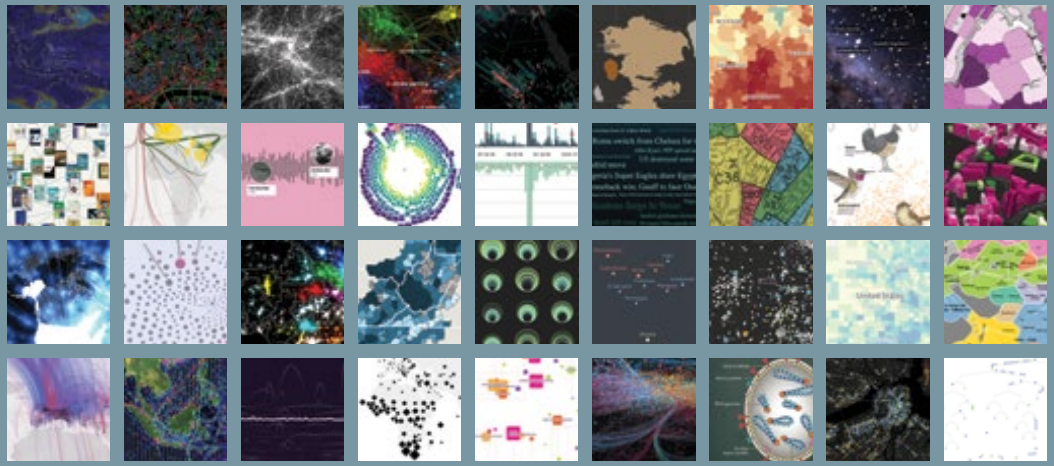


Macroscopes for a Global Future



20 YEARS

PLACES & SPACES
MAPPING SCIENCE

ANNUAL REPORT 2024

A Message from the Curators

Exhibit curators Elizabeth G. Record, Todd N. Theriault, and Katy Börner in Luddy Hall on the campus of Indiana University, the institutional home of *Places & Spaces*.

Celebrating 20 years of *Places & Spaces* at the "Macroscopes for a Global Future" event in June.

This year, the *Places & Spaces: Mapping Science* exhibit turned 20. As is to be expected, such a major milestone offers the opportunity for a bit of celebration. We're proud of the work we've done with *Places & Spaces*, and we're continually amazed by the impressive maps, macroscopes, sculptures, and illustrations contributed to the exhibit by talented creators over the past two decades. But a 20th anniversary is also an appropriate occasion for self-reflection. As curators, we found ourselves thinking a lot about where we've been, what we've achieved, and where we're going next.

We spent the last two decades identifying exemplary science maps and interactive data visualizations, or *macroscopes*, coaxing them out of sometimes highly specialized domains, and situating them in broader historical, social, and technological contexts that make them accessible to the general public. But to make something accessible means not only to make it intelligible; it also means to make it available and actionable. And so we work tirelessly to bring the exhibit to libraries, museums, classrooms, offices, websites, festivals, fairs—all places where people meet, learn, work, innovate, and play.

Katy Börner and Elizabeth G. Record greet early online attendees to the “Macroscope Tools for Global Challenges” event on September 20, 2024.

As our audiences have grown larger and more global, so have our aspirations. This is apparent in the very title of the exhibit’s 20th iteration: “Macroscopes for a Global Future.” In the ten years (2015-2024) that the exhibit has focused on interactive data visualizations, or macroscopes, we have witnessed a global pandemic, worldwide ecological disasters, and destabilizing international conflicts. This has only reinforced the conviction that if we are to survive and flourish as a species, we need to move beyond provincial and short-term thinking and understand that all challenges are ultimately shared challenges because all fates are intertwined.

With their ability to comprehend vast networks and reveal long-range causalities, Macroscopes are well suited for an era in which “thinking globally and long-term” has gone from trendy slogan to vital necessity.

As a whole, the 40 macroscopes—collected over the exhibit’s second decade—are powerful tools for understanding the large-scale economic, political, cultural, medical, educational, and ecological relationships that shape our lives in the here and now. Imagining a desirable future for ourselves and others, however, may require us not only to expand our thinking beyond the local, but also to expand our concept of intelligence beyond the human. It is in this direction that we will be headed in the exhibit’s third decade.

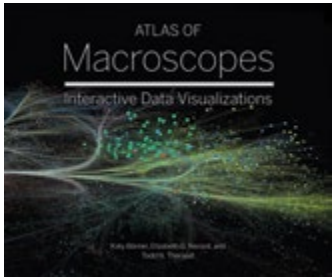
Todd N. Theriault highlights some of his favorite macroscopes during one of the many guided tours given over the five months the exhibit was on display at the University Collections at McCalla, Indiana University.

An image depicting the idea of multiple intelligences created by Katy Börner and the text-to-image AI tool Midjourney.

The *Places & Spaces: Envisioning Intelligences* exhibit planned for 2025–2034 will engage works that examine the multiple intelligences displayed by both biological and technological life forms. We hope to treat a wide range of intelligences—linguistic, kinesthetic, communication, musical, emotional, and more—from a variety of sources—human, animal, plant, and technological. Our aim in this is two-fold: to better understand the variational richness of intelligence and to inspire collaboration and coordination across intelligence types and life forms. We hope you'll join this exploration over the next decade.

No doubt, you will hear more about this new direction in the coming months. For now, though, we'd like to give our 20th year the retrospective it deserves. As you'll see in the pages that follow, 2024 was truly a momentous year for us. And it's been our true pleasure to share so many wonderful moments with all of you!

