Information Visualization State of the Art and Future Directions

Staša Milojević
School of Library and Information Science
Indiana University Bloomington
Bloomington, IN 47405
smilojev@indiana.edu

Chaomei Chen
College of Information Science and Technology
Drexel University
Philadelphia, PA 19104
cc345@drexel.edu

Bradley M. Hemminger
School of Information and Library Science
University of North Carolina Chapel Hill
Chapel Hill, NC 27599
bmh@ils.unc.edu

Loet Leydesdorff
Amsterdam School of Communication Research
University of Amsterdam
1012 CX Amsterdam
loet@leydesdorff.net

Jason Priem
School of Information and Library Science
University of North Carolina Chapel Hill
Chapel Hill, NC 27599
priem@email.unc.edu

Scott B. Weingart
School of Library and Information Science
Indiana University Bloomington
Bloomington, IN 4740
weingart.scott@gmail.com

ABSTRACT
The panel explores the theoretical, metric, algorithmic, and design aspects of state-of-the-art information visualization, and offers insights regarding the challenges and future directions in this field. The goal of the panel is to start a collaborative discussion around a number of important themes.

Keywords
Information visualization.

INTRODUCTION
Visual representations have become a hallmark of modern society and the key techno-cultural phenomena of our world. The wide-spread influence and popularity of information visualization can to a large extent be attributed to growing programming literacy and the availability of data. In parallel to a collective fascination and the ubiquity of visual representation, information visualization has blossomed into a thriving and rapidly expanding research area. It is an interdisciplinary field that spans a wide array of domains: from information retrieval, digital libraries, scientometrics, networks science to, most recently, the humanities.

And while using images to represent a world around us may be as old as the human civilization, using information visualization to understand data is a much more recent phenomenon. Information visualization is increasingly becoming a legitimate method (alongside established methods such as experimentation and modeling) for discovering patterns and structures in data. Recently, attempts were made to use visualization to capture the changing dynamics of different systems (Chen, 2006b). Thus, visualizations are no longer an end goal in and of themselves, but a point of departure for exploring the world around us. Visualizations have been used to map timelines (Rosenberg & Grafton, 2010), science (Börner, 2010; Boyack, Klavans, & Börner, 2005; Chen, 2003, 2006a; Leydesdorff, 1987; Leydesdorff & Rafols, 2012; Leydesdorff & Welbers, 2011), literature (Moretti, 2007), and blogosphere (Lima, 2011).

ASIST 2012, October 28-31, 2012, Baltimore, MD, USA.

Like any other representation, visual representations serve as powerful metaphors that shape the way we view, organize and classify the world. Some of the most popular and powerful representations used are trees (used to represent hierarchies), cartographic maps, and, more recently, the networks.

This panel will explore the theoretical, metric, algorithmic, and design aspects of state-of-the-art information visualization and offer insights in both the challenges and the promising future directions.

The goal of the panel is to start a collaborative discussion around a number of important themes:

-Information visualization as a process vs. the final product;

-Information visualization for representation vs. for scientific exploration;

-The influence of large data sets and powerful tools on the development of visualizations;

-The visualization within and outside Information Science;

-Structural vs. dynamic visualizations;

-What are the most fruitful theoretical conceptualizations;

-The need for the establishment of standards.

FORMAT

The topic will be introduced briefly by the moderator and each panelist will give a short (approximately 10 min.) presentation in which they outline their views on the current best practices, major challenges, emerging cutting-edge research, tools, techniques and the major developments expected in the near future. After the panelists have given their presentations, the audience will be encouraged to engage with the panel and each other about the topic. The moderator will facilitate the discussion and the issues raised by the panelists will be used as the springboard for the discussion. This format should capitalize on the diverse expertise of the panel and stimulate interactivity.

PANELISTS

Staša Milojević is an Assistant Professor in the School of Library and Information Science at Indiana University Bloomington. Her research focuses on studying how modern scientific disciplines/fields form, organize, and develop. She approaches modern scientific fields/disciplines as complex heterogeneous socio-cultural networks of people, ideas, documents and institutions. In large-scale longitudinal studies of fields such as nanotechnology she combines models, theories, and methods from information science, science and technology studies, and social network analysis. She will moderate the session.

