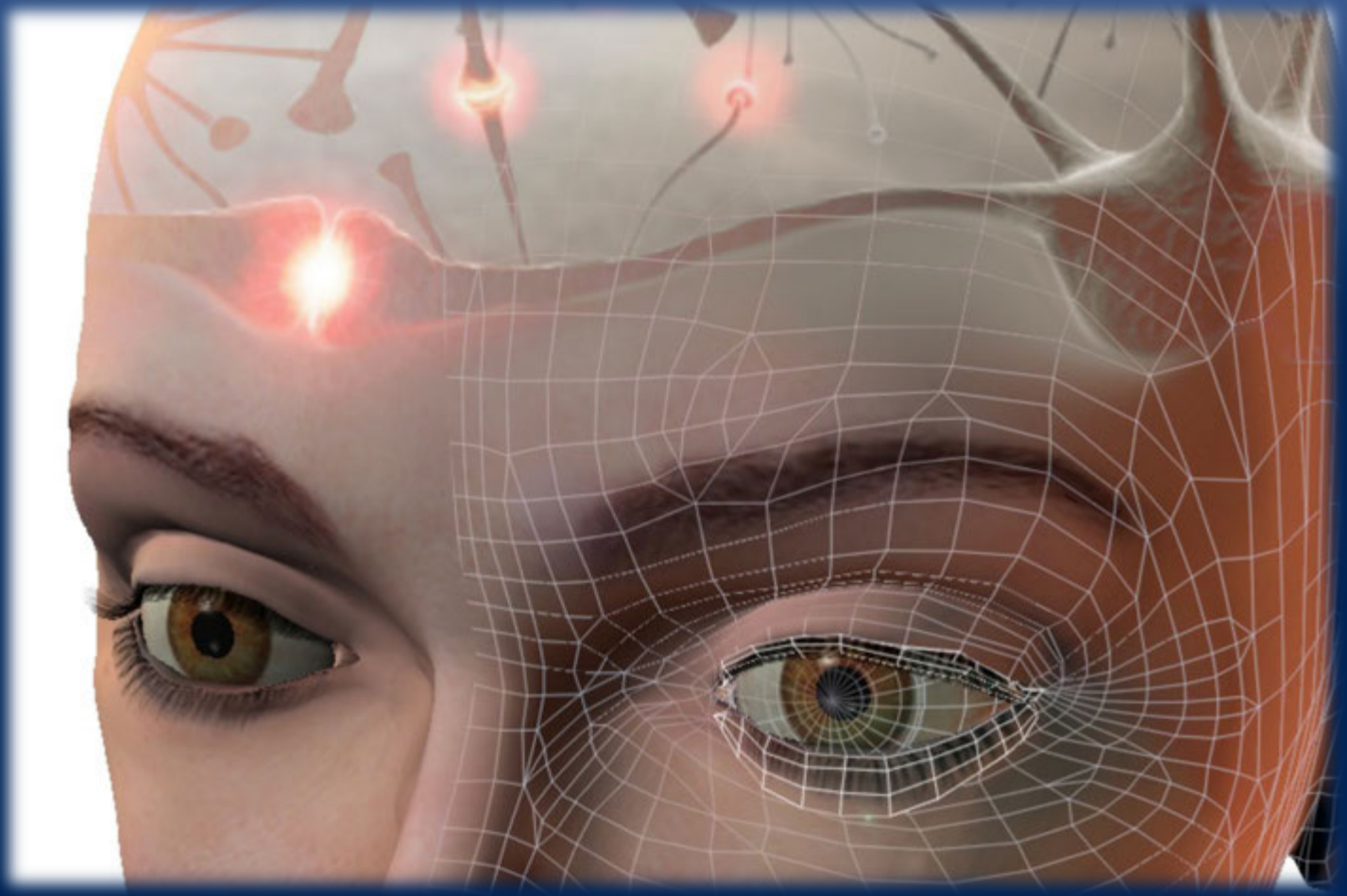
Insight Through Images: Visualization and Collaboration Technologies for Exploring Big Data



Maxine D. Brown, Director
UIC Electronic Visualization Laboratory

Electronic Visualization Laboratory

- Established 1973
- 4 full-time staff
- Currently 15 funded grad students, 6 undergrads
- Interdisciplinary CS, Art, Bio-medical, Communications, etc.
- Work in partnership with universities, research labs, non-profit orgs and industry.