Atlas of Macroscopes



We spent a good portion of 2024 finishing up the *Atlas of Macroscopes: Interactive Data Visualizations*. This fourth entry in the *Atlas* series serves as a delightful companion to the second decade of *Places & Spaces*. All 40 macroscopes are featured in lavishly illustrated double-page spreads, with plenty of technical tidbits, data dives, and maker moments to enhance the reader's appreciation of these remarkable works.

This guided tour of the exhibit macroscopes is bookended by discussions of what makes a macroscope, how and why they work, what their strengths and limitations can be, and where they might go in the future. You'll be able to pick up a copy of the book at bookstores and online retailers starting September 2025.

Atlas authors Katy Börner, Todd N. Theriault, Elizabeth G. Record, and book designer Tracey L. Theriault show off their (temporary) MIT Press tattoos.

New Educator Assistant

Exhibit Educator Syd Overtoom joined the Places & Spaces exhibit team in November 2024

Syd Overtoom (he/they) graduated from Indiana University Indianapolis in 2024 with a Master of Arts in Museum Studies. They also received their Bachelor of Arts in East Asian Studies and minors in Human Sexuality and Gender Studies from Indiana University Bloomington in 2021. He has worked with the Monroe County History Center, the Wylie House, University Collections at McCalla, the Indiana Historical Society, and the Children's Museum of Indianapolis. Now, post-graduation, he is focused on balancing his career endeavors of both education and evaluation, which he is able to do working at CNS in education and outreach and the Children's Museum of Indianapolis in audience evaluation and research. When not at work, Syd spends his free time reading books, especially historical and educational non-fiction, and going on hikes with his family.

What are some of your chief responsibilities?

Communicating with exhibit venues and artists, representing the exhibit at events, and continuously keeping tabs on exhibit updates and projects. I also update the **scimaps.org** website with venue/event content, media pieces related to the exhibit, and information about those who help out with the exhibit, such as members of the advisory board. Additionally, I help with physical and digital elements of the exhibit, such as the maps in Luddy Hall.

What have you enjoyed most about your time with the exhibit?

I have loved getting hands-on experience of exhibit installation and running program activities. While at IUI, much of my focus was on creating curriculum materials for exhibits or audience evaluation, so I didn't do as much in-person programming or exhibit-related work. Working with the exhibit and CNS is letting me expand my museum skills in the best way, so it's been a lot of fun!

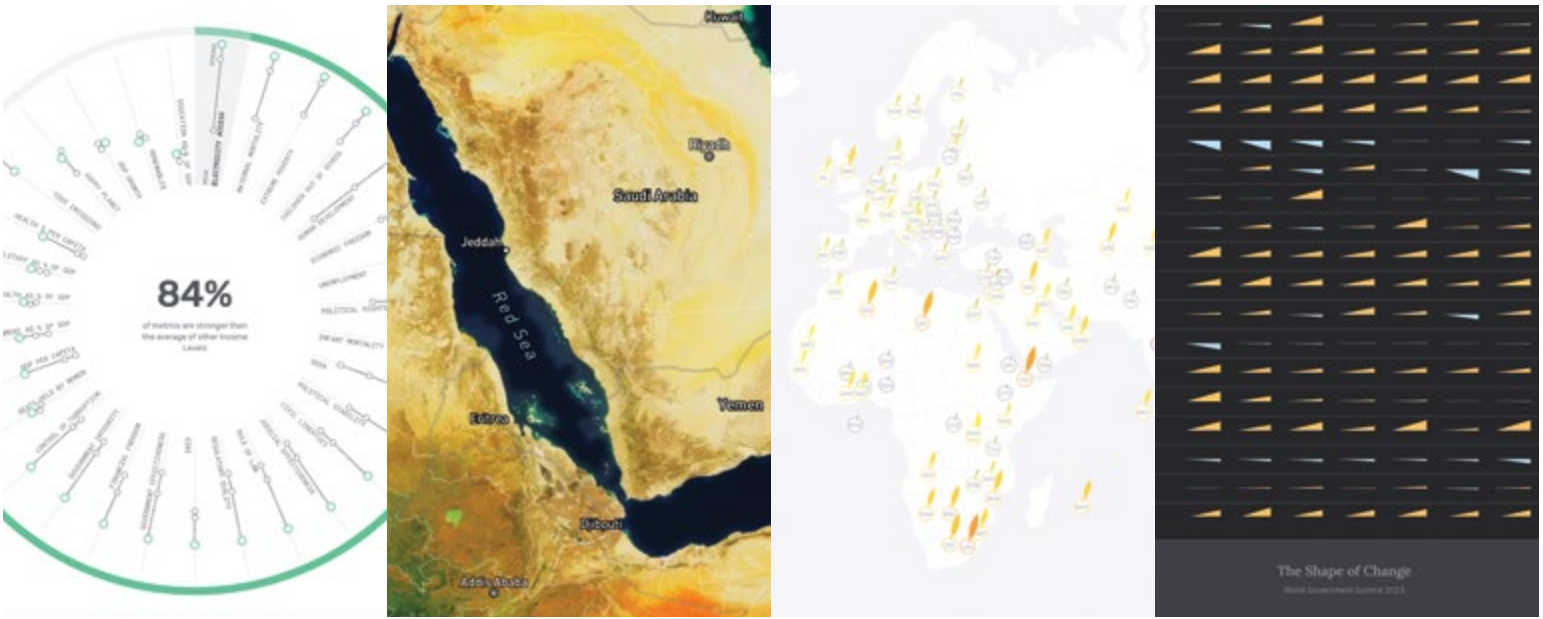
Do you have a particular exhibit memory that you'd like to share?

