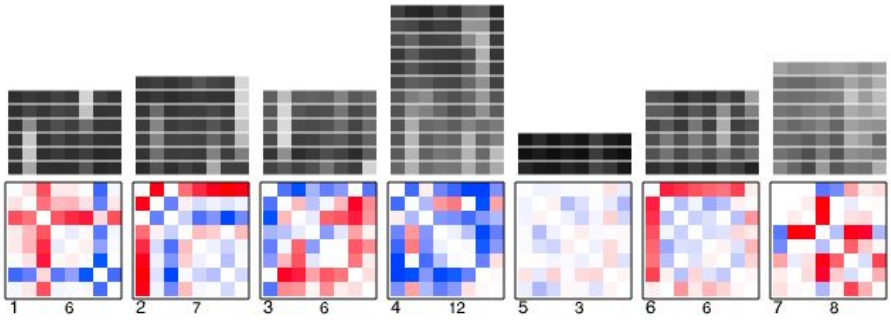

Figure 5. Small Multipiles is software for visualizing temporal networks such as for brain connectivity analysis.

prior to a statistical analysis. They detected high-level temporal patterns in individual networks and this helped them to formulate and reject several hypotheses.

FUNCTIONAL DESCRIPTION

MultiPiles is a visualization interface for the exploration of dense dynamic networks with changing edge weights. Dynamic networks are networks which change topology over time and/or edge weights change over time.

- Participants: Benjamin Bach, Nathalie Henry-Riche, Tim Dwyer, Tara Madhyastha, Jean-Daniel Fekete, Thomas Grabowski
- Contact: Benjamin Bach
- URL: http://visualizingbrainconnectivity.org/multipiles

6.6. Network Cube

SCIENTIFIC DESCRIPTION

Network visualizations support research in a range of scientific domains from biology to humanities. We created a platform to bridge the gap between domain scientists and visualisation researchers; NetworkCube [43] aims in being a fast way to deploy experimental visualizations from research to domain experts analyzing dynamic networks. In turn, InfoVis researchers benefit from studying how their visualizations are used in the wild.

FUNCTIONAL DESCRIPTION

NetworkCube is implemented in Java and JavaScript and will be available shortly online.

- Participants: Benjamin Bach, Nathalie Henry Riche, Roland Fernandez, Emmanoulis Giannisakis, Bongshin Lee, Jean-Daniel Fekete
- Contact: Benjamin Bach

6.7. Time Curves

SCIENTIFIC DESCRIPTION

Time curves [13], as seen in Figure 6, are a general approach for visualizing patterns of evolution in temporal data. Examples of such patterns include slow and regular progressions, large sudden changes, and reversals to previous states. These patterns can be of interest in a range of domains, such as collaborative document editing, dynamic network analysis, and video analysis. Time curves employ the metaphor of folding a timeline visualization into itself so as to bring similar time points close to each other. This metaphor can be applied to any dataset where a similarity metric between temporal snapshots can be defined, thus it is largely datatype-agnostic. We illustrate how time curves can visually reveal informative patterns in a range of different datasets.

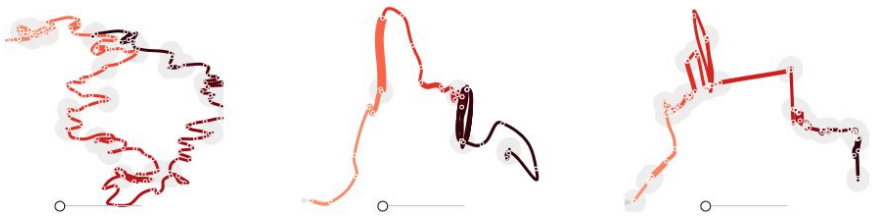

Figure 6. Time Curves is software for visualizing the evolution of patterns in temporal data.

FUNCTIONAL DESCRIPTION

Time Curves are implemented in Java and JavaScript.

- Participants: Benjamin Bach, Conglei Shi, Nicolas Heulot, Tara Madhyastha, Tom Grabowski, Pierre Dragicevic
- Contact: Benjamin Bach
- URL: http://www.aviz.fr/~bbach/timecurves/

6.8. SmartTokens

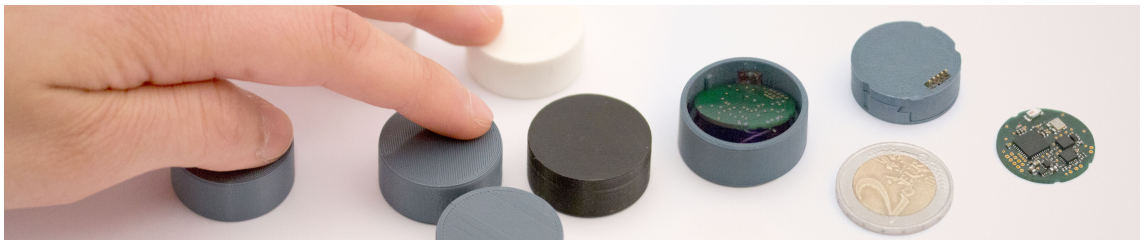

Figure 7. SmartTokens are small-sized tokens supporting touch and motion sensing, and wireless communication with a coordinator.

SCIENTIFIC DESCRIPTION

SmartTokens are small-sized tangible tokens that can sense multiple types of motion, multiple types of touch/grip, and send input events wirelessly as state-machine transitions. By providing an open platform for embedding basic sensing capabilities within small form-factors, SmartTokens extend the design space of tangible user interfaces. We describe the design and implementation of SmartTokens and illustrate how they can be used in practice by introducing a novel TUI design for event notification and personal task management.

FUNCTIONAL DESCRIPTION

SmartTokens are simple and cost-effective, but smart enough to be used as handles for digital information. SmartTokens allow to make generic, scalable and affordable user interfaces. They embed custom electronics, including touch and motion sensors as well as wireless communication functionalities.

- Participants: Mathieu Le Goc, Pierre Dragicevic, Samuel Huron, Jeremy Boy, Jean-Daniel Fekete
- Contact: Mathieu Le Goc
- URL: http://www.aviz.fr/smarttokens

6.9. Sparklificator

FUNCTIONAL DESCRIPTION

Sparklificator is a general open-source jQuery library that eases the process of integrating word-scale visualizations into HTML documents. It provides a range of options for adjusting the position (on top, to the right, as an overlay), size, and spacing of visualizations within the text. The library includes default visualizations, including small line and bar charts, and can also be used to integrate custom word-scale visualizations created using web-based visualization toolkits such as D3.

- Participants: Pascal Goffin, Wesley Willett and Petra Isenberg
- Contact: Jean-Daniel Fekete
- URL: http://inria.github.io/sparklificator/

7. New Results

7.1. Design Considerations for Composite Physical Visualizations

Participants: Mathieu Le Goc [correspondant], Pierre Dragicevic, Samuel Huron, Jean-Daniel Fekete.

Physical visualization has existed for thousands of years, yet the Information Visualization community is just starting to study it. Many current physical visualizations are monolithic, static, and not interactive. Some of them are made of multiple individual objects that can be rearranged in order to represent a variety of informative configurations. We call them composite physical visualizations. A major benefit of such visualizations is that they support modularity and updatability, but their design space is not well understood.

We show [29] that composite physical visualizations can be classified according to two orthogonal dimensions: i) their level of actuation and ii) their manipulability. Among existing systems, some have a high manipulability but no support for actuation, while others are fully actuated but not manipulable. Only a few systems are combining both qualities and none supports both full manipulability and full actuation. We discuss the tradeoffs between these two dimensions, and identify the opportunities and challenges for future research and design.

7.2. Design Considerations for Enhancing Word-Scale Visualizations with Interaction

Participants: Pascal Goffin, Wesley Willett, Jean-Daniel Fekete, Petra Isenberg.

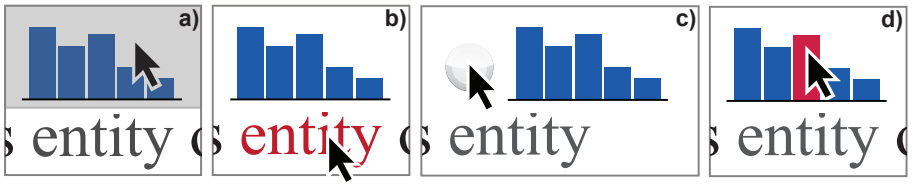

Figure 8. Illustration of where interaction can take place in the context of word-scale visualizations.

This paper presents a design space for interaction with word-scale visualizations. Most sparklines and word-scale visualizations are static and do not support any interaction. However, when word-scale visualizations are used in digital environments, interaction can enhance their use by allowing various data manipulation and management operations. Our design space covers where (Figure 8), when, and how interaction can be triggered for word-scale visualizations embedded in a text document. It also includes how and when to transition from a view where the text with word-scale visualizations is the focus (document-centric view) to a view in which the visualizations becomes the reading focus (visualization-centric view).

7.3. Drawing Characteristics for Reproducing Traditional Hand-Made Stippling

Participants: Domingo Martín, Vicente Del Sol, Celia Romo, Tobias Isenberg [correspondant].

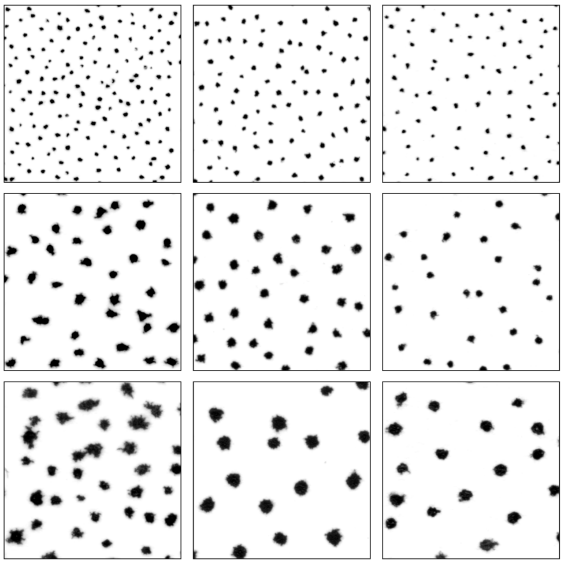

Figure 9. Samples from the stipple dot experiments.

We contribute an in-depth analysis of the characteristics of traditional stippling and relate these to common practices in NPAR stippling techniques as well as to the abilities and limitations of existing printing and display technology. We focus specifically on the properties of stipple dots and consider the dimensions and attributes of pens and paper types used in artistic practice (see Figure 9). With our analysis we work toward an understanding of the requirements for digital stippling, with the ultimate goal to provide tools to artists and illustrators that can replicate the stippling process faithfully in the digital domain. From the results of our study we provide a dataset for use in new example-based stippling techniques, derive a taxonomy of characteristics and conditions for the reproduction of stippling, and define future directions of work.

More on the project Web page: http://tobias.isenberg.cc/VideosAndDemos/Martin2015DCR.

7.4. Evaluation of an IEC Framework for Guided Visual Search

Participants: Nadia Boukhelifa [correspondant], Anastasia Bezerianos, Waldo Cancino, Evelyne Lutton.

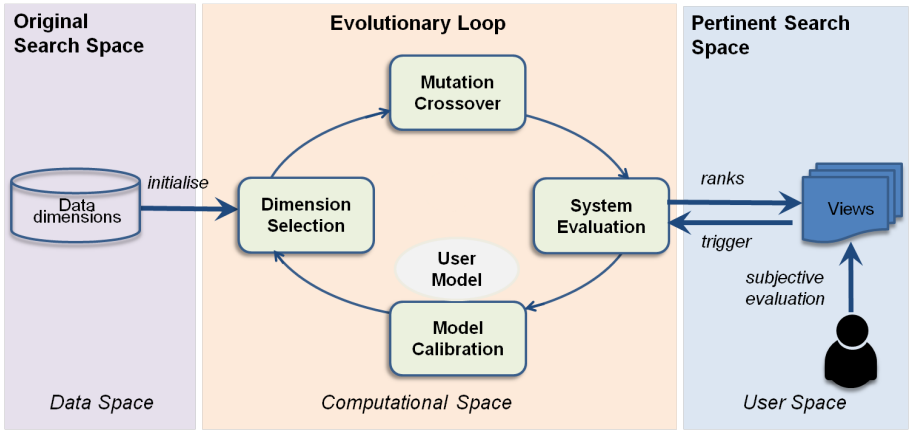

Figure 10. Illustration of the evolutionary visual exploration framework.

