

Ceci n'est pas la data: Towards a Notion of Interaction Literacy for Data Visualization

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The VisBIA 2018 - Workshop on Visual Interfaces for Big Data Environments in Industrial Applications invited Benjamin Bach to talk about interaction literacy in data science and visualization. He has been involved in numerous visualization projects over the last years, also with many international collaborations. This paper introduces Benjamin Bach and his work and briefly outlines the contents of the talk.

CCS Concepts: • **Information systems** → **Recommender systems**; Search interfaces; • **Human-centered computing** → *Interaction paradigms*; *Information visualization*;

Additional Key Words and Phrases: Design Informatics, Interaction Literacy, Visualization Literacy

1 PERSONAL INFORMATION

Benjamin is an Assistant Professor in Design Informatics and Visualization at the School of Informatics, University of Edinburgh. In his research he designs and investigates interactive information visualization interfaces to help people explore, communicate, and understand data. His research interests include:

- Network Visualization
- Visualization of spatio-temporal data
- Data-driven storytelling
- Visualization in Augmented and Virtual Reality (Immersive Analytics)
- Non-digital visualization
- Teaching and learning visualization

Before joining the University of Edinburgh in 2017, Benjamin worked as a postdoc at Harvard University (Visual Computing Group), Monash University, as well as the Microsoft-Research Inria Joint Centre. Benjamin was visiting researcher at the University of Washington and Microsoft Research in 2015. He obtained his PhD in 2014 from the Université Paris Sud where he worked at the Aviz Group at Inria. The PhD thesis entitled *Connections, Changes, and Cubes: Unfolding Dynamic Networks for Visual Exploration* got awarded an honorable mention as the Best Thesis by the IEEE Visualization Committee. His website can be found here: <http://benjbach.me>.

2 TALK

We are seeing more and more people doing data visualizations in many different areas: digital humanities, bio-visualization, text visualization, data journalism, visualization of health data, visualizing the brain, visualizing transportation, visualization trends on twitter, etc. Data visualizations are becoming commonplace in news articles, on websites, and museums. We see new economies emerging around the need for data visualization; start-ups and companies and with them coming new jobs and new creativity. With more courses in the universities, more people get trained in data visualization in recent years and many of them are selling their skills as data visualization designers/coders/researchers, etc.

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As more and more people use data visualizations in their daily work, we need to assure training people in interpreting and using visualization; we need to be sure people use and learn these novel and powerful visualizations from research and design. There are many concepts related to the understanding of data and visualization, including *data literacy* as well as *visualization literacy*. Data literacy refers to the ability to explore, analyze, and communicate data in a very general sense [13]. Visualization literacy has been described by Boy et al. as *the ability to use well established data visualizations (e. g., line graphs) to handle information in an effective, efficient, and confident manner* [7].

In this talk, I am reflecting on another new literacy for the data-age: *Interaction Literacy*. I want to define Interaction Literacy as the *ability to explore and interrogate data through visualization interfaces*. Interaction literacy is the skill to proactively engage with data through several forms, to ask questions, to be critical about the presented data, to look for strategies to extract knowledge and insight from the data. In short interaction literacy is complementing data and visualization literacy for the component of interaction. In this sense, interaction literacy has some similarities to Human-Data-Interaction (HDI) [9]. However, HDI is not specifically focusing on data exploration and exploratory data analysis, but on the much larger complex of assuring data privacy and manage data ecosystems.

In the following, I demonstrate some aspects of interaction literacy on my own projects.

HiPiler (<http://hipiler.higlass.io>) is a project visualizing small subregions in large Hi-C matrices [10]. Hi-C matrices are used in genomic science to explore genome foldings. Finding subregions (patterns) of some 10×10 pixels in large matrices of 3 million \times 3 million cells is tedious problem potentially requiring extensive exploration through pan and zooming. Instead, HiPiler extracts patterns suggested by an algorithm and provides an extensive interface to explore these patterns independently from their position in the matrix. HiPiler allows for ordering, clustering, and filtering snippets, as well as laying them out in scatterplots and using multidimensional scaling. HiPiler requires interaction literacy on a low level, i.e. knowing the functionality of the interface and which interface components lead to which actions.

Matrix Cubes are a visualization metaphor and interaction interface for dynamic networks [2]. The underlying metaphor are space-time cubes constructed from stacked adjacency matrices. While this visualization generally is a 3D visualization, users must apply transformation operations on the cube to obtain more legible and task-appropriate visualizations; projection, filtering, decomposition, rotation etc. Matrix Cubes, due to their relative freedom of interaction, highlight a further aspect of interaction literacy; interaction with visualization models. A user must understand the visualization metaphors and model, then learning which operations he/she can apply. Besides learning how the specific interface works, this kind of interaction literacy requires learning specific strategies and when to use which operation onto the cube.

While Matix Cubes was designed for 2D interfaces, in other projects we have investigated different interaction modalities involving virtual reality, augmented reality and tangible interfaces [8]. These projects, explored with 3D visualizations such as Matrix Cubes, but also scatterplots and other space-time cubes [1]. More direct and natural interaction in these modalities require interaction literacy on a physical level, related to the spatial and immersive nature of the interface: pointing and selecting in space, moving within and around visualizations, moving cutting planes, and eventually gestures. Some of these aspects, we studied for augmented reality with the HoloLens [4] and are further investigating with the notion of the AR-CANVAS [5], a design space and conceptual model for visualizing situated data in augmented reality.

Interaction literacy, as illustrated by these projects is a wide term that demands more precise thinking about how to improve interaction skills of future citizens with data visualization interfaces. As many deceptive examples of charts have shown [11], a single (static) visualization rarely shows any truth at all (here is where the title of this talk is coming from: *Ceci n'est pas la data*—it's (one very specific) picture of the data). Interaction literacy is the skill to teach people to be critical, to search for multiple perspective, to explore the data, and to be objective about the data, more so if the storyteller is not. Interaction literacy requires an open mind-set. It's the skill to ask

questions and try to organize the chaos in which we find ourselves when approaching data. While interaction literacy poses more questions than it can provide answers, I think it is powerful means to describe the current state of (interactive) data visualization and the need for more care towards end-users, especially with respect to simplicity and training. One possible solution for approaching interaction illiteracy might be data-driven storytelling [12]. Especially data comics [3, 6] might provide an easily accessible way to tell compelling stories with data and to explain complex processes (data transformation and analysis, patterns in data visualization, interaction, etc.) in a linear and visual way.

Similar to data literacy and visualization literacy, interaction literacy might help us better understanding the needs of end-users of data visualization interfaces and not just design for interaction and exploration, but think about activities we can engage people in understanding data, being critical, especially audiences without special training in any of the data related disciplines; exhibitions, games, workshops and classroom teaching, discussions, etc.

The slides for this talk can be found online: <http://aviz.fr/~bbach/talks/interactionliteracy.pdf>.

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