Working through the refresh for the Luddy building! For the iConference, we wanted to update the maps in the halls so there was a new array of content from *Places & Spaces*. I enjoyed figuring out which maps would work best based on theming and relevancy.

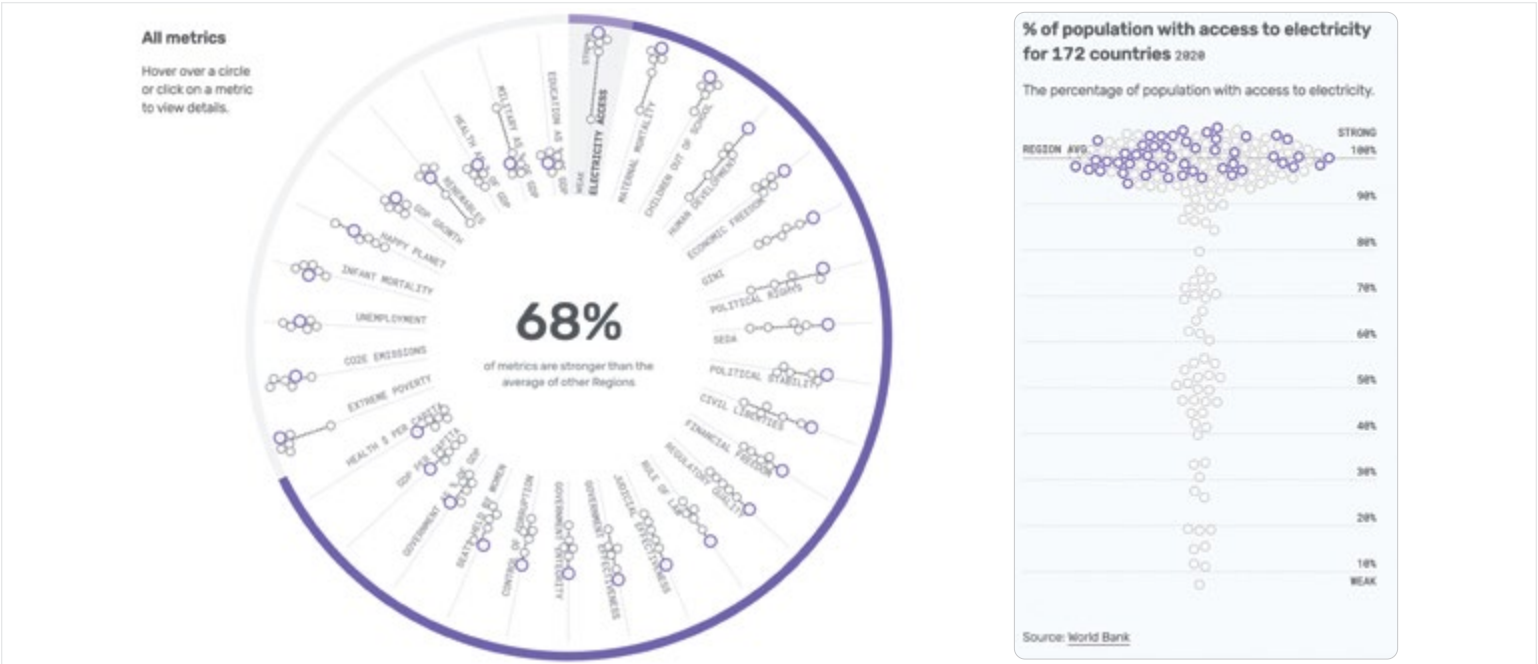
What museum project did you enjoy working on the most?

I've loved all the projects, but if I had to choose, it would be the *Sacred Places* project at the Children's Museum. It was an exhibit evaluation project that lasted for nine months, and it was also the exhibit I conducted research on for my graduate program. I got so much experience from that one project since I got to do exhibit observations, surveys, interviews, focus groups, and data analysis and reporting. I even got to propose an evaluation question for the entire evaluation process! It was an unforgettable experience working on such a wonderful multi-cultural exhibit while progressing as a museum professional.