We evaluated and analysed a framework for Evolutionary Visual Exploration (EVE) [14] (Figure 10) that guides users in exploring large search spaces. EVE uses an interactive evolutionary algorithm to steer the exploration of multidimensional datasets towards two dimensional projections that are interesting to the analyst. This method smoothly combines automatically calculated metrics and user input in order to propose pertinent views to the user. We revisited this framework and a prototype application that was developed as a demonstrator, and summarized our previous study with domain experts and its main findings. We then reported on results from a new user study with a clear predefined task that examined how users leveragde the system and how the system evolved to match their needs.

While previously we showed that using EVE, domain experts were able to formulate interesting hypotheses and reach new insights when exploring freely, the new findings indicated that users, guided by the interactive evolutionary algorithm, were able to converge quickly to an interesting view of their data when a clear task was specified. We provided a detailed analysis of how users interact with an evolutionary algorithm and how the system responded to their exploration strategies and evaluation patterns. This line of work aims at building a bridge between the domains of visual analytics and interactive evolution. The benefits are numerous, in particular for evaluating Interactive Evolutionary Computation (IEC) techniques based on user study methodologies.

Next, we summarized and reflected upon our experience in evaluating our guided exploratory visualization system [35]. This system guided users in their exploration of multidimensional datasets to pertinent views of their data, where the notion of pertinence is defined by automatic indicators, such as the amount of visual patterns in the view, and subjective user feedback obtained during their interaction with the tool. To evaluate this type of system, we argued for deploying a collection of validation methods that are: user-centered, observing the utility and effectiveness of the system for the end-user; and algorithm-centered, analysing the computational behaviour of the system. We reported on observations and lessons learnt from working with expert users both for the design and the evaluation of our system.

More on the project Web page: http://www.aviz.fr/EVEhttp://www.aviz.fr/EVE.

7.5. Exploring the Effect of Word-Scale Visualizations on Reading Behavior

Participants: Pascal Goffin, Wesley Willett, Anastasia Bezerianos, Petra Isenberg.

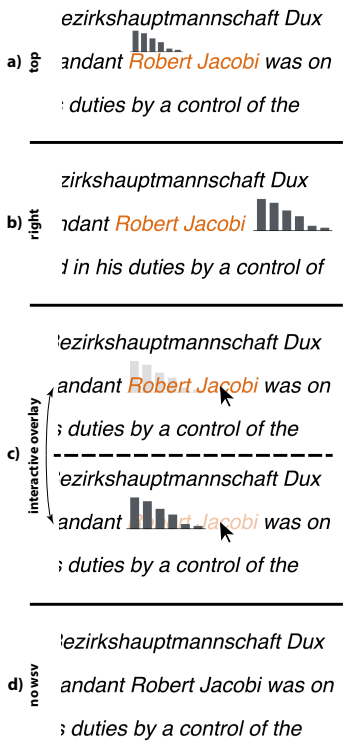

Figure 11. Illustration of the study conditions.

We studied how the integration of small visualizations (word-scale visualizations) into a sentence affects reading speed and memorization during a brief reading task. In particular, we were interested in how different placement types—with their inherent text appearance and layout changes—affect readers. We designed a quantitative study in which we gave sentences with or without small visualizations for participants to read (study conditions are shows in Figure 11). Then, we invited them to answer questions on the sentences. We found that the information encoded in the visualizations is more prominent and easily remembered than information in the written text, but that different placement options had little to no effect on reading performance, even if participants had different preferences.

7.6. Exploration of the Brain's White Matter Structure through Visual Abstraction and Multi-Scale Local Fiber Tract Contraction

Participants: Maarten H. Everts, Eric Begue, Henk Bekker, Jos B. T. M. Roerdink, Tobias Isenberg [correspondant].

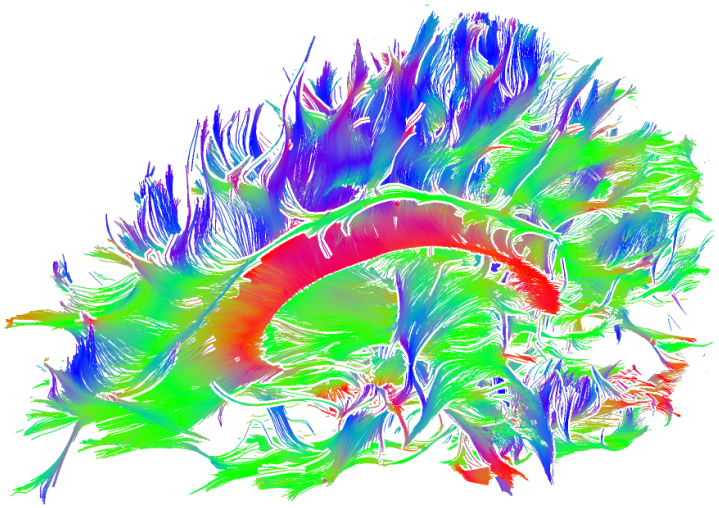

Figure 12. Contraction of the white matter fiber tracts in the brain.

We developed a visualization technique for brain fiber tracts from DTI data that provides insight into the structure of white matter through visual abstraction. We achieve this abstraction by analyzing the local similarity of tract segment directions at different scales using a stepwise increase of the search range. Next, locally similar tract segments are moved toward each other in an iterative process, resulting in a local contraction of tracts perpendicular to the local tract direction at a given scale. This not only leads to the abstraction of the global structure of the white matter as represented by the tracts, but also creates volumetric voids (see Figure 12). This increase of empty space decreases the mutual occlusion of tracts and, consequently, results in a better understanding of the brain's three-dimensional fiber tract structure. Our implementation supports an interactive and continuous transition between the original and the abstracted representations via various scale levels of similarity. We also support the selection of groups of tracts, which are highlighted and rendered with the abstracted visualization as context.

More on the project Web page: http://tobias.isenberg.cc/VideosAndDemos/Everts2015EBW.

7.7. Interactive Illustrative Line Styles and Line Style Transfer Functions for Flow Visualization

Participants: Maarten H. Everts, Henk Bekker, Jos B. T. M. Roerdink, Tobias Isenberg [correspondant].

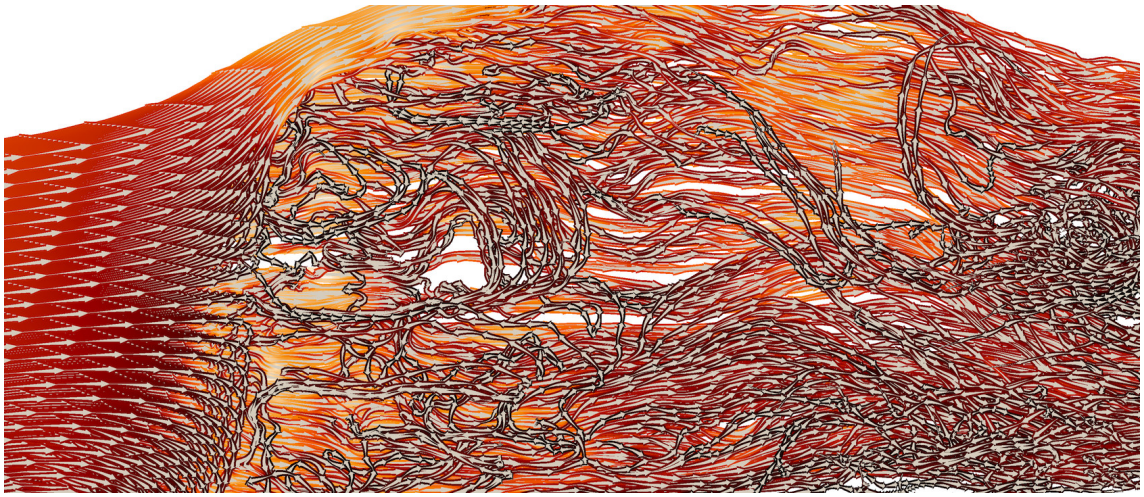

Figure 13. Illustrative line styles applied to streamline visualization of a complex 3D flow.

We present a flexible illustrative line style model for the visualization of streamline data. Our model partitions view-oriented line strips into parallel bands whose basic visual properties can be controlled independently. We thus extend previous line stylization techniques specifically for visualization purposes by allowing the parametrization of these bands based on the local line data attributes. Moreover, our approach supports emphasis and abstraction by introducing line style transfer functions that map local line attribute values to complete line styles. With a flexible GPU implementation of this line style model we enable the interactive exploration of visual representations of streamlines. We demonstrate the effectiveness of our model by applying it to 3D flow field datasets (see Figure 13).

More on the project Web page: http://tobias.isenberg.cc/VideosAndDemos/Everts2015IIL.

7.8. Research Agenda for Data Physicalization

Participants: Yvonne Jansen, Pierre Dragicevic [correspondant], Petra Isenberg, Jason Alexander, Abhijit Karnik, Johan Kildal, Sriram Subramanian, Kasper Hornbæk.

Physical representations of data have existed for thousands of years. Yet it is now that advances in digital fabrication, actuated tangible interfaces, and shape-changing displays are spurring an emerging area of research that we call Data Physicalization. It aims to help people explore, understand, and communicate data using computer-supported physical data representations. We call these representations physicalizations, analogously to visualizations – their purely visual counterpart. We joined our efforts with research teams from Europe and published a research agenda where we go beyond the focused research questions addressed so far by delineating the research area, synthesizing its open challenges and laying out opportunities for future work. Examples can be seen in Figure 14.

More on the Data Physicalization Wiki: dataphys.org/.

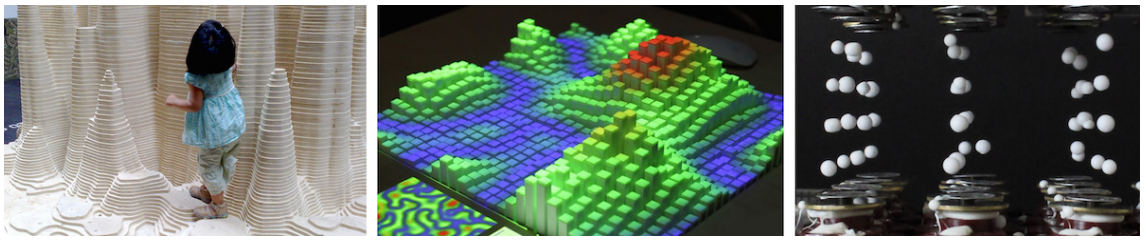

Figure 14. Three examples of data physicalizations.

7.9. Storytelling and Engagement

Participants: Jeremy Boy, Jean-Daniel Fekete, Françoise Detienne.

We conducted three web-based field experiments, in which we evaluated the impact of using initial narrative visualization techniques and storytelling on user-engagement with exploratory information visualizations. We conducted these experiments on a popular news and opinion outle, and on a popular visualization gallery website. While data journalism exposes visualizations to a large public, we do not know how effectively this public makes sense of interactive graphics, and in particular if people explore them to gain additional insight to that provided by the journalists. In contrast to our hypotheses, our results indicated that augmenting exploratory visualizations with introductory 'stories' does not seem to increase user-engagement in exploration.

Many online data graphics use narrative design elements to explain a given dataset in a straightforward and compelling way. According to New York Times graphic editors Mike Bostock and Shan Carter, these explanatory graphics are preferable for data-journalism, as they have the advantage of exposing up-front what the main insights from the data are, without making people ''have to work for them." However, most only provide limited interactivity, which reduces the potential for personal extraction of insight. In essence and by definition, Information visualization (Infovis) is interactive and exploratory. Thus, finding ways to make exploratory graphics more accessible and engaging to people is important, because if open/public/civic data is to truly empower people, then these people should be able to use appropriate tools to gain their own insights and knowledge—not only that provided by journalists in articles written or designed from a specific perspective. We explored the potential of narrative visualization techniques and storytelling to trigger this desired user-engagement. By engagement, we specifically mean a user's investment in the exploration of a visualization.

8. Partnerships and Cooperations

8.1. National Initiatives

8.1.1. ANR FITOC: From Individual To Collaborative Visual Analytics

Participants: Petra Isenberg [correspondant], Jean-Daniel Fekete, Pierre Dragicevic, Pascal Goffin.

