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Title and Abstract

Data Visualizations of Complex Systems

The visual representation of information requires a deep understanding of human perceptual and cognitive capabilities, data mining and visualization algorithms, interface and interaction design, as well as creativity. Data is typically non-spatial and needs to be mapped into a physical space that represents relationships contained in the information faithfully and efficiently. If done successfully, data visualizations combine human and machine intelligence to solve tasks that neither could accomplish alone.

Börner's *Atlas of Forecasts* uses advanced data visualizations to introduce different types of computational models, and it demonstrates how model results can be used to inform effective decision-making. The models aim to capture the structure and dynamics of developments in education and the job market, progress in science and technology, and the impact of government policies—all from the micro to the macro levels. Model results can help us decide which human skills are needed in an artificial intelligence–empowered economy; which courses and degrees are most effective in upskilling and reskilling the current and future workforce; what progress in science and technology is likely to happen; and how policymakers can future-proof regions or nations.

Last Christmas, the *Atlas of Macroscopes: Interactive Data Visualizations* became available in stores around the globe. Transcending the static nature of the maps featured in the initial atlas trilogy, macroscopes, or interactive data visualizations, give us holistic views of complex systems or networks. They provide an entry point for scientists and laypeople alike and empower us to engage directly with large datasets and to conduct our own lines of questioning. As portals to continuously evolving data, macroscopes can serve as windows to the dynamics of any terrain—personal or professional, local or global—and offer key insights into our surroundings and even our place in the universe.

Börner's recent work focuses on the Human Reference Atlas (HRA) that aims to develop a common coordinate framework (CCF) for the healthy human body, see HRA Portal at https://humanatlas.io. Diverse interactive user interfaces make it possible to explore data provided by 25+ international consortia: The Exploration User Interface (EUI, https://apps.humanatlas.io/eui) let's users examine data coverage across scales—from the whole body to the single cell level. The Cell Distance Explorer (CDE, https://apps.humanatlas.io/cde) computes and visualizes distance distributions

between different cells, cell types, and anatomical structures and cell types and morphological features. For project goals, data, code, and hands-on exercises visit the Visible Human MOOC (VHMOOC, https://expand.iu.edu/browse/sice/cns/courses/hubmap-visible-human-mooc) or join the talk.

Bio

KATY BÖRNER is the Victor H. Yngve Distinguished Professor of Engineering and Information Science in the Departments of Intelligent Systems Engineering and Information Science, Luddy School of Informatics, Computing, and Engineering; core faculty of the Cognitive Science Program; and founding director of the Cyberinfrastructure for Network Science Center (http://cns.iu.edu)—all at Indiana University in Bloomington, Indiana. She is a curator of the *Mapping Science* exhibit (http://scimaps.org) and she leads the international Human Reference Atlas effort (https://humanatlas.io). She holds an MS in electrical engineering from the University of Technology in Leipzig, and a PhD in computer science from the University of Kaiserslautern. Börner is a Fellow of the American Association for the Advancement of Science (AAAS), a Humboldt Research Fellow, an Association for Computing Machinery (ACM) Fellow, Network Society Fellow, and a Stiftung Charité Visiting Fellow.

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