Macroscopes for a Global Future

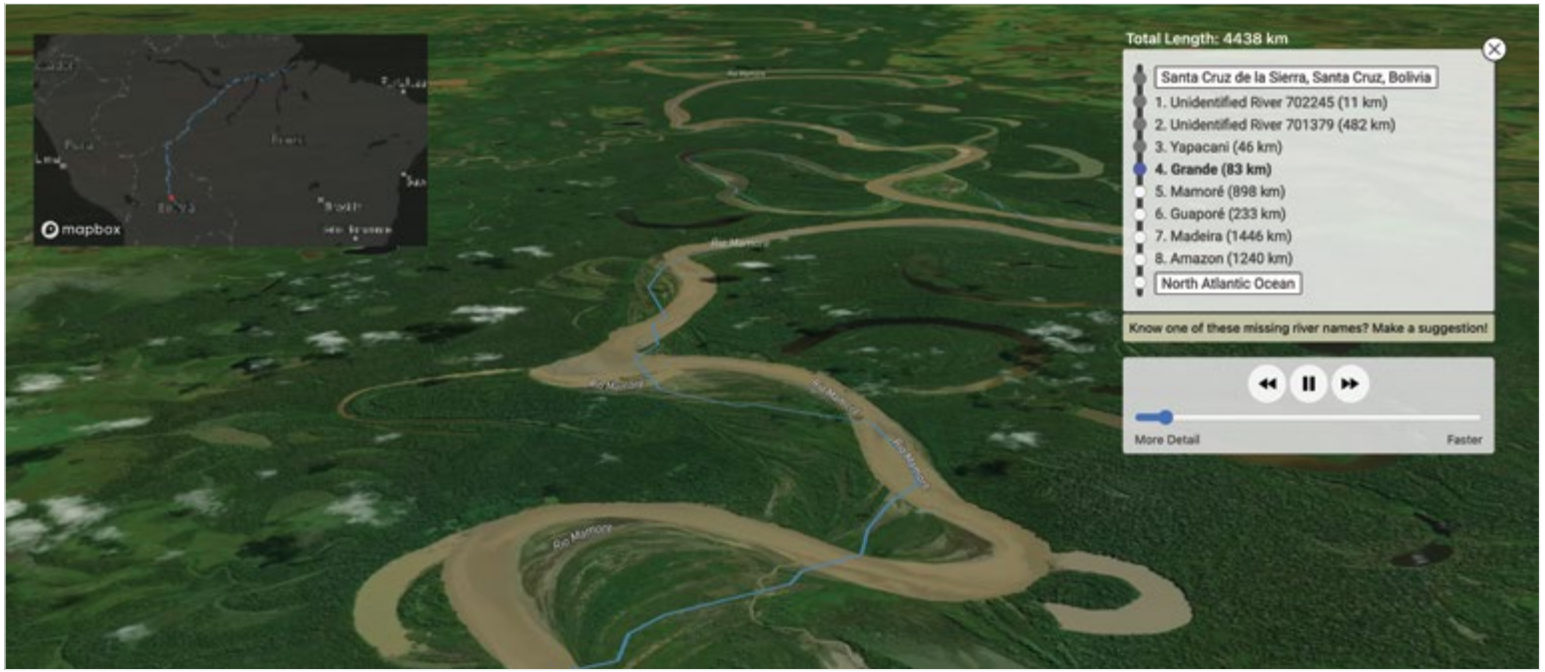


Our world is fast becoming a vast network of dependent relations. In this web of connections, individual actions can have widespread ramifications. Therefore, our tools for understanding this global future must be broad in scope, nuanced in analysis, and mindful of context. The macroscopes in this year's iteration all share those characteristics. They have a distinctly global scope and a big picture bias. Using large and complex datasets, they provide a planetary perspective on the subjects they cover. Multifactor analysis teases out the effects of indirect dependencies as well as more visible relationships. They also understand that visualizations that engage are the ones most likely to influence people's views and actions. Thus, their interfaces are intuitive, allowing users to focus on the topic rather than the tool. To flourish in the future, we must recognize that all fates are connected. Macroscopes with a global perspective can reinforce this reality and help us chart a path into our collective future.



How Do We Compare?

This winner of the 2023 World Data Visualization Prize allows users to compare nations of the world according to 31 economic, social, and environmental metrics. Understanding that context is key, this dashboard encourages comparison by region and income level. A high-income country, for instance, may have a lower percentage of people living in poverty than many other nations around the world. However, that same statistic may not look so great when compared to other high-income countries. Users can get acquainted with this macroscope by pressing the shuffle button at top of the dashboard. This will show how data points are arranged on both the main radial graph and the dot plot in the sidebar. From there, you can select comparisons from the drop-down menu. Or you can get more specific information by hovering over individual data points.