The project addresses fundamental problems of technological infrastructure and the design of data representation and interaction to build a bridge between individual and team work for visual data analysis. In collaboration with the University of Magdeburg we have begun to tackle this challenge through the design of tangible widgets that help to bridge the gap between individual and collaborative information seeking.

8.1.2. ANR EASEA-Cloud

Participants: Evelyne Lutton [correspondant], Waldo Cancino, Hugo Gilbert, Pierre Collet.

The aim of the EASEA-CLOUD project is to exploit the massively parallel resources that are offered by clusters or a grid of modern GPU-equipped machines in order to find solutions to inverse problems whose evaluation function can be intrinsically sequential. Massive parallelization of generic sequential problems can be achieved by evolutionary computation, that can efficiently exploit the parallel evaluation of thousands of potential solutions (a population) for optimization or machine-learning purposes. The project consists in turning the existing EASEA (EAsy Specification of Evolutionary Algorithms, http://easea.unistra.fr/) research platform into an industrial-grade platform that could be exploited by running in "cloud" mode, on a large grid of computers (ISC-PIF/CREA is the current manager of the French National Grid). The necessary steps are to develop:

- a professional-grade API, development environment and human-computer interface for the existing academic EASEA platform,
- cloud-management tools (in order to launch an experiment on a grid of computers, monitor the experiment and bill the laboratories or companies that will be using EASEA-CLOUD for intensive computation,
- novel visualisation tools, in order to monitor an evolutionary run, potentially launched on several hundred heterogeneous GPU machines.

The consortium is made of thee partners: LSIIT/UDS (which is developing the EASEA platform), ISCPIR/CREA (for its experience in grid and cloud computing), AVIZ/Inria (for its experience in visualization tools for evolutionary computation) and two subcontractors: LogXLabs (a software development company in order to create industrial-grade code and interfaces) an BIOEMERGENCE-IMAGIF, the "valorisation" department of CNRS Gif s/Yvette. Valorisation will take place in strong collaboration with UNISTRA VALO, the valorisation structure of Université de Strasbourg. The project started on October 1st, 2012, for 2 years. AVIZ is in charge of developing new visualisation tools adapted to the monitoring of the optimization process.

8.2. European Initiatives

8.2.1. FP7 & H2020 Projects

8.2.1.1. CENDARI

Title: Collaborative EuropeaN Digital/Archival Infrastructure

Programm: FP7

Duration: February 2012 - January 2016

Coordinator: Trinity College - Dublin

Partners:

Consortium of European Research Libraries (United Kingdom)

Koninklijke Bibliotheek (Netherlands)

Fondazione Ezio Franceschini Onlus (Italy)

Freie Universitaet Berlin (Germany)

King's College London (United Kingdom)

"matematicki Institutnu, Beograd" (Serbia)

Narodni Knihovna Ceske Republiky (Czech Republic)

Societa Internazionale Per Lo Studio Del Medioevo Latino-S.I.S.M.E.L.Associazione (Italy)

The Provost Fellows & Scholars of The College of The Holy and Undivided Trinity of Queen Elizabeth Near Dublin (Ireland)

Georg-August-Universitaet Goettingen Stiftung Oeffentlichen Rechts (Germany)

Universitaet Stuttgart (Germany)

The University of Birmingham (United Kingdom)

Universita Degli Studi di Cassino E Del Lazio Meridionale (Italy)

Inria contact: Jean-Daniel Fekete & Lauerent Romary

'The Collaborative EuropeaN Digital Archive Infrastructure (CENDARI) will provide and facilitate access to existing archives and resources in Europe for the study of medieval and modern European history through the development of an 'enquiry environment'. This environment will increase access to records of historic importance across the European Research Area, creating a powerful new platform for accessing and investigating historical data in a transnational fashion overcoming the national and institutional data silos that now exist. It will leverage the power of the European infrastructure for Digital Humanities (DARIAH) bringing these technical experts together with leading historians and existing research infrastructures (archives, libraries and individual digital projects) within a programme of technical research informed by cutting edge reflection on the impact of the digital age on scholarly practice. The enquiry environment that is at the heart of this proposal will create new ways to discover meaning, a methodology not just of scale but of kind. It will create tools and workspaces that allow researchers to engage with large data sets via federated multilingual searches across heterogeneous resources while defining workflows enabling the creation of personalized research environments, shared research and teaching spaces, and annotation trails, amongst other features. This will be facilitated by multilingual authority lists of named entities (people, places, events) that will harness user involvement to add intelligence to the system. Moreover, it will develop new visual paradigms for the exploration of patterns generated by the system, from knowledge transfer and dissemination, to language usage and shifts, to the advancement and diffusion of ideas.'

8.2.2. Collaborations with Major European Organizations

We collaborate with several larger european research organizations, such as:

Fraunhofer Institute, IGD (DE)

We are collaborating on visual analytics, setting up European projects and coordinating European initiatives on the subject.

University of Stuttgart, Visualization Center (DE)

We are collaborating on the development of a comprehensive visualization publication dataset

Technical University of Vienna, Visualization Research Group (AT)

We are collaborating on a project to derive major visualization domain keywords and collaborating on projects and workshops related to the evaluation of visualization.

8.3. International Initiatives

8.3.1. Inria International Partners

8.3.1.1. Declared Inria International Partners

- We hosted a visiting PhD student as part of the Inria-Mitacs collaboration.
- AVIZ collaborates with several researchers from Microsoft Research Redmond, in particular on the topic of new interactions for information visualization and brain connectivity visualization.

8.3.1.2. Informal International Partners

- Arizona State University, USA
- University of Groningen, the Netherlands
- University of Granada, Spain
- New York University, USA
- Harvard University, USA

- Google, USA

8.4. International Research Visitors

8.4.1. Visits of International Scientists

- Teresa Onorati, PostDoc at the University of Madrid visited us for three months.

8.4.1.1. Internships

- Paul Lapides and Alice Thudt visited from the University of Calgary, Canada.

8.4.2. Visits to International Teams

8.4.2.1. Sabbatical programme

Fekete Jean-Daniel

Date: Jan 2015 - Dec 2015

Institution: NYU (United States) and Harvard University (United States)

9. Dissemination

9.1. Promoting Scientific Activities

9.1.1. Scientific events organisation

9.1.1.1. General chair, scientific chair

- Petra Isenberg and Tobias Isenberg co-chaired the Workshop on Data Exploration for Interactive Surfaces at ITS (DEXIS)

9.1.1.2. Member of the organizing committees

- Petra Isenberg was IEEE VIS VisKids co-chair
- Tobias Isenberg was IEEE VIS exhibits co-chair
- Pierre Dragicevic was IEEE VIS panels co-chair

9.1.2. Scientific events selection

9.1.2.1. Member of the conference program committees

- ACM Conference on Human Factors in Computing Systems – Work In Progress: Samuel Huron
- ACM/Eurographics Expressive: Tobias Isenberg
- ACM Symposium on Spatial User Interfaces (SUI): Tobias Isenberg
- ACM Tabletop and Interactive Surfaces: Petra Isenberg, Tobias Isenberg
- Eurographics Visual Analytics Workshop (EuroVA): Nadia Boukhelifa
- Eurographics/VGTC Conference on Visualization (EuroVis) Short Papers: Tobias Isenberg
- IEEE 3D User Interfaces (3DUI): Tobias Isenberg
- IEEE Information Visualization (InfoVis): Pierre Dragicevic, Tobias Isenberg, Jean-Daniel Fekete
- IEEE Scientific Visualization (SciVis): Tobias Isenberg
- IEEE VIS Art Show (VISAP): Samuel Huron, Tobias Isenberg

9.1.2.2. Reviewer

- 3DUI: IEEE Symposium on 3D User Interfaces: Tobias Isenberg
- CHI: ACM Conference on Human Factors in Computing System: Nadia Boukhelifa, Jeremy Boy, Pierre Dragicevic, Pascal Goffin, Samuel Huron, Mathieu LeGoc, Petra Isenberg, Tobias Isenberg, Jean-Daniel Fekete

- EXPRESSIVE: The Joint Symposium on Computational Aesthetics and Sketch-Based Interfaces and Modeling and Non-Photorealistic Animation and Rendering: Tobias Isenberg
- EUROVA: EuroVis Workshop on Visual Analytics: Nadia Boukhelifa
- EUROVIS: Eurographics/IEEE Conference on Visualization: Tobias Isenberg, Jean-Daniel Fekete
- GI: Graphics Interface: Samuel Huron
- IHM: Conférence Francophone sur l'Interaction Homme-Machine: Pierre Dragicevic
- INFOVIS: IEEE Information Visualization Conference: Nadia Boukhelifa, Pierre Dragicevic, Pascal Goffin, Tobias Isenberg
- INTERACT: IFIP Conference on Human-Computer Interaction: Pierre Dragicevic
- ITS: ACM Conference on Interactive Tabletops and Surfaces: Jeremy Boy, Petra Isenberg, Tobias Isenberg
- IUI: Intelligent User Interfaces: Tobias Isenberg
- MOBILEHCI: International Conference on Human-Computer Interaction with Mobile Devices and Services: Pierre Dragicevic
- PACIFICVIS: IEEE Pacific Visualization Symposium: Nadia Boukhelifa
- SCCG: Spring Conference on Computer Graphics: Tobias Isenberg
- SCIVIS: IEEE Scientific Visualization Conference: Tobias Isenberg
- SIGGRAPH: ACM Conference on Computer Graphics and Interactive Techniques: Tobias Isenberg
- SIGGRAPH ASIA: ACM Conference on Computer Graphics and Interactive Techniques in Asia: Tobias Isenberg
- SUI: ACM Symposium on Spatial User Interaction: Tobias Isenberg
- TEI: Tangible, Embedded and Embodied Interaction: Mathieu LeGoc
- UIST: ACM Symposium on User Interface Software and Technology: Pierre Dragicevic
- VAST: IEEE Visual Analytics Science and Technology: Nadia Boukhelifa
- VISAP: IEEE Visualization Arts Program: Petra Isenberg, Tobias Isenberg
- VR: IEEE Virtual Reality: Tobias Isenberg

9.1.3. Journal

9.1.3.1. Member of the editorial boards

- Jean-Daniel Fekete was Associate Editor of IEEE Transactions on Visualization and Computer Graphics.
- Petra Isenberg was a guest editor of a special issue of Sage Publishing's Information Visualization on selected papers from BELIV 2014.
- Tobias Isenberg is associate editor of Elsevier Computers & Graphics.
- Tobias Isenberg was a guest editor of a special issue of Sage Publishing's Information Visualization on selected papers from BELIV 2014.

9.1.3.2. Reviewer - Reviewing activities

- Applied Mathematical Modeling: Tobias Isenberg
- Book review for Morgan Claypool Publishers: Petra Isenberg
- C&G: Computers & Graphics Journal: Nadia Boukhelifa, Tobias Isenberg
- JCSCW: Journal on Computer Supported Cooperative Work: Petra Isenberg
- Information Visualization Journal: Tobias Isenberg
- SCC: Spatial Cognition Computational Journal: Nadia Boukhelifa
- TVCG: IEEE Transactions on Visualization and Computer Graphics: Jeremy Boy, Tobias Isenberg