Chaomei Chen is an Associate Professor in the College of Information Science and Technology at Drexel University. He is a Chang Jiang Scholar (visiting professor) at Dalian University of Technology, China (2008-2011) and has been a visiting professor at Brunel University in the United Kingdom (2002-2008). His research interests include information visualization, visual analytics, knowledge domain visualization, mapping scientific frontiers, and theories of scientific discoveries and creativity. Dr. Chen is the author of *Turning Points: The Nature of Creativity* (Springer, 2011), *Information Visualization: Beyond the Horizon* (Springer 2004, 2006) and *Mapping Scientific Frontiers: The Quest for Knowledge Visualization* (Springer 2003). He is the founder and the Editor-in-Chief of the journal *Information Visualization* and an editorial board member of *Journal of Informetrics*. Dr. Chen has published over 170 peer-reviewed publications in journals and conference proceedings. Dr. Chen created the widely used software CiteSpace for visualizing and analyzing emerging trends in scientific literature. CiteSpace has been used by users in over 3,800 cities of 105 countries.

Brad Hemminger is an associate professor at the School of Information and Library Science (SILS) at the University of North Carolina. His research interests include digital scholarship, information seeking, visualization and user interface design, digital libraries and biomedical health informatics. A particular current focus is the application of analytical and visualization tools to large data sets in the sciences. He has published over 85 papers, served on several international standards committees, and consulted for a number of companies in the areas of visualization and user interfaces. He teaches Information Visualization at SILS, and is the director of the Informatics and Visualization Lab at UNC, as well as the Center for Research and Development of Digital Libraries.

Loet Leydesdorff is a Professor in the Dynamics of Scientific Communication and Technological Innovation at the Amsterdam School of Communications Research (*ASCoR*) of the University of Amsterdam . He is Visiting Professor of the Institute of Scientific and Technical Information of China (*ISTIC*) in Beijing, and Honorary Fellow of *SPRU* – the Science and Technology Policy Research Unit of the University of Sussex . Leydesdorff has published extensively in systems theory, social network analysis, scientometrics, and the sociology of innovation. Dr. Leydesdorff is the author of monographs *The Knowledge-Based Economy: Modeled, Measured, Simulated* (2006), *A Sociological Theory of Communication: The Self-Organization of the Knowledge-Based Society* (2001) and *The Challenge of Scientometrics: The development, measurement, and self-organization of scientific communications* (1995). He received the *Derek de Solla Price Award* for Scientometrics and Informetrics in 2003 and held *"The City of Lausanne " Honor Chair* at the School of Economics , Université de Lausanne, in 2005.In

2007, he was Vice-President of Computing Anticipatory Systems (CASYS'07). Dr. Leydesdorff has created a number of software tools for visualization and animation.

Jason Priem is a doctoral student at the University of North Carolina at Chapel Hill, studying how the Web is revolutionizing scholarly communication. Jason has been a leader in the altmetrics movement, investigating new measures of scholarly impact on the social Web, and also helps to lead the open-source total-impact project. He has been involved in creating both interactive and static visualizations.

Scott B. Weingart is a doctoral student of Information Science and History & Philosophy of Science at Indiana University Bloomington. His overarching research is in modeling and mapping the growth of science on a large scale – thematically, geographically, and temporally – hoping eventually to reveal what conditions yield the most rapid rate of discovery and innovation. As a member of the Cyberinfrastructure for Network Science Center he has been involved in the development of large scale network analysis software.

REFERENCES

Börner, K. (2010). *Atlas of science: Visualizing what we know*. Cambridge: MIT Press.

Boyack, K. W., Klavans, R., & Börner, K. (2005). Mapping the backbone of science. *Scientometrics, 64*(3), 351-374.

Chen, C. (2003). *Mapping scientific frontiers: The quest for knowledge visualization*. London: Springer.

Chen, C. (2006a). CiteSpace II: Detecting and visualizing emerging trends and transient patterns in scientific literature. *Journal of the American Society for Information Science and Technology, 57*(3), 359-377.

Chen, C. (2006b). *Information visualization: Beyond the horizon*. London: Springer.

Leydesdorff, L. (1987). Various methods for the mapping of science. *Scientometrics, 11*, 291-320.

Leydesdorff, L., & Rafols, I. (2012). Interactive Overlays: A New Method for Generating Global Journal Maps from Web-of-Science Data. *Journal of Informetrics, 6*(3), 318-332.

Leydesdorff, L., & Welbers, K. (2011). The semantic mapping of words and co-words in contexts. *Journal of Informetrics, 5*(3), 469-475.

Lima, M. (2011). *Visual complexity mapping patterns of information*. New York: Princeton Architectural Press.

Moretti, F. (2007). *Graphs, maps, trees: Abstract models for literary history*. London: Verso.

Rosenberg, D., & Grafton, A. (2010). *Cartographies of time: A history of the timeline*. New York: Princeton Architectural Press.