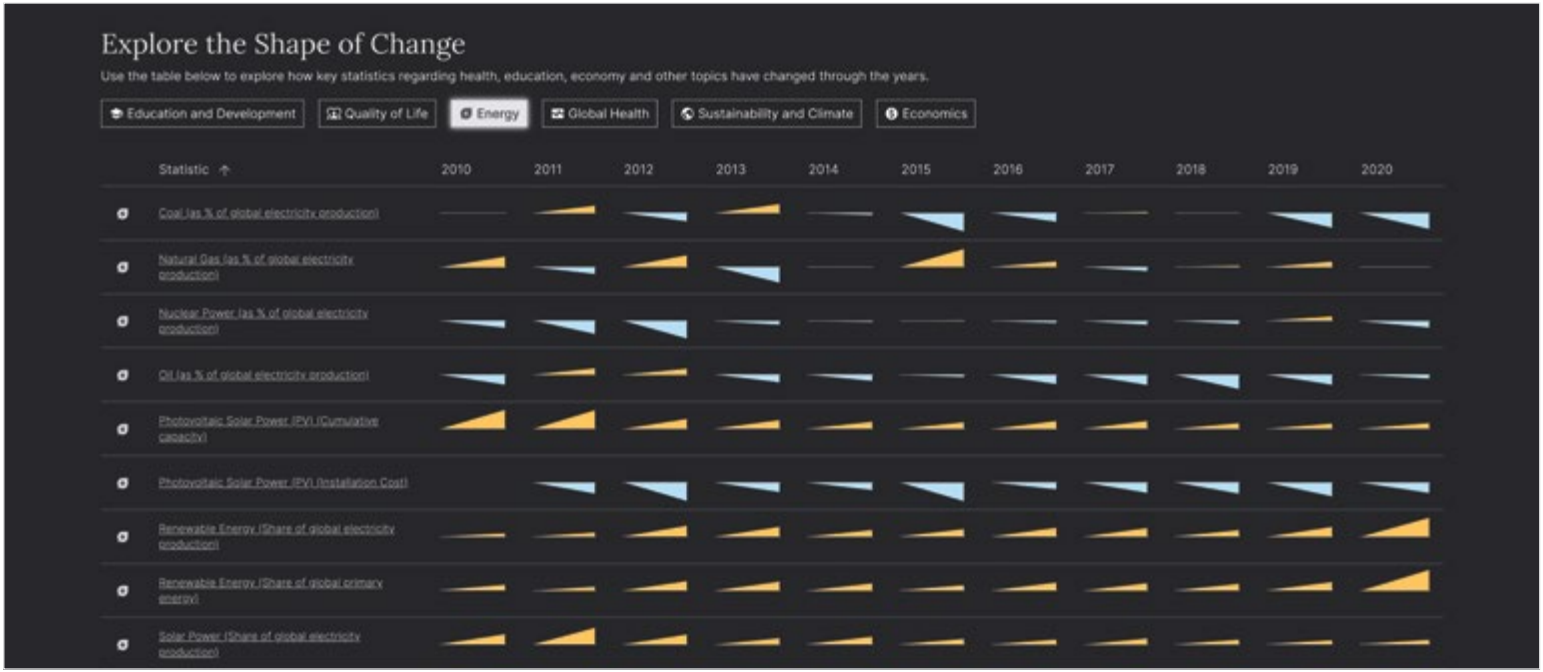


River Runner

For map lovers, few things are more enjoyable than tracing a path from your present location to some longed-for destination. What route would be the quickest or the most interesting? What might you see along the way? The joy of imaginative map exploration is perfectly captured in this visualization from graphics journalist Sam Learner. *River Runner* allows us to place a virtual drop of water anywhere in the world and watch as it makes its way across a three-dimensional map to the nearest large body of water. As it rolls from river to river, we follow its journey from a bird's-eye view. This soaring perspective allows for some amazing views of the landscape while also giving us a sense of the distance our water drop must travel. In the end, we are left both thrilled by the journey and mindful of the interconnectedness of the world's vast aquatic ecosystem.

The Whole Picture

Every day, our world becomes more connected. This allows for messages, ideas, and goods to travel faster and farther than ever before. But as this macroscope demonstrates, connections can lead to vulnerabilities. *The Whole Picture* looks at one of our most crucial networks: the global food supply chain. It reveals how disruptions, delays, or sanctions can affect the flow of goods in unexpected ways. It's easy to see how problems with grapes in Italy could lead to a shortage of wine in Europe. What's less obvious is how a shock to U.S. soybeans can affect pork and poultry production in places like Panama, Egypt, and Indonesia. By using a network model that accounts for both food and the materials that go into producing it, *The Whole Picture* is able to capture the interdependent nature of this vital global system.



The Shape of Change

Every so often, an event occurs that turns the world's attention to a global crisis. At such times, voices of outrage will demand action, and politicians will make promises. But years later, we may be left wondering: did anything really change? The *Shape of Change* taps into this very human concern by first reminding us of some prominent news stories that raised awareness of issues like oil dependency, air pollution, and global literacy. We are then asked if these problems have improved or not, and we can check our answers against statistical data. Further down, a series of charts track developments in key health, economic, and environmental areas. For each year, a wedge shape efficiently communicates whether change in that area was positive or negative. By challenging preconceived notions about global challenges, The *Shape of Change* replaces subjective perception with empirical data.

Venues & Events

McCalla

From June 6 to November 3, 2024, the exhibit was featured at the University Collections at McCalla, a beautiful historic building on the Indiana University campus. On display in the gallery were 40 macroscopes, 40 maps of science, two *WorldProcessor* globes, two sculptures, the *Humanexus* film, and a dress adorned with Ward Shelley's *History of Science Fiction*. McCalla proved to be a wonderful location for hosting events in conjunction with the exhibit's 20th anniversary. Its close proximity to our offices made it convenient to lead impromptu tours of the exhibit with students, visiting artists and scholars, and members of the community.

20th Debut Event

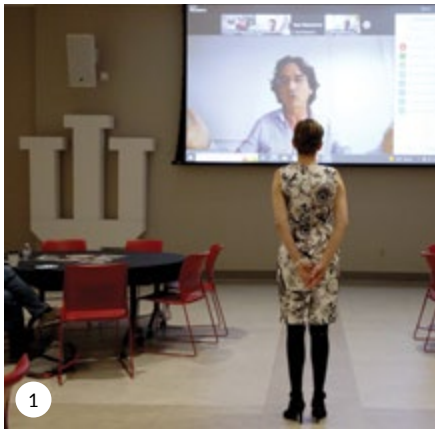
The debut of "Macroscopes for a Global Future," the 20th iteration of *Places & Spaces*, occurred on June 6, 2024, the opening day of the exhibit at McCalla. The event was jam packed with talks by exhibit curators, behind-the-scenes tours of the new macroscopes by the makers themselves, curator-led guided tours, a VR demo, and a screening of *Humanexus*. More photos from the event are available at **scimaps.org/venues**.