9.1.4. Invited talks

- Jean-Daniel Fekete: Invited Talk, MIT, “Visualizing Large and Dense Graphs”, Dec. 2nd, 2015
- Jean-Daniel Fekete: Invited Talk, Brown University, “ProgressiVis: a New Workflow Model for Scalability in Information Visualization”, Nov. 4. 2015
- Jean-Daniel Fekete: Invited Talk, Columbia University, “Visualizing Large and Dense Networks”, Sep. 18th, 2015
- Jean-Daniel Fekete: Invited Talk, IBM Watson Research Center, “ProgressiVis: a New Workflow Model for Scalability in Information Visualization”, Sep. 17. 2015
- Jean-Daniel Fekete: Invited Talk, Center for Data Science, New York University, “ProgressiVis: a New Workflow Model for Scalability in Information Visualization”, Sep. 14, 2015
- Jean-Daniel Fekete: Invited Talk, University of Maryland, “Visualization for the People: Where Are We Now”, Sep. 10th, 2015
- Jean-Daniel Fekete: Invited Talk, CANVAS Summer School, Toronto,“Visualization for the People: Where Are We Now”, Jul. 2015
- Jean-Daniel Fekete: Invited Talk, Microsoft Research Redmond, “Visualization for the People: Where Are We Now”, Tuesday, Jun. 9, 2015
- Jean-Daniel Fekete: Invited Talk, Tableau Software, “Matrix-Based Visualization”, Monday, Jun. 8. 2015
- Jean-Daniel Fekete: The Visualization Distinguished Lecture Series, Georgia Tech “Visualization for the People: Where Are We Now”, Friday, Apr. 10, 2015
- Jeremy Boy: Invited talk at Harvard, December 1, 2015 on “Towards Enabling Casual-Users to Engage in Data Exploration Using Information Visualization Interfaces”.
- Pierre Dragicevic: “Recent and Future Information Visualization Research at Inria / Aviz”. Guest lecture at HIIT Finland, 4 March 2015.
- Pierre Dragicevic: “Introduction aux nouvelles statistiques pour l’IHM”. Rencontre Jeunes Chercheurs en Interaction Homme-Machine (RJC IHM 2015), Oléron, 1 June 2015.
- Pierre Dragicevic: “How to Adopt the New Statistics in HCI”. Doctoral Colloquium HCI Group Univ Munich, Venice, 6 October 2015.
- Pierre Dragicevic: “Overview of Temporal Data Visualization Approaches”. 3ème journée ESSTE INRA – Visualisation des données spatio-temporelles et méthodes, Agro ParisTech, 27 November 2015.
- Petra Isenberg: keynote at the 2015 CANVAS summer school, Toronto, Canada on “Novel Display Technology for Visual Analytics”.
- Tobias Isenberg: ““Touching” the Third Dimension—Exploration of Scientific Data on Surfaces”. Inria Méditerranée, Sophia Antipolis, France, Sep. 28, 2015.
- Tobias Isenberg: “Illustrative Visualization for Molecular Data”. Keynote, conference of the thematic groups “Enzymes” and “Graphics and Molecular Modeling” of the Société Française de Biophysique, Sète, France, May 28 2015
- Tobias Isenberg: “Abstraction in Non-Photorealistic Rendering and Illustrative Visualizations.”. Hasso Plattner Institute Potsdam, Germany, Apr. 30, 2015
- Romain di Vozzo: “How to create a fablab?” Institut Supérieur des Etudes Techniques de Sousse. Sousse, Tunisia.

9.1.5. Leadership within the scientific community

- Jean-Daniel Fekete is a member of the Visualization Executive Committee of the IEEE VIS Conference

- Jean-Daniel Fekete is the chair of the Steering Committee of the IEEE Information Visualization Conference
- Jean-Daniel Fekete is a member of the Steering Committee of the EuroVis Conference
- Tobias Isenberg is a member of the Steering Committee of the Expressive conference.
- Tobias Isenberg is a Member of the Executive Committee of the Visualization and Computer Graphics Technical Committee of the IEEE Computer Society (Publications Chair).

9.2. Teaching - Supervision - Juries

9.2.1. Teaching

Aviz members were involved in teaching the following lectures at the Masters or PhD level:

Jean-Daniel Fekete: *Information Visualization*, course on Interaction, 2h, Harvard, USA

Jean-Daniel Fekete: *Information Visualization*, course on Interaction, 2h, NYU-Poly, USA

Petra Isenberg, Pierre Dragicevic, *Visual Analytics*, Ecole Centrale, Paris, France

Pierre Dragicevic, Jean-Daniel Fekete, Lonni Besancon, Nadia Boukhelifa, Tobias Isenberg, *Information Visualization*, Université Paris Sud, France

Tobias Isenberg, *Non-Photorealistic Rendering*, University of Granada, Spain

Tobias Isenberg, *Interaction with 3D visualizations*, Tobias Isenberg at the CANVAS summer school in data analytics, visual analytics, and visualization in Toronto, Canada

Romain di Vozzo: *Digital Fabrication* 24h, HCID Master, Université Paris Sud, France

Aviz members were involved in teaching the following tutorials at international scientific conferences to students, data analysis specialists, and academics:

Tutorial on *Tools & Techniques for Direct Volume Interaction* co-taught by Tobias Isenberg at IEEE Visualization 2015

Tutorial on *Tools & Techniques for Direct Volume Interaction* co-taught by Tobias Isenberg at Eurographics 2015

9.2.2. Supervision

PhD in progress: Lonni Besançon, An Interaction Continuum for Scientific Visualization, Université Paris-Sud, 2014, Tobias Isenberg and Mehdi Ammi

PhD in progress: Evanthia Dimara, Information Visualization for Decision Making, Université Paris-Sud, 2014, Pierre Dragicevic, Anastasia Bezerianos and Jean-Daniel Fekete

PhD in progress: Pascal Goffin, From Individual to Collaborative Work, Université Paris-Sud, 2013, Petra Isenberg and Jean-Daniel Fekete

PhD in progress: Mathieu Le Goc, Dynamic and Interactive Physical Visualization, Université Paris-Sud, 2013, Pierre Dragicevic and Jean-Daniel Fekete

9.2.3. Juries

Jean-Daniel Fekete: PhD committee of Jorge Poco Medina, "Visual Intercomparison of Multifaceted Climate Data", NYU-Poly, June 2015

Jean-Daniel Fekete: Nivan Ferreira, "Visual Analytics Techniques For Exploration Of Spatiotemporal Data", NYU-Poly, June 2015

PhD committee: Dr. Emmanuel Iarussi, Computer-Assisted Drawing, Inria Sophia Antipolis, France, September 2015, Tobias Isenberg

PhD committee: Dr. Leïla Schemali, Édition et Visualisation Stéréoscopiques [Interaction with, Editing of, and Visualization of Stereoscopic 3D Objects], Telecom ParisTech, France, January 2015, Tobias Isenberg

Pierre Dragicevic: Commission Scientifique Inria Saclay

Pierre Dragicevic: Commission Consultative de Spécialistes de l'Université Paris-Sud (CCSU)

Pierre Dragicevic: Jury MCF UPSud 0274

Pierre Dragicevic: PhD committee of Bin Yang, Memory island: visualizing hierarchical knowledge as insightful islands, Universite´ Pierre et Marie Curie, 8 June 2015.

Pierre Dragicevic: PhD committee of Azam Khan, Choice & Consequence: Exploratory Data Analysis for Critical Decision Making, University of Copenhagen, 14 Aug 2015.

Pierre Dragicevic: PhD committee of Renaud Gervais, Interaction and introspection with tangible augmented objects, Université de Bordeaux, 9 Dec 2015.

Romain di Vozzo: Fablab projects evaluation. Master Innovation Technologique & Entrepreneuriat. Ecole Polytechnique.

9.3. Popularization

Aviz members have been involved in several popularization activities:

- Romain di Vozzo: invitation of Richard Stallman to give a Digiteo conference on Free Software.
- Jeremy Boy wrote a chapter for "Le kit Serie graphique : Connaître et pratiquer le design graphique au collège" published by Le Centre National des Arts Plastiques (CNAP) .
- Jeremy Boy's *Is the World a Better Place Today* online visualization platform was mentioned in Le Monde http://data.blog.lemonde.fr/2015/10/21/la-journee-de-la-statistique-un-evenement-francais-pas-celebre-en-france/
- Jeremy Boy gave an interview on his *Is the World a Better Place Today* online visualization platform to the NYU News and Publications Department http://engineering.nyu.edu/news/2015/11/23/when-united-nations-puts-call-out-data-pros
- Mathieu Le Goc, Pierre Dragicevic, Samuel Huron, Jeremy Boy, Jean-Daniel Fekete: SmartTokens: Embedding Motion and Grip Sensing in Small Tangible Objects - Extended Material.
- Pierre Dragicevic and Yvonne Jansen: the Curated List of Physical Visualizations is continuously being updated.

10. Bibliography

Major publications by the team in recent years

[1] A. BEZERIANOS, F. CHEVALIER, P. DRAGICEVIC, N. ELMQVIST, J.-D. FEKETE. *GraphDice: A System for Exploring Multivariate Social Networks*, in "Computer Graphics Forum - Eurographics/IEEE-VGTC Symposium on Visualization 2010 (EuroVis 2010)", June 2010, vol. 10, n° 3, pp. 863-872 [*DOI :* 10.1111/J.1467-8659.2009.01687.X], http://hal.inria.fr/inria-00521661

[2] A. BEZERIANOS, P. DRAGICEVIC, J.-D. FEKETE, J. BAE, B. WATSON. *GeneaQuilts: A System for Exploring Large Genealogies*, in "IEEE Transactions on Visualization and Computer Graphics", Nov-Dec 2010, vol. 16, n° 6, pp. 1073–1081, http://doi.ieeecomputersociety.org/10.1109/TVCG.2010.159

[3] F. CHEVALIER, P. DRAGICEVIC, A. BEZERIANOS, J.-D. FEKETE. *Using Text Animated Transitions to Support Navigation in Document Histories*, in "CHI '10: Proceedings of the 28th international conference on Human factors in computing systems", New York, NY, USA, ACM, 2010, pp. 683–692 [*DOI :* 10.1145/1753326.1753427], http://hal.inria.fr/hal-00690289

[4] T. ISENBERG, P. ISENBERG, J. CHEN, M. SEDLMAIR, T. MÖLLER. *A Systematic Review on the Practice of Evaluating Visualization*, in "IEEE Transactions on Visualization and Computer Graphics", December 2013, vol. 19, n° 12, pp. 2818–2827 [*DOI :* 10.1109/TVCG.2013.126], http://tobias.isenberg.cc/VideosAndDemos/Isenberg2013SRP

[5] P. ISENBERG, T. ISENBERG, T. HESSELMANN, B. LEE, U. VON ZADOW, A. TANG. *Data Visualization on Interactive Surfaces: A Research Agenda*, in "IEEE Computer Graphics and Applications", March/April 2013, vol. 33, n° 2, pp. 16–24 [*DOI :* 10.1109/MCG.2013.24], http://tobias.isenberg.cc/VideosAndDemos/Isenberg2013DVI

[6] D. F. KEEFE, T. ISENBERG. *Reimagining the Scientific Visualization Interaction Paradigm*, in "IEEE Computer", May 2013, vol. 46, n° 5, pp. 51–57 [*DOI :* 10.1109/MC.2013.178], http://tobias.isenberg.cc/VideosAndDemos/Keefe2013NIS

[7] H. LAM, E. BERTINI, P. ISENBERG, C. PLAISANT, S. CARPENDALE. *Empirical Studies in Information Visualization: Seven Scenarios*, in "IEEE Transactions on Visualization and Computer Graphics", 2012, vol. 18, n° 9, pp. 1520–1536 [*DOI :* 10.1109/TVCG.2011.279], http://hal.inria.fr/hal-00932606

[8] L. MICALLEF, P. DRAGICEVIC, J.-D. FEKETE. *Assessing the Effect of Visualizations on Bayesian Reasoning Through Crowdsourcing*, in "IEEE Transactions on Visualization and Computer Graphics", December 2012, pp. 2536–2545, http://hal.inria.fr/hal-00717503

[9] L. YU, K. EFSTATHIOU, P. ISENBERG, T. ISENBERG. *Efficient Structure-Aware Selection Techniques for 3D Point Cloud Visualizations with 2DOF Input*, in "IEEE Transactions on Visualization and Computer Graphics", December 2012, vol. 18, n° 12, pp. 2245–2254, Received a Best Paper Honorable Mention Award at IEEE Visualization 2012 [*DOI :* 10.1109/TVCG.2012.217], http://tobias.isenberg.cc/VideosAndDemos/Yu2012ESA

Publications of the year

Doctoral Dissertations and Habilitation Theses

[10] J. BOY. *Engaging the People to Look Beyond the Surface of Online Information Visualizations of Open Data*, Telecom ParisTech, May 2015, https://hal.inria.fr/tel-01225585

[11] *Best Paper*
S. HURON. *Constructive Visualization*, Univeristé Paris-Saclay, September 2015, Samuel Huron received the best thesis award at the IEEE VGTC Vis Pioneer Group Best PhD Dissertation Award for his thesis "Constructive Visualization: A Token-based Paradigm Allowing to Assemble Dynamic Visual Representation for Non-experts", https://hal.inria.fr/tel-01255116.