EVL's Focus – Integrated, Visualization and Virtual Reality Collaboration Spaces

"Lenses" for Data Exploration

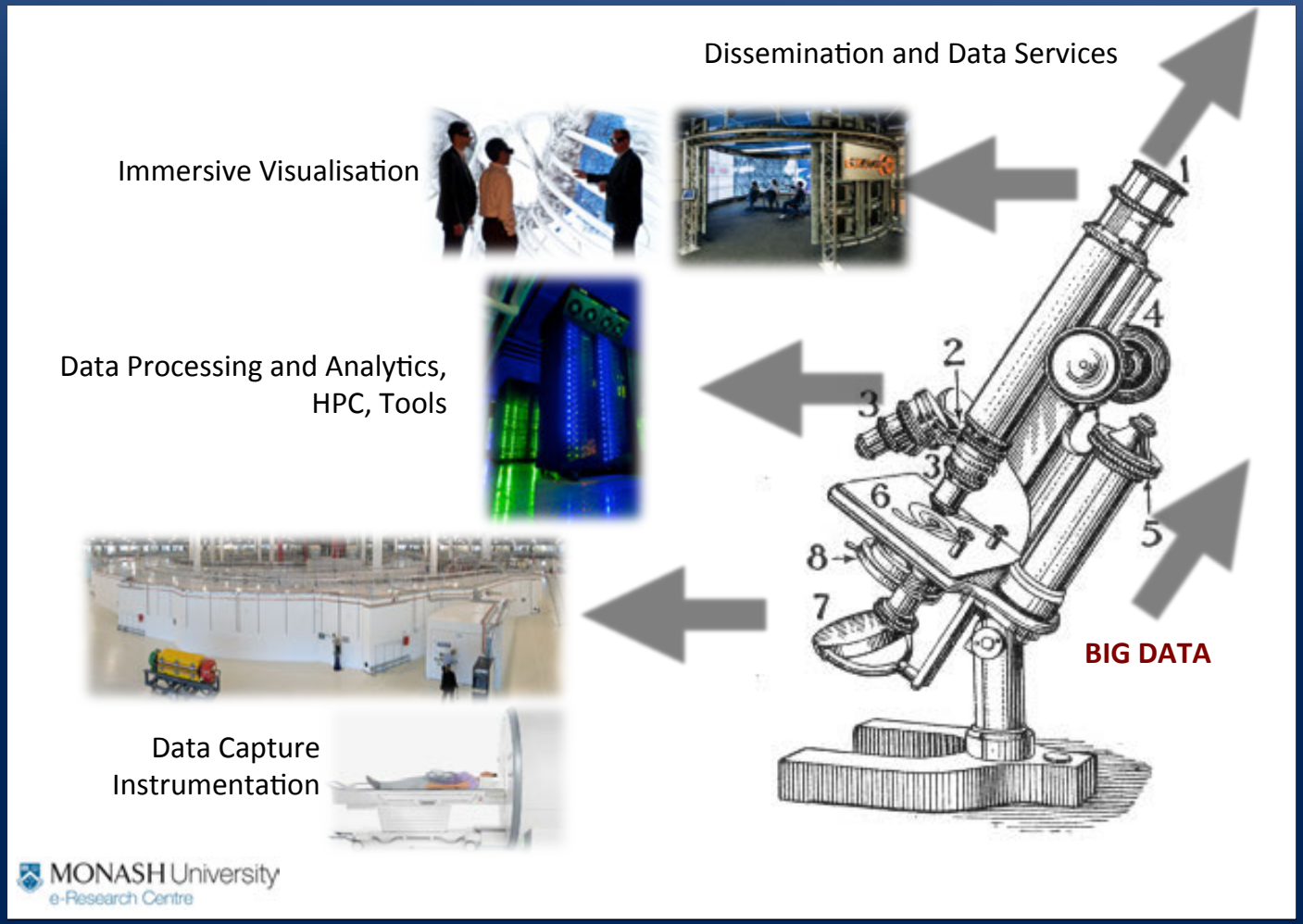


Image: Paul Bonnington, eResearch Centre, Monash University

Electronic Visualization Laboratory, University of Illinois at Chicago

Today The World Is Increasingly Data Driven

- Data is now easy to acquire and growing faster than we can analyze it.
- Data is growing in complexity – multiple and different types of data need to be fused to enable discovery.
- Getting a handle on scale and complexity are the challenges.

How Do Mortals Deal With Scale and Complexity? Merging Northwest & Delta Airlines

IN THE BEGINNING: BRIDGING