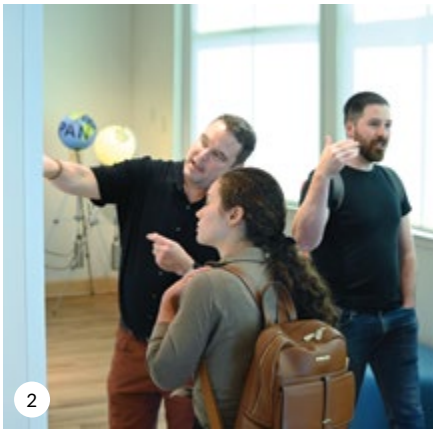
① Visitors to the exhibit at McCalla taking a moment to look a bit closer; ② Exploring *River Runner* on the macroscope kiosk; ③ Elizabeth G. Record welcomes macroscope makers Sam Learner, Rita Costa, Beatriz Malveiro, and Liuhuaying Yang; ④ The debut event was the perfect opportunity to catch up with both longstanding friends of the exhibit and also some new fans; ⑤ A detail from Carrie E. Longley's "Sculpture of Science;" ⑥ Ingo Günther's "The Shape of Science," a three-dimensional print of Richard Klavans and Kevin W. Boyack's *UCSD Map of Science* dataset of 2006.

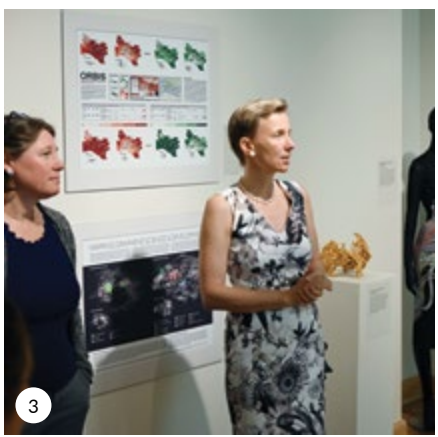
Macroscope Tools for Global Challenges

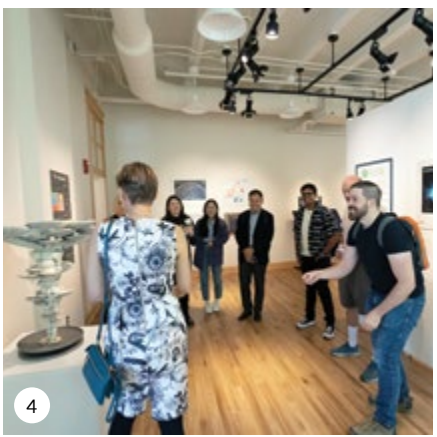
As part of our ongoing 20th anniversary celebrations, we asked a group of distinguished international scholars to help us think about how macroscopes can address the many global challenges we all face. Representatives of such prestigious institutions as the French National Centre for Scientific Research (CNRS), the Chinese Academy of Sciences, the Université de Franche-Comté, the Royal Netherlands Academy of Arts and Sciences, and Elsevier were on hand to share their perspectives and expertise. The talks were followed by Q&A, lively conversations, refreshments, and guided tours of the exhibit. More information about the event is available at **scimaps.org/venues**.

Yunwei Chen of the Chinese Academy of Sciences speaks on mapping the development and structure of science.









① David Chavalarias of CNRS joins from Paris to discuss how political polarization on social media affects elections; ② Todd N. Theriault introduces attendees to some of his favorite pieces; ③ Elizabeth G. Record and Katy Börner discuss the exhibit maps; ④ Attendees interact with the "Sculpture of Science."

Inspired by Nature

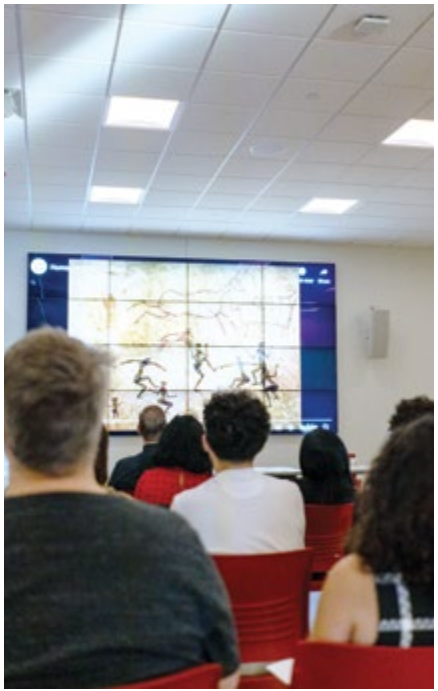
Connections Between Art, Science, and Engineering

On November 22, *Places & Spaces* collaborated with the Sidney and Lois Eskenazi Museum of Art for an evening of exploring the connections between science and art. In her talk, Katy Börner introduced *Inspired by Nature*, a collection of art pieces motivated by an appreciation for biological processes and the beauty of the natural world at multiple scales. Energized by the works on display, both speaker and audience engaged in a conversation about noticing and nurturing harmonies between nature, science, and art.

① Katy Börner introducing the *Places & Spaces* exhibit, a longstanding example of connecting science and art; ② Hands-on activities at the museum; ③ Artist and educator Angela Caldwell stands next to her beadwork piece, "Beauty is Everywhere."

Works in the collection, from left: *Capillus Linus (HairLine)*, 2009, Carrie E. Longley; *Molecular Galaxy*, 2017, Beata Edyta Mierzwa; *Beauty Is Everywhere*, 2024, Angela Caldwell; *Tabula Floris*, 2024, Luke Nikolov; *CeCe and Squiggy*, 2024, Shouvik Maiti, Melanie B. Goldstone, and Todd N. Theriault. See more about the exhibit at **cns-iu.github.io/workshops/2024-11-18_inspired_by_nature**.