Articles in International Peer-Reviewed Journals

[12] B. BACH, N. HENRY-RICHE, T. DWYER, T. MADHYASTHA, J.-D. FEKETE, T. GRABOWSKI. *Small MultiPiles: Piling Time to Explore Temporal Patterns in Dynamic Networks*, in "Computer Graphics Forum", 2015 [*DOI :* 10.1111/CGF.12615], https://hal.inria.fr/hal-01158987

[13] B. BACH, C. SHI, N. HEULOT, T. MADHYASTHA, T. GRABOWSKI, P. DRAGICEVIC. *Time Curves: Folding Time to Visualize Patterns of Temporal Evolution in Data*, in "IEEE Transactions on Visualization and

Computer Graphics", January 2016, vol. 22, n° 1 [*DOI :* 10.1109/TVCG.2015.2467851], https://hal.inria.fr/hal-01205821

[14] N. BOUKHELIFA, A. BEZERIANOS, W. CANCINO, E. LUTTON. *Evolutionary Visual Exploration: Evaluation of an IEC Framework for Guided Visual Search*, in "Evolutionary Computation", 2016, forthcoming [*DOI :* 10.1162/EVCO_A_00161], https://hal.inria.fr/hal-01218959

[15] J. BOY, L. EVEILLARD, F. DETIENNE, J.-D. FEKETE. *Suggested Interactivity: Seeking Perceived Affordances for Information Visualization*, in "IEEE Transactions on Visualization and Computer Graphics", January 2016, vol. 22, n° 1, pp. 639-648 [*DOI :* 10.1109/TVCG.2015.2467201], https://hal.inria.fr/hal-01188973

[16] M. EVERTS, E. BEGUE, H. BEKKER, J. B. T. M. ROERDINK, T. ISENBERG. *Exploration of the Brain's White Matter Structure through Visual Abstraction and Multi-Scale Local Fiber Tract Contraction*, in "IEEE Transactions on Visualization and Computer Graphics", July 2015, vol. 21, n° 7, pp. 808–821 [*DOI :* 10.1109/TVCG.2015.2403323], https://hal.inria.fr/hal-01132636

[17] M. H. FOROUZANFAR, L. ALEXANDER, H. R. ANDERSON, V. F. BACHMAN, S. BIRYUKOV, M. BRAUER, R. BURNETT, D. CASEY, M. M. COATES, A. COHEN, K. DELWICHE, K. ESTEP, J. J. FROSTAD, K. C. ASTHA, H. H. KYU, M. MORADI-LAKEH, M. NG, E. L. SLEPAK, B. A. THOMAS, J. WAGNER, G. M. AASVANG, C. ABBAFATI, A. ABBASOGLU OZGOREN, F. ABD-ALLAH, S. F. ABERA, V. ABOYANS, B. ABRAHAM, J. P. ABRAHAM, I. ABUBAKAR, N. M. E. ABU-RMEILEH, T. C. ABURTO, T. ACHOKI, A. ADELEKAN, K. ADOFO, A. K. ADOU, J. C. ADSUAR, A. AFSHIN, E. E. AGARDH, M. J. AL KHABOURI, F. H. AL LAMI, S. S. ALAM, D. ALASFOOR, M. I. ALBITTAR, M. A. ALEGRETTI, A. V. ALEMAN, Z. A. ALEMU, R. ALFONSO-CRISTANCHO, S. ALHABIB, R. ALI, M. K. ALI, F. ALLA, P. ALLEBECK, P. J. ALLEN, U. ALSHARIF, E. ALVAREZ, N. ALVIS-GUZMAN, A. A. AMANKWAA, A. T. AMARE, E. A. AMEH, O. AMELI, H. AMINI, W. AMMAR, B. O. ANDERSON, C. A. T. ANTONIO, P. ANWARI, S. ARGESEANU CUNNINGHAM, J. ARNLÖV, V. S. A. ARSENIJEVIC, A. ARTAMAN, R. J. ASGHAR, R. ASSADI, L. S. ATKINS, C. ATKINSON, M. A. AVILA, B. AWUAH, A. BADAWI, M. C. BAHIT, T. BAKFALOUNI, K. BALAKRISHNAN, S. BALALLA, R. K. BALU, A. BANERJEE, R. M. BARBER, S. L. BARKER-COLLO, S. BARQUERA, L. BARREGARD, L. H. BARRERO, T. BARRIENTOS-GUTIERREZ, A. C. BASTO-ABREU, A. BASU, S. BASU, M. O. BASULAIMAN, C. BATIS RUVALCABA, J. BEARDSLEY, N. BEDI, T. BEKELE, M. L. BELL, C. BENJET, D. A. BENNETT, H. BENZIAN, E. BERNABÉ, T. J. BEYENE, N. BHALA, A. BHALLA, Z. A. BHUTTA, B. BIKBOV, A. A. BIN ABDULHAK, J. D. BLORE, F. M. BLYTH, M. A. BOHENSKY, B. BORA BAŞARA, G. BORGES, N. M. BORNSTEIN, D. BOSE, S. BOUFOUS, R. R. BOURNE, M. BRAININ, A. BRAZINOVA, N. J. BREITBORDE, H. BRENNER, A. D. M. BRIGGS, D. M. BRODAY, P. M. BROOKS, N. G. BRUCE, T. S. BRUGHA, B. BRUNEKREEF, R. BUCHBINDER, L. N. BUI, G. BUKHMAN, A. G. BULLOCH, M. BURCH, P. G. J. BURNEY, I. R. CAMPOS-NONATO, J. C. CAMPUZANO, A. J. CANTORAL, J. CARAVANOS, R. CÁRDENAS, E. CARDIS, D. O. CARPENTER, V. CASO, C. A. CASTAÑEDA-ORJUELA, R. E. CASTRO, F. CATALÁ-LÓPEZ, F. CAVALLERI, A. ÇAVLIN, V. K. CHADHA, J.-C. CHANG, F. J. CHARLSON, H. CHEN, W. CHEN, Z. CHEN, P. P. CHIANG, O. CHIMED-OCHIR, R. CHOWDHURY, C. A. CHRISTOPHI, T.-W. CHUANG, S. S. CHUGH, M. CIRILLO, T. K. D. CLASSEN, V. COLISTRO, M. COLOMAR, S. M. COLQUHOUN, A. G. CONTRERAS, C. COOPER, K. COOPERRIDER, L. T. COOPER, J. CORESH, K. J. COURVILLE, M. H. CRIQUI, L. CUEVAS-NASU, J. DAMSERE-DERRY, H. DANAWI, L. DANDONA, R. DANDONA, P. I. DARGAN, A. DAVIS, D. V. DAVITOIU, A. DAYAMA, E. F. DE CASTRO, V. DE LA CRUZ-GÓNGORA, D. DE LEO, G. DE LIMA, L. DEGENHARDT, B. DEL POZO-CRUZ, R. P. DELLAVALLE, K. DERIBE, S. DERRETT, D. C. DES JARLAIS, M. DESSALEGN, G. A. DEVEBER, K. M. DEVRIES, S. D. DHARMARATNE, M. K. DHERANI, D. DICKER, E. L. DING, K. DOKOVA, E. R. DORSEY, T. R. DRISCOLL, L. DUAN, A. M. DURRANI, B. E. EBEL, R. G. ELLENBOGEN, Y. M. ELSHREK, M. ENDRES, S. P. ERMAKOV, H. E. ERSKINE, B. ESHRATI, A. ESTEGHAMATI, S. FAHIMI, E. J. A. FARAON, F. FARZADFAR, D. F. J. FAY, V. L. FEIGIN, A. B. FEIGL, S.-M. FERESHTEHNEJAD, A.

J. FERRARI, C. P. FERRI, A. D. FLAXMAN, T. D. FLEMING, N. FOIGT, K. J. FOREMAN, U. F. PALEO, R. C. FRANKLIN, B. GABBE, L. GAFFIKIN, E. GAKIDOU, A. GAMKRELIDZE, F. G. GANKPÉ, R. T. GANSEVOORT, F. A. GARCÍA-GUERRA, E. GASANA, J. M. GELEIJNSE, B. D. GESSNER, P. GETHING, K. B. GIBNEY, R. F. GILLUM, I. A. M. GINAWI, M. GIROUD, G. GIUSSANI, S. GOENKA, K. GOGINASHVILI, H. GOMEZ DANTES, P. GONA, T. GONZALEZ DE COSIO, D. GONZÁLEZ-CASTELL, C. C. GOTAY, A. GOTO, H. N. GOUDA, R. L. GUERRANT, H. C. GUGNANI, F. GUILLEMIN, D. GUNNELL, R. GUPTA, R. GUPTA, R. A. GUTIÉRREZ, N. HAFEZI-NEJAD, H. HAGAN, M. HAGSTROMER, Y. A. HALASA, R. R. HAMADEH, M. HAMMAMI, G. J. HANKEY, Y. HAO, H. L. HARB, T. N. HAREGU, J. M. HARO, R. HAVMOELLER, S. I. HAY, M. T. HEDAYATI, I. B. HEREDIA-PI, L. HERNANDEZ, K. R. HEUTON, P. HEYDARPOUR, M. HIJAR, H. W. HOEK, H. J. HOFFMAN, J. C. HORNBERGER, H. D. HOSGOOD, D. G. HOY, M. HSAIRI, G. HU, H. HU, C. HUANG, J. J. HUANG, B. J. HUBBELL, L. HUIART, A. HUSSEINI, M. L. IANNARONE, K. M. IBURG, B. T. IDRISOV, N. IKEDA, K. INNOS, M. INOUE, F. ISLAMI, S. ISMAYILOVA, K. H. JACOBSEN, H. A. JANSEN, D. L. JARVIS, S. K. JASSAL, A. JAUREGUI, S. JAYARAMAN, P. JEEMON, P. N. JENSEN, V. JHA, F. JIANG, G. JIANG, Y. JIANG, J. B. JONAS, K. JUEL, H. KAN, S. S. KANY ROSELINE, N. E. KARAM, A. KARCH, C. K. KAREMA, G. KARTHIKEYAN, A. KAUL, N. KAWAKAMI, D. S. KAZI, A. H. KEMP, A. P. KENGNE, A. KEREN, Y. S. KHADER, S. E. A. H. KHALIFA, E. A. KHAN, Y.-H. KHANG, S. KHATIBZADEH, I. KHONELIDZE, C. KIELING, D. KIM, S. KIM, Y. KIM, R. W. KIMOKOTI, Y. KINFU, J. M. KINGE, B. M. KISSELA, M. KIVIPELTO, L. D. KNIBBS, A. K. KNUDSEN, Y. KOKUBO, M. R. KOSE, S. KOSEN, A. KRAEMER, M. KRAVCHENKO, S. KRISHNASWAMI, H. KROMHOUT, T. KU, B. KUATE DEFO, B. KUCUK BICER, E. J. KUIPERS, C. KULKARNI, V. S. KULKARNI, G. A. KUMAR, G. F. KWAN, T. LAI, A. LAKSHMANA BALAJI, R. LALLOO, T. LALLUKKA, H. LAM, Q. LAN, V. C. LANSINGH, H. J. LARSON, A. LARSSON, D. O. LARYEA, P. M. LAVADOS, A. E. LAWRYNOWICZ, J. L. LEASHER, J.-T. LEE, J. LEIGH, R. LEUNG, M. LEVI, Y. LI, Y. LI, J. LIANG, X. LIANG, S. S. LIM, M. P. LINDSAY, S. E. LIPSHULTZ, S. LIU, Y. LIU, B. K. LLOYD, G. LOGROSCINO, S. J. LONDON, N. LOPEZ, J. LORTET-TIEULENT, P. A. LOTUFO, R. LOZANO, R. LUNEVICIUS, J. MA, S. MA, V. M. P. MACHADO, M. F. MACINTYRE, C. MAGIS-RODRIGUEZ, A. A. MAHDI, M. MAJDAN, R. MALEKZADEH, S. MANGALAM, C. C. MAPOMA, M. MARAPE, W. MARCENES, D. J. MARGOLIS, C. MARGONO, G. B. MARKS, R. V. MARTIN, M. B. MARZAN, M. T. MASHAL, F. MASIYE, A. J. MASON-JONES, K. MATSUSHITA, R. MATZOPOULOS, B. M. MAYOSI, T. T. MAZORODZE, A. C. MCKAY, M. MCKEE, A. MCLAIN, P. A. MEANEY, C. MEDINA, M. M. MEHNDIRATTA, F. MEJIA-RODRIGUEZ, W. MEKONNEN, Y. A. MELAKU, M. MELTZER, Z. A. MEMISH, W. MENDOZA, G. A. MENSAH, A. MERETOJA, F. A. MHIMBIRA, R. MICHA, T. R. MILLER, E. J. MILLS, A. MISGANAW, S. MISHRA, N. MOHAMED IBRAHIM, K. A. MOHAMMAD, A. H. MOKDAD, G. L. MOLA, L. MONASTA, J. C. MONTAÑEZ HERNANDEZ, M. MONTICO, A. R. MOORE, L. MORAWSKA, R. MORI, J. MOSCHANDREAS, W. N. MOTURI, D. MOZAFFARIAN, U. O. MUELLER, M. MUKAIGAWARA, E. C. MULLANY, K. S. MURTHY, M. NAGHAVI, Z. NAHAS, A. NAHEED, K. S. NAIDOO, L. NALDI, D. NAND, V. NANGIA, K. M. V. NARAYAN, D. NASH, B. NEAL, C. NEJJARI, S. P. NEUPANE, C. R. NEWTON, F. N. NGALESONI, J. D. D. NGIRABEGA, G. NGUYEN, N. T. NGUYEN, M. J. NIEUWENHUIJSEN, M. I. NISAR, J. R. NOGUEIRA, J. M. NOLLA, S. NOLTE, O. F. NORHEIM, R. E. NORMAN, B. NORRVING, L. NYAKARAHUKA, I.-H. OH, T. OHKUBO, B. O. OLUSANYA, S. B. OMER, J. N. OPIO, R. OROZCO, R. S. PAGCATIPUNAN, A. W. PAIN, J. D. PANDIAN, C. I. A. PANELO, C. PAPACHRISTOU, E.-K. PARK, C. D. PARRY, A. J. PATERNINA CAICEDO, S. B. PATTEN, V. K. PAUL, B. I. PAVLIN, N. PEARCE, L. S. PEDRAZA, A. PEDROZA, L. PEJIN STOKIC, A. PEKERICLI, D. M. PEREIRA, R. PEREZ-PADILLA, F. PEREZ-RUIZ, N. PERICO, S. A. L. PERRY, A. PERVAIZ, K. PESUDOVS, C. B. PETERSON, M. PETZOLD, M. R. PHILLIPS, H. P. PHUA, D. PLASS, D. POENARU, G. V. POLANCZYK, S. POLINDER, C. D. POND, C. A. POPE, D. POPE, S. POPOVA, F. POURMALEK, J. POWLES, D. PRABHAKARAN, N. M. PRASAD, D. M. QATO, A. D. QUEZADA, D. A. A. QUISTBERG, L. RACAPÉ, A. RAFAY, K. RAHIMI, V. RAHIMI-MOVAGHAR, S. U. RAHMAN, M. RAJU, I. RAKOVAC, S. M. RANA, M. RAO, H. RAZAVI, K. S. REDDY, A. H. REFAAT, J. REHM, G. REMUZZI, A. L. RIBEIRO, P. M. RICCIO, L. RICHARDSON, A. RIEDERER, M. ROBINSON, A. ROCA, A. RODRIGUEZ, D. ROJAS-RUEDA, I. ROMIEU, L. RONFANI, R. ROOM, N. ROY, G. M. RUHAGO, L. RUSHTON, N. SABIN, R. L. SACCO, S. SAHA, R. SAHATHEVAN, M. A. SAHRAIAN, J. A. SALOMON, D. SALVO, U. K. SAMPSON, J. R. SANABRIA, L. M. SANCHEZ, T. G. SÁNCHEZ-PIMIENTA, L. SANCHEZ-

RIERA, L. SANDAR, I. S. SANTOS, A. SAPKOTA, M. SATPATHY, J. E. SAUNDERS, M. SAWHNEY, M. I. SAYLAN, P. SCARBOROUGH, J. C. SCHMIDT, I. J. C. SCHNEIDER, B. SCHÖTTKER, D. C. SCHWEBEL, J. G. SCOTT, S. SEEDAT, S. G. SEPANLOU, B. SERDAR, E. E. SERVAN-MORI, G. SHADDICK, S. SHAHRAZ, T. S. LEVY, S. SHANGGUAN, J. SHE, S. SHEIKHBAHAEI, K. SHIBUYA, H. H. SHIN, Y. SHINOHARA, R. SHIRI, K. SHISHANI, I. SHIUE, I. D. SIGFUSDOTTIR, D. H. SILBERBERG, E. P. SIMARD, S. SINDI, A. SINGH, G. M. SINGH, J. A. SINGH, V. SKIRBEKK, K. SLIWA, M. SOLJAK, S. SONEJI, K. SØREIDE, S. SOSHNIKOV, L. A. SPOSATO, C. T. SREERAMAREDDY, N. J. C. STAPELBERG, V. STATHOPOULOU, N. STECKLING, D. J. STEIN, M. B. STEIN, N. STEPHENS, H. STÖCKL, K. STRAIF, K. STROUMPOULIS, L. STURUA, B. F. SUNGUYA, S. SWAMINATHAN, M. SWAROOP, B. L. SYKES, K. M. TABB, K. TAKAHASHI, R. T. TALONGWA, N. TANDON, D. TANNE, M. TANNER, M. TAVAKKOLI, B. J. TE AO, C. M. TEIXEIRA, M. M. TÉLLEZ ROJO, A. S. TERKAWI, J. L. TEXCALAC-SANGRADOR, S. V. THACKWAY, B. THOMSON, A. L. THORNE-LYMAN, A. G. THRIFT, G. D. THURSTON, T. TILLMANN, M. TOBOLLIK, M. TONELLI, F. TOPOUZIS, J. A. TOWBIN, H. TOYOSHIMA, J. TRAEBERT, B. X. TRAN, L. TRASANDE, M. TRILLINI, U. TRUJILLO, Z. T. DIMBUENE, M. TSILIMBARIS, E. M. TUZCU, U. S. UCHENDU, K. N. UKWAJA, S. B. UZUN, S. VAN DE VIJVER, R. VAN DINGENEN, C. H. VAN GOOL, J. VAN OS, Y. Y. VARAKIN, T. J. VASANKARI, A. M. N. VASCONCELOS, M. S. VAVILALA, L. J. VEERMAN, G. VELASQUEZ-MELENDEZ, N. VENKETASUBRAMANIAN, L. VIJAYAKUMAR, S. VILLALPANDO, F. S. VIOLANTE, V. V. VLASSOV, S. E. VOLLSET, G. R. WAGNER, S. G. WALLER, M. T. WALLIN, X. WAN, H. WANG, J. WANG, L. WANG, W. WANG, Y. WANG, T. S. WAROUW, C. H. WATTS, S. WEICHENTHAL, E. WEIDERPASS, R. G. WEINTRAUB, A. WERDECKER, K. R. WESSELLS, R. WESTERMAN, H. A. WHITEFORD, J. D. WILKINSON, H. C. WILLIAMS, T. N. WILLIAMS, S. M. WOLDEYOHANNES, C. D. A. WOLFE, J. Q. WONG, A. D. WOOLF, J. L. WRIGHT, B. WURTZ, G. XU, L. L. YAN, G. YANG, Y. YANO, P. YE, M. YENESEW, G. K. YENTÜR, P. YIP, N. YONEMOTO, S.-J. YOON, M. Z. YOUNIS, Z. YOUNOUSSI, C. YU, M. E. ZAKI, Y. ZHAO, Y. ZHENG, M. ZHOU, J. ZHU, S. ZHU, X. ZOU, J. R. ZUNT, A. D. LOPEZ, T. VOS, C. J. MURRAY. *Global, regional, and national comparative risk assessment of 79 behavioural, environmental and occupational, and metabolic risks or clusters of risks in 188 countries, 1990-2013: a systematic analysis for the Global Burden of Disease Study 2013*, in "Lancet", December 2015, vol. 386, n° 10010, pp. 2287-323, https://hal-unilim.archives-ouvertes.fr/hal-01262737

[18] K. LAWONN, S. GLASSER, A. VILANOVA, B. PREIM, T. ISENBERG. *Occlusion-free Blood Flow Animation with Wall Thickness Visualization*, in "IEEE Transactions on Visualization and Computer Graphics", January 2016, vol. 22, n° 1, pp. 728–737 [*DOI :* 10.1109/TVCG.2015.2467961], https://hal.inria.fr/hal-01178054

[19] B. LEE, N. HENRY RICHE, P. ISENBERG, S. CARPENDALE. *More than Telling a Story: A Closer Look at the Process of Transforming Data into Visually Shared Stories*, in "IEEE Computer Graphics and Applications", September 2015, vol. 35, n° 5, pp. 84–90 [*DOI :* 10.1109/MCG.2015.99], https://hal.inria.fr/hal-01158445

[20] D. LÓPEZ, L. OEHLBERG, C. DOGER, T. ISENBERG. *Towards an Understanding of Mobile Touch Navigation in a Stereoscopic Viewing Environment for 3D Data Exploration*, in "IEEE Transactions on Visualization and Computer Graphics", December 2016, pp. 00–00 [*DOI :* 10.1109/TVCG.2015.2440233], https://hal.inria.fr/hal-01174618

[21] C. J. L. MURRAY, R. M. BARBER, K. J. FOREMAN, A. ABBASOGLU OZGOREN, F. ABD-ALLAH, S. F. ABERA, V. ABOYANS, J. P. ABRAHAM, I. ABUBAKAR, L. J. ABU-RADDAD, N. M. ABU-RMEILEH, T. ACHOKI, I. N. ACKERMAN, Z. ADEMI, A. K. ADOU, J. C. ADSUAR, A. AFSHIN, E. E. AGARDH, S. S. ALAM, D. ALASFOOR, M. I. ALBITTAR, M. A. ALEGRETTI, Z. A. ALEMU, R. ALFONSO-CRISTANCHO, S. ALHABIB, R. ALI, F. ALLA, P. ALLEBECK, M. A. ALMAZROA, U. ALSHARIF, E. ALVAREZ, N. ALVIS-GUZMAN, A. T. AMARE, E. A. AMEH, H. AMINI, W. AMMAR, H. R. ANDERSON, B. O. ANDERSON, C. A. T. ANTONIO, P. ANWARI, J. ARNLÖV, V. S. ARSIC ARSENIJEVIC, A. ARTAMAN, R. J. ASGHAR, R. ASSADI, L. S. ATKINS, M. A. AVILA, B. AWUAH, V. F. BACHMAN, A. BADAWI, M. C. BAHIT, K. BALAKRISHNAN, A. BANERJEE, S. L. BARKER-COLLO, S. BARQUERA, L. BARREGARD, L. H.