Humanexus Film Screening and Panel Discussion



The event included a screening of *Humanexus and* remarks from the panel on fostering civil discourse.

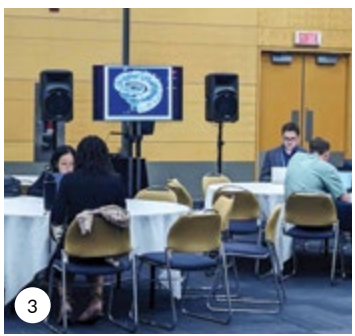
Talking Together

Days before the presidential election in the United States, *Places & Spaces* and the IU Museum of Archaeology and Anthropology collaborated for an event promoting civic and civil discourse. The evening began with a screening of *Humanexus*, followed by remarks from Katy Börner, Lisa-Marie Napoli (Director of the Political and Civic Engagement [PACE] program), and Keith Barton (Professor of Curriculum and Instruction), all scholars who study and model effective communication. Audience members then formed groups to discuss some of the impediments to considerate civic discourse and how political discussion can be maintained in a way that is illuminating, not inflammatory.

Fruitful small-group discussions exemplified the goal of the evening.

Additional Venues

The exhibit was featured in poster presentations at The Future of Scientific Conferencing in June and at Japan's National Institute of Science and Technology Policy Public Online Symposium in December. As has become a yearly tradition, the exhibit took part in both IU's ScienceFest and First Thursday series.



① Katy Börner presented the exhibit at the National Graduate Institute for Policy Studies (GRIPS) in Minato, Tokyo; ② Maps of science were displayed during the Visualizing Complexity Science Workshop held at the Complexity Science Hub in Vienna, Austria; ③ The exhibit was also featured at NetSci 2024, the International School and Conference on Network Science, held in Québec City, Québec, Canada.

Exhibit by the Numbers

Exhibit finances are managed by the Cyberinfrastructure for Network Science Center at the Luddy School of Informatics, Computing, and Engineering at Indiana University. Shown below are exhibit expenditures for January 1–December 31, 2024.

2024 Expenses

Compensation: $8,982
General Expenses: $3,100
Total: $12,082

2024 Revenue

CNS Support: $12,082
Total: $12,082

Exhibit in Numbers (since 2005)

Exhibit Maps: **100**
Exhibit Macroscopes: **40**
Mapmakers: **215**
Macroscope Makers: **112**
Display Venues and Events: **481**
Press Items: **219**
Workshops Organized: **45**
Website Visits: **8,129,121**

Exhibit Advisors

The Indiana University exhibit team benefits greatly from the expert input it receives from this international advisory board. Advisory board members review exhibition submissions and provide their expertise and guidance to the exhibit on many levels.

Gary Berg-Cross is a cognitive psychologist (Ph.D., SUNY–Stony Brook) who has taught at a number of institutions over his career (SUNY, Widener, University of Delaware, George Washington, George Mason University, and others). For eight years, he served as the Spatial Ontology Community of Practice (SOCoP) Executive Secretariat helping to run workshops and vocabulary development efforts to advance the field. Currently, Berg-Cross serves as a consulting knowledge engineer on earth science projects and is co-organizer of the annual Ontology Summit hosted at NSF and NIST. [Potomac, MD, USA]

Bonnie DeVarco writes and lectures on design science, virtual worlds, next-generation geographic information systems, information visualization, and the culture of cyberspace. Previously, DeVarco was a Distinguished Visiting Scholar with the Media X Research Network at Stanford University (2009-2012) and served as chief archivist for the Buckminster Fuller Archives. Currently, DeVarco is completing a book on Buckminster Fuller and is coauthor with Eileen Clegg of *Shape of Thought*, on the history and evolution of visual language. [Palo Alto, CA, USA]

Ingo Günther has tried to cross-infuse journalism and art even before he founded the first independent TV station in Eastern Europe (Leipzig's Channel X) in 1989. That same year he began the Worldprocessor project, which has resulted in well over 1,000 modified thematic globes that not only reside in museum collections but have also graced the covers and pages of political magazines (Foresight, Harper's). His works have appeared in museums all over the world, including the Nationalgalerie Berlin, the Guggenheim Museum, Kunsthalle Düsseldorf, Espacio Buenos Aires, Iwaki City Art Museum, Somerset House in London, Hood Museum at Dartmouth, and the MIT Museum. [Karlsruhe, Germany]

Francis Harvey is head of the Department of Cartography and Visual Communication at the Leibniz Institute for Regional Geography and professor of Visual Communication in Geography at the University of Leipzig, Germany. His research and teaching activities center around geographic information systems (GIS), particularly their technologies, applications, ethical dimensions, and societal implications. Harvey's *Primer of GIS: Fundamental Geographic and Cartographic Concepts* (Guilford, 2015) is now in its second edition. [Leipzig, Germany]

Peter A. Hook is director and associate dean of the Washington University Law Library. He received his doctorate from the Luddy School of Informatics, Computing, and Engineering at Indiana University where his primary research focus was information visualization, particularly the visualization of knowledge organization systems, concept mapping, and the spatial navigation of bibliographic data in which the underlying structural organization of the domain is conveyed to the user. [St. Louis, MO, USA]