BARRERO, A. BASU, S. BASU, M. O. BASULAIMAN, J. BEARDSLEY, N. BEDI, E. BEGHI, T. BEKELE, M. L. BELL, C. BENJET, D. A. BENNETT, I. M. BENSENOR, H. BENZIAN, E. BERNABÉ, A. BERTOZZI-VILLA, T. J. BEYENE, N. BHALA, A. BHALLA, Z. A. BHUTTA, K. BIENHOFF, B. BIKBOV, S. BIRYUKOV, J. D. BLORE, C. D. BLOSSER, F. M. BLYTH, M. A. BOHENSKY, I. W. BOLLIGER, B. BORA BAŞARA, N. M. BORNSTEIN, D. BOSE, S. BOUFOUS, R. R. A. BOURNE, L. N. BOYERS, M. BRAININ, C. E. BRAYNE, A. BRAZINOVA, N. J. K. BREITBORDE, H. BRENNER, A. D. BRIGGS, P. M. BROOKS, J. C. BROWN, T. S. BRUGHA, R. BUCHBINDER, G. C. BUCKLE, C. M. BUDKE, A. BULCHIS, A. G. BULLOCH, I. R. CAMPOS-NONATO, H. CARABIN, J. R. CARAPETIS, R. CÁRDENAS, D. O. CARPENTER, V. CASO, C. A. CASTAÑEDA-ORJUELA, R. E. CASTRO, F. CATALÁ-LÓPEZ, F. CAVALLERI, A. ÇAVLIN, V. K. CHADHA, J.-C. CHANG, F. J. CHARLSON, H. CHEN, W. CHEN, P. P. CHIANG, O. CHIMED-OCHIR, R. CHOWDHURY, H. CHRISTENSEN, C. A. CHRISTOPHI, M. CIRILLO, M. M. COATES, L. E. COFFENG, M. S. COGGESHALL, V. COLISTRO, S. M. COLQUHOUN, G. S. COOKE, C. COOPER, L. T. COOPER, L. M. COPPOLA, M. CORTINOVIS, M. H. CRIQUI, J. A. CRUMP, L. CUEVAS-NASU, H. DANAWI, L. DANDONA, R. DANDONA, E. DANSEREAU, P. I. DARGAN, G. DAVEY, A. DAVIS, D. V. DAVITOIU, A. DAYAMA, D. DE LEO, L. DEGENHARDT, B. DEL POZO-CRUZ, R. P. DELLAVALLE, K. DERIBE, S. DERRETT, D. C. DES JARLAIS, M. DESSALEGN, S. D. DHARMARATNE, M. K. DHERANI, C. DIAZ-TORNÉ, D. DICKER, E. L. DING, K. DOKOVA, E. R. DORSEY, T. R. DRISCOLL, L. DUAN, H. C. DUBER, B. E. EBEL, K. M. EDMOND, Y. M. ELSHREK, M. ENDRES, S. P. ERMAKOV, H. E. ERSKINE, B. ESHRATI, A. ESTEGHAMATI, K. ESTEP, E. J. A. FARAON, F. FARZADFAR, D. F. FAY, V. L. FEIGIN, D. T. FELSON, S.-M. FERESHTEHNEJAD, J. G. FERNANDES, A. J. FERRARI, C. FITZMAURICE, A. D. FLAXMAN, T. D. FLEMING, N. FOIGT, M. H. FOROUZANFAR, F. G. R. FOWKES, U. F. PALEO, R. C. FRANKLIN, T. FÜRST, B. GABBE, L. GAFFIKIN, F. G. GANKPÉ, J. M. GELEIJNSE, B. D. GESSNER, P. GETHING, K. B. GIBNEY, M. GIROUD, G. GIUSSANI, H. GOMEZ DANTES, P. GONA, D. GONZÁLEZ-MEDINA, R. A. GOSSELIN, C. C. GOTAY, A. GOTO, H. N. GOUDA, N. GRAETZ, H. C. GUGNANI, R. GUPTA, R. GUPTA, R. A. GUTIÉRREZ, J. HAAGSMA, N. HAFEZI-NEJAD, H. HAGAN, Y. A. HALASA, R. R. HAMADEH, H. HAMAVID, M. HAMMAMI, J. HANCOCK, G. J. HANKEY, G. M. HANSEN, Y. HAO, H. L. HARB, J. M. HARO, R. HAVMOELLER, S. I. HAY, R. J. HAY, I. B. HEREDIA-PI, K. R. HEUTON, P. HEYDARPOUR, H. HIGASHI, M. HIJAR, H. W. HOEK, H. J. HOFFMAN, H. D. HOSGOOD, M. HOSSAIN, P. J. HOTEZ, D. G. HOY, M. HSAIRI, G. HU, C. HUANG, J. J. HUANG, A. HUSSEINI, C. HUYNH, M. L. IANNARONE, K. M. IBURG, K. INNOS, M. INOUE, F. ISLAMI, K. H. JACOBSEN, D. L. JARVIS, S. K. JASSAL, S. H. JEE, P. JEEMON, P. N. JENSEN, V. JHA, G. JIANG, Y. JIANG, J. B. JONAS, K. JUEL, H. KAN, A. KARCH, C. K. KAREMA, C. KARIMKHANI, G. KARTHIKEYAN, N. J. KASSEBAUM, A. KAUL, N. KAWAKAMI, K. KAZANJAN, A. H. KEMP, A. P. KENGNE, A. KEREN, Y. S. KHADER, S. E. A. KHALIFA, E. A. KHAN, G. KHAN, Y.-H. KHANG, C. KIELING, D. KIM, S. KIM, Y. KIM, Y. KINFU, J. M. KINGE, M. KIVIPELTO, L. D. KNIBBS, A. K. KNUDSEN, Y. KOKUBO, S. KOSEN, S. KRISHNASWAMI, B. KUATE DEFO, B. KUCUK BICER, E. J. KUIPERS, C. KULKARNI, V. S. KULKARNI, G. A. KUMAR, H. H. KYU, T. LAI, R. LALLOO, T. LALLUKKA, H. LAM, Q. LAN, V. C. LANSINGH, A. LARSSON, A. E. B. LAWRYNOWICZ, J. L. LEASHER, J. LEIGH, R. LEUNG, C. E. LEVITZ, B. LI, Y. LI, Y. LI, S. S. LIM, M. LIND, S. E. LIPSHULTZ, S. LIU, Y. LIU, B. K. LLOYD, K. T. LOFGREN, G. LOGROSCINO, K. J. LOOKER, J. LORTET-TIEULENT, P. A. LOTUFO, R. LOZANO, R. M. LUCAS, R. LUNEVICIUS, R. A. LYONS, S. MA, M. F. MACINTYRE, M. T. MACKAY, M. MAJDAN, R. MALEKZADEH, W. MARCENES, D. J. MARGOLIS, C. MARGONO, M. B. MARZAN, J. R. MASCI, M. T. MASHAL, R. MATZOPOULOS, B. M. MAYOSI, T. T. MAZORODZE, N. W. MCGILL, J. J. MCGRATH, M. MCKEE, A. MCLAIN, P. A. MEANEY, C. MEDINA, M. M. MEHNDIRATTA, W. MEKONNEN, Y. A. MELAKU, M. MELTZER, Z. A. MEMISH, G. A. MENSAH, A. MERETOJA, F. A. MHIMBIRA, R. MICHA, T. R. MILLER, E. J. MILLS, P. B. MITCHELL, C. N. MOCK, N. MOHAMED IBRAHIM, K. A. MOHAMMAD, A. H. MOKDAD, G. L. D. MOLA, L. MONASTA, J. C. MONTAÑEZ HERNANDEZ, M. MONTICO, T. J. MONTINE, M. D. MOONEY, A. R. MOORE, M. MORADI-LAKEH, A. E. MORAN, R. MORI, J. MOSCHANDREAS, W. N. MOTURI, M. L. MOYER, D. MOZAFFARIAN, W. T. MSEMBURI, U. O. MUELLER, M. MUKAIGAWARA, E. C. MULLANY, M. E. MURDOCH, J. MURRAY, K. S. MURTHY, M. NAGHAVI, A. NAHEED, K. S. NAIDOO, L. NALDI, D. NAND, V. NANGIA, K. M. V. NARAYAN, C. NEJJARI, S. P. NEUPANE, C. R. NEWTON, M. NG, F. N. NGALESONI, G. NGUYEN, M. I. NISAR, S. NOLTE, O. F. NORHEIM, R. E. NORMAN, B. NORRVING, L.

NYAKARAHUKA, I.-H. OH, T. OHKUBO, S. L. OHNO, B. O. OLUSANYA, J. N. OPIO, K. ORTBLAD, A. ORTIZ, A. W. PAIN, J. D. PANDIAN, C. I. A. PANELO, C. PAPACHRISTOU, E.-K. PARK, J.-H. PARK, S. B. PATTEN, G. C. PATTON, V. K. PAUL, B. I. PAVLIN, N. PEARCE, D. M. PEREIRA, R. PEREZ-PADILLA, F. PEREZ-RUIZ, N. PERICO, A. PERVAIZ, K. PESUDOVS, C. B. PETERSON, M. PETZOLD, M. R. PHILLIPS, B. K. PHILLIPS, D. E. PHILLIPS, F. B. PIEL, D. PLASS, D. POENARU, S. POLINDER, D. POPE, S. POPOVA, R. G. POULTON, F. POURMALEK, D. PRABHAKARAN, N. M. PRASAD, R. L. PULLAN, D. M. QATO, D. A. QUISTBERG, A. RAFAY, K. RAHIMI, S. U. RAHMAN, M. RAJU, S. M. RANA, H. RAZAVI, K. S. REDDY, A. REFAAT, G. REMUZZI, S. RESNIKOFF, A. L. RIBEIRO, L. RICHARDSON, J. H. RICHARDUS, D. A. ROBERTS, D. ROJAS-RUEDA, L. RONFANI, G. A. ROTH, D. ROTHENBACHER, D. H. ROTHSTEIN, J. T. ROWLEY, N. ROY, G. M. RUHAGO, M. Y. SAEEDI, S. SAHA, M. A. SAHRAIAN, U. K. A. SAMPSON, J. R. SANABRIA, L. SANDAR, I. S. SANTOS, M. SATPATHY, M. SAWHNEY, P. SCARBOROUGH, I. J. SCHNEIDER, B. SCHÖTTKER, A. E. SCHUMACHER, D. C. SCHWEBEL, J. G. SCOTT, S. SEEDAT, S. G. SEPANLOU, P. T. SERINA, E. E. SERVAN-MORI, K. A. SHACKELFORD, A. SHAHEEN, S. SHAHRAZ, T. SHAMAH LEVY, S. SHANGGUAN, J. SHE, S. SHEIKHBAHAEI, P. SHI, K. SHIBUYA, Y. SHINOHARA, R. SHIRI, K. SHISHANI, I. SHIUE, M. G. SHRIME, I. D. SIGFUSDOTTIR, D. H. SILBERBERG, E. P. SIMARD, S. SINDI, A. SINGH, J. A. SINGH, L. SINGH, V. SKIRBEKK, E. L. SLEPAK, K. SLIWA, S. SONEJI, K. SØREIDE, S. SOSHNIKOV, L. A. SPOSATO, C. T. SREERAMAREDDY, J. D. STANAWAY, V. STATHOPOULOU, D. J. STEIN, M. B. STEIN, C. STEINER, T. J. STEINER, A. STEVENS, A. STEWART, L. J. STOVNER, K. STROUMPOULIS, B. F. SUNGUYA, S. SWAMINATHAN, M. SWAROOP, B. L. SYKES, K. M. TABB, K. TAKAHASHI, N. TANDON, D. TANNE, M. TANNER, M. TAVAKKOLI, H. R. TAYLOR, B. J. TE AO, F. TEDIOSI, A. M. TEMESGEN, T. TEMPLIN, M. TEN HAVE, E. Y. TENKORANG, A. S. TERKAWI, B. THOMSON, A. L. THORNE-LYMAN, A. G. THRIFT, G. D. THURSTON, T. TILLMANN, M. TONELLI, F. TOPOUZIS, H. TOYOSHIMA, J. TRAEBERT, B. X. TRAN, M. TRILLINI, T. TRUELSEN, M. TSILIMBARIS, E. M. TUZCU, U. S. UCHENDU, K. N. UKWAJA, E. A. UNDURRAGA, S. B. UZUN, W. H. VAN BRAKEL, S. VAN DE VIJVER, C. H. VAN GOOL, J. VAN OS, T. J. VASANKARI, N. VENKETASUBRAMANIAN, F. S. VIOLANTE, V. V. VLASSOV, S. E. VOLLSET, G. R. WAGNER, J. WAGNER, S. G. WALLER, X. WAN, H. WANG, J. WANG, L. WANG, T. S. WAROUW, S. WEICHENTHAL, E. WEIDERPASS, R. G. WEINTRAUB, W. WENZHI, A. WERDECKER, R. WESTERMAN, H. A. WHITEFORD, J. D. WILKINSON, T. N. WILLIAMS, C. D. WOLFE, T. M. WOLOCK, A. D. WOOLF, S. WULF, B. WURTZ, G. XU, L. L. YAN, Y. YANO, P. YE, G. K. YENTÜR, P. YIP, N. YONEMOTO, S.-J. YOON, M. Z. YOUNIS, C. YU, M. E. ZAKI, Y. ZHAO, Y. ZHENG, D. ZONIES, X. ZOU, J. A. SALOMON, A. D. LOPEZ, T. VOS. *Global, regional, and national disability-adjusted life years (DALYs) for 306 diseases and injuries and healthy life expectancy (HALE) for 188 countries, 1990-2013: quantifying the epidemiological transition*, in "Lancet", November 2015, vol. 386, n^{o} 10009, pp. 2145-91, https://hal-unilim.archives-ouvertes.fr/hal-01262808

[22] A. SUSLIK SPRITZER, J. BOY, P. DRAGICEVIC, J.-D. FEKETE, C. M. DAL SASSO FREITAS. *Towards a smooth design process for static communicative node-link diagrams*, in "Computer Graphics Forum", May 2015, vol. 34, n^{o} 3, pp. 461-470 [*DOI :* 10.1111/CGF.12658], https://hal.inria.fr/hal-01158223