Lev Manovich is professor at the City University of New York (CUNY) Graduate Center and author of several books on digital culture, including *Software Takes Command* (Bloomsbury Academic, 2013). In 2007, Manovich founded the Software Studies Initiative in order to develop a new paradigm of Cultural Analytics through data analysis and interactive visualization of patterns and trends in media and visual cultures. [New York, NY, USA]

Elijah Meeks is the executive director of the Data Visualization Society and a data visualization engineer at Apple. His prior experience includes working in the digital humanities at Stanford and developing data visualization applications at Netflix. He is the author of D3.js in Action, the data visualization library Semiotic, and various essays on the subject of modern professional data visualization. His work includes the development of data visualization libraries, tools and exploratory applications. [Los Gatos, CA, USA]

André Skupin, professor of geography at San Diego State University, is interested in the application of geographic metaphors, cartographic principles, and computational methods to the visualization of non-geographic information. His research is interdisciplinary, aimed at increased cross-fertilization between geography, information science, and computer science. Recent work includes novel methods for visualizing human movement and demographic change as trajectories in n-dimensional attribute space. [San Diego, CA, USA]

Olga Subirós is an architect, curator, exhibition designer, and founder of Olga Subirós Studio. She is currently curating the Matter Matters exhibition at the DHub-Design Museum of Barcelona. Subirós curated the project AIR at the Architecture Venice Biennale 2021. She co-curated (with José Luis de Vicente) Big Bang Data, a major exhibition of data-driven artworks and objects that provide crucial insight into the world of big data. From 2014–2018, the exhibit toured worldwide, appearing at the Centre de Cultura Contemporànea de Barcelona (CCCB), Fundación Telefónica in Madrid, Somerset House London, ArtScience Museum Singapore, Centro de Cultura Digital in Mexico, and the DOX Centre for Contemporary Art in Prague. Subirós is a guest lecturer for the Master's in Data Design program at the ELISAVA Barcelona School of Design and Engineering. [Barcelona, Spain]

Tim Utter is the director of the Social Sciences and Clark Library at the University of Michigan where he manages a team of seventeen librarians and a dozen students. His duties include curating a map collection of around 425,000 items, and he enjoys sharing items from the collection through K-12 and university class visits, tours, and open houses. He is also responsible for creating and bringing in exhibits. [Ann Arbor, MI, USA]

Stephen Uzzo is currently chief technology officer for the National Museum of Mathematics and former chief scientist for the New York Hall of Science. He works in museum planning and design and research initiatives to study and integrate data-driven and complexity science into teaching and learning. Dr. Uzzo is concerned with providing opportunities for underserved learners to navigate a future in which AI and big data predominate and the risks of misuse of personal data expand. [New York, NY, USA]

Benjamin Wiederkehr is funding partner and managing director of Interactive Things, a design and development studio for human data interaction. He is part of the Open Government Data task force in Switzerland and helps to facilitate open access to government data for everyone. Wiederkehr organizes the Data Visualization Zürich lecture series and writes, speaks, and teaches about the intersection of data, design, and people. [Zürich, Switzerland]

Host the Exhibit

The *Places & Spaces* exhibit travels in a variety of formats to fit every space and budget. Visit **scimaps.org** to explore the many ways you can bring the exhibit to your space. In the meantime, see what others are saying about hosting the exhibit:

"The University of Michigan's Clark Library was very excited to host the newest iteration of the Places & Spaces *exhibit, "Macroscopes for a New Perspective." We had hundreds of visitors, including several university and a few K-12 classes that came to view the exhibit, and in some cases included it in their coursework. It was especially rewarding to see parents come in with their children and spend long periods exploring topics in the Macroscopes."*

—**Tim Utter**, Director, Social Sciences and Clark Library, University of Michigan

"This exhibit reveals the power that a good visualization has to convey complex information. Visualizations tell the story of data in a way that isn't readily evident when you're only looking at raw numbers."

—**Kristi Holmes**, Director, Galter Health Sciences Library and Professor of Preventive Medicine (Health and Biomedical Informatics) and Medical Education at the Feinberg School of Medicine, Northwestern University.

"Hosting Places & Spaces: Mapping Science *was a wonderful opportunity for Duke. The diversity of maps meant that there was something for everyone. It was also incredibly meaningful to be able to get up close and see all of the magnificent detail of the complex visualizations. There was always something new to discover in the exhibit. It brought the campus community together around data visualization and enriched the environment in which we teach, research, work, and play."*

—**Angela Zoss**, Interim Head, Assessment and User Experience Strategy, Duke University

Exhibit maps and macroscopes, high-definition touchscreen macroscope kiosk, and views of Ingo Günther's WorldProcessor Globes.

Resources

Books and Essays

Börner, Katy. 2010. *Atlas of Science: Visualizing What We Know.* Cambridge, MA: The MIT Press. (**mitpress.mit.edu/books/atlas-science**)

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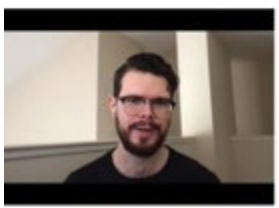
Ingo Günther: Artist of spherical information

Kalev Leetaru on how news stories create unlikely communities

Marc Smith: Taking snapshots of virtual communities



Nikita Rokotyan on creating *An Alternative Data-Driven Country Map*

Nikita Rokotyan on the power of dimensionality reduction

Steven Ross on the origins of the *Watson News Explorer*

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MAPPING SCIENCE

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