[23] W. WILLETT, P. GOFFIN, P. ISENBERG. *Understanding Digital Note-Taking Practice for Visualization*, in "IEEE Computer Graphics and Applications", July 2015, vol. 35, n^{o} 4, pp. 38–51 [*DOI :* 10.1109/MCG.2015.52], https://hal.inria.fr/hal-01179038

[24] L. YU, K. EFSTATHIOU, P. ISENBERG, T. ISENBERG. *CAST: Effective and Efficient User Interaction for Context-Aware Selection in 3D Particle Clouds*, in "IEEE Transactions on Visualization and Computer Graphics", January 2016, vol. 22, n^{o} 1, pp. 886–895 [*DOI :* 10.1109/TVCG.2015.2467202], https://hal.inria.fr/hal-01178051

International Conferences with Proceedings

[25] N. BOUKHELIFA, E. GIANNISAKIS, E. DIMARA, W. WILLETT, J.-D. FEKETE. *Supporting Historical Research Through User-Centered Visual Analytics*, in "sixth international Eurovis workshop on visual analytics (EuroVA)", Cagliary, Italy, May 2015 [*DOI :* 10.2312/EUROVA.20151095], https://hal.inria.fr/hal-01156527

[26] J. BOY, J.-D. FEKETE, F. DÉTIENNE. *Storytelling in Information Visualizations: Does it Engage Users to Explore Data?*, in "Proceedings of the 33rd ACM Conference on Human Factors in Computing Systems (CHI 2015)", Seoul, South Korea, ACM (editor), ACM, April 2015, pp. 1449-1458 [*DOI :* 10.1145/2702123.2702452], https://hal.inria.fr/hal-01133305

[27] Y. JANSEN, P. DRAGICEVIC, P. ISENBERG, J. ALEXANDER, A. KARNIK, J. KILDAL, S. SUBRAMANIAN, K. HORNBÆK. *Opportunities and Challenges for Data Physicalization*, in "Proceedings of the ACM Conference on Human Factors in Computing Systems (CHI)", New York, NY, United States, ACM, April 2015 [*DOI :* 10.1145/2702123.2702180], https://hal.inria.fr/hal-01120152

[28] M. LE GOC, P. DRAGICEVIC, S. HURON, J. BOY, J.-D. FEKETE. *SmartTokens: Embedding Motion and Grip Sensing in Small Tangible Objects*, in "Proceedings of the Symposium on User Interface Software and Technology (UIST)", New York, NY, United States, ACM, November 2015 [*DOI :* 10.1145/2807442.2807488], https://hal.inria.fr/hal-01211270

[29] M. LE GOC, P. DRAGICEVIC, S. HURON, J.-D. FEKETE. *Design Considerations for Composite Physical Visualizations*, in "Proceedings of the CHI Workshop on Exploring the Challenges of Making Data Physical", Seoul, South Korea, April 2015, https://hal.inria.fr/hal-01138024

[30] D. MARTÍN, V. DEL SOL, C. ROMO, T. ISENBERG. *Drawing Characteristics for Reproducing Traditional Hand-Made Stippling*, in "Proceedings of Non-Photorealistic Animation and Rendering (NPAR, part of Expressive)", Goslar, Germany, Eurographics Association, June 2015, pp. 103–115 [*DOI :* 10.2312/EXP.20151183], https://hal.inria.fr/hal-01174610

[31] L. OEHLBERG, W. WILLETT, W. E. MACKAY. *Patterns of Physical Design Remixing in Online Maker Communities*, in "ACM Conference on Human Factors in Computing Systems - CHI 2015", Seoul, South Korea, ACM, April 2015, pp. 639-648 [*DOI :* 10.1145/2702123.2702175], https://hal.inria.fr/hal-01263171

[32] C. PERIN, P. DRAGICEVIC, J.-D. FEKETE. *Crossets: Manipulating Multiple Sliders by Crossing*, in "Proceedings of Graphics Interface Conference (GI)", Toronto, Canada, Canadian Information Processing Society, June 2015, pp. 233-240, https://hal.inria.fr/hal-01152074

[33] R. VUILLEMOT, C. PERIN. *Investigating the Direct Manipulation of Ranking Tables for Time Navigation*, in "Proceedings of the ACM Conference on Human Factors in Computing Systems (CHI)", New York, NY, United States, ACM, April 2015, pp. 2703-2706, Best paper honorable mention [*DOI :* 10.1145/2702123.2702237], https://hal.inria.fr/hal-01138447

[34] *Best Paper*
W. WILLETT, B. JENNY, T. ISENBERG, P. DRAGICEVIC. *Lightweight Relief Shearing for Enhanced Terrain Perception on Interactive Maps*, in "Proceedings of the Conference on Human Factors in Computing Systems (CHI)", New York, United States, ACM, April 2015 [*DOI :* 10.1145/2702123.2702172], https://hal.inria.fr/hal-01105179.

Conferences without Proceedings

[35] N. BOUKHELIFA, A. BEZERIANOS, E. LUTTON. *A Mixed Approach for the Evaluation of a Guided Exploratory Visualization System*, in "EuroVis Workshop on Reproducibility, Verification and Validation in Visualization (EuroRV^3)", Cagliari, Italy, May 2015, https://hal.inria.fr/hal-01153887

[36] J.-D. FEKETE. *ProgressiVis: a Toolkit for Steerable Progressive Analytics and Visualization*, in "1st Workshop on Data Systems for Interactive Analysis", Chicago, United States, October 2015, 5 p. , https://hal.inria.fr/hal-01202901

[37] P. GOFFIN, W. WILLETT, P. ISENBERG. *Sharing Information from Personal Digital Notes using Word-Scale Visualizations*, in "Proceedings of the IEEE VIS Workshop on Personal Visualization: Exploring Data in Everyday Life", Los Alamitos, CA, United States, October 2015, https://hal.inria.fr/hal-01216223

[38] C. PERIN, M. LE GOC, R. DI VOZZO, J.-D. FEKETE, P. DRAGICEVIC. *DIY Bertin Matrix*, in "Proceedings of the CHI Workshop on Exploring the Challenges of Making Data Physical", Seoul, South Korea, April 2015, https://hal.inria.fr/hal-01138897

Scientific Books (or Scientific Book chapters)

[39] T. ISENBERG. *A Survey of Illustrative Visualization Techniques for Diffusion-Weighted MRI Tractography*, in "Visualization and Processing of Higher Order Descriptors for Multi-Valued Data", I. HOTZ, T. SCHULTZ (editors), June 2015, pp. 235–256 [*DOI :* 10.1007/978-3-319-15090-1_12], https://hal.inria.fr/hal-01132649

Research Reports

[40] P. DRAGICEVIC. *HCI Statistics without p-values*, Inria, June 2015, n^{o} RR-8738, 32 p. , https://hal.inria.fr/hal-01162238

[41] M. EVERTS, H. BEKKER, J. B. T. M. ROERDINK, T. ISENBERG. *Interactive Illustrative Line Styles and Line Style Transfer Functions for Flow Visualization*, arXiv.org, March 2015, n^{o} 1503.05787, Extended version of a short paper at Pacific Graphics 2011 (http://dx.doi.org/10.2312/PE/PG/PG2011short/105-110), https://hal.inria.fr/hal-01133715

[42] P. ISENBERG, B. LEE, A. JOSHI, T. ISENBERG. *Proceedings of the Workshop on Data Exploration for Interactive Surfaces (DEXIS 2015)*, Inria Saclay, December 2015, n^{o} RR-8819, 27 p. , https://hal.inria.fr/hal-01246192

Other Publications

[43] B. BACH, N. HENRY RICHE, R. FERNANDEZ, E. GIANNISAKIS, B. LEE, J.-D. FEKETE. *NetworkCube: Bringing Dynamic Network Visualizations to Domain Scientists*, October 2015, Posters of the Conference on Information Visualization (InfoVis), Poster, https://hal.inria.fr/hal-01205822

[44] J.-D. FEKETE. *Reorder.js: A JavaScript Library to Reorder Tables and Networks*, October 2015, IEEE VIS 2015, Poster, https://hal.inria.fr/hal-01214274

[45] P. GOFFIN, W. WILLETT, A. BEZERIANOS, P. ISENBERG. *Exploring the Effect of Word-Scale Visualizations on Reading Behavior*, ACM, 2015, Extended Abstracts of the Conference on Human Factors in Computing Systems (CHI), Poster [*DOI :* 10.1145/2702613.2732778], https://hal.inria.fr/hal-01127995

[46] P. GOFFIN, W. WILLETT, J.-D. FEKETE, P. ISENBERG. *Design Considerations for Enhancing Word-Scale Visualizations with Interaction*, IEEE, October 2015, Posters of the Conference on Information Visualization (InfoVis), Poster, https://hal.inria.fr/hal-01216216

[47] T. ONORATI, P. ISENBERG, A. BEZERIANOS, E. PIETRIGA, P. DIAZ. *WallTweet: A Knowledge Ecosystem for Supporting Situation Awareness*, November 2015, ITS Workshop on Data Exploration for Interactive Surfaces (DEXIS), https://hal.inria.fr/hal-01237149

References in notes

[48] S. K. CARD, J. D. MACKINLAY, B. SHNEIDERMAN (editors). *Readings in information visualization: using vision to think*, Morgan Kaufmann Publishers Inc., San Francisco, CA, USA, 1999

[49] J. BERTIN. *Sémiologie graphique : Les diagrammes - Les réseaux - Les cartes*, Les réimpressions, Editions de l'Ecole des Hautes Etudes en Sciences, Paris, France, 1967

[50] A. BEZERIANOS, P. DRAGICEVIC, R. BALAKRISHNAN. *Mnemonic rendering: an image-based approach for exposing hidden changes in dynamic displays*, in "UIST '06: Proceedings of the 19th annual ACM symposium on User interface software and technology", New York, NY, USA, ACM, 2006, pp. 159–168, http://doi.acm.org/10.1145/1166253.1166279

[51] J.-D. FEKETE, C. PLAISANT. *Interactive Information Visualization of a Million Items*, in "Proc. IEEE Symposium on Information Visualization 2002 (InfoVis 2002)", Boston, USA, IEEE Press, October 2002, pp. 117-124

[52] J.-D. FEKETE, C. PLAISANT. *Les leçons tirées des deux compétitions de visualisation d'information*, in "Proceedings of IHM 2004", Namur, Belgium, International Conference Proceedings Series, ACM Press, September 2004, pp. 7-12

[53] J. J. GIBSON. *The Ecological Approach to Visual Perception*, Lawrence Erlbaum Associates, New Jersey, USA, 1979

[54] Y. GUIARD, Y. DU, J.-D. FEKETE, M. BEAUDOUIN-LAFON, C. APPERT, O. CHAPUIS. *Shakespeare's Complete Works as a Benchmark for Evaluating Multiscale Document-Navigation Techniques*, in "Proceedings of BEyond time and errors: novel evaLuation methods for Information Visualization (BELIV'06)", Venice, Italy, ACM Press, May 2006, pp. 65-70

[55] N. HENRY RICHE, J.-D. FEKETE. *Evaluating Visual Table Data Understanding*, in "Proceedings of BEyond time and errors: novel evaLuation methods for Information Visualization (BELIV'06)", Venice, Italy, ACM Press, May 2006, 6 p.

[56] B. LEE, C. PLAISANT, C. SIMS PARR, J.-D. FEKETE, N. HENRY RICHE. *Task taxonomy for graph visualization*, in "BELIV '06: Proceedings of the 2006 AVI workshop on BEyond time and errors", New York, NY, USA, ACM, 2006, pp. 1–5, http://doi.acm.org/10.1145/1168149.1168168

[57] C. PLAISANT, J.-D. FEKETE, G. GRINSTEIN. *Promoting Insight-Based Evaluation of Visualizations: From Contest to Benchmark Repository*, in "IEEE Transactions on Visualization and Computer Graphics", 2008, vol. 14, n^{o} 1, pp. 120–134, http://doi.ieeecomputersociety.org/10.1109/TVCG.2007.70412

[58] A. TRIESMAN. *Preattentive Processing in Vision*, in "Computer Vision, Graphics, and Image Processing", August 1985, vol. 31, n^{O} 2, pp. 156-177

[59] E. TUFTE. *The Visual Display of Quantitative Information*, Graphics Press, 1983

[60] J. W. TUKEY. *Exploratory Data Analysis*, Addison-Wesley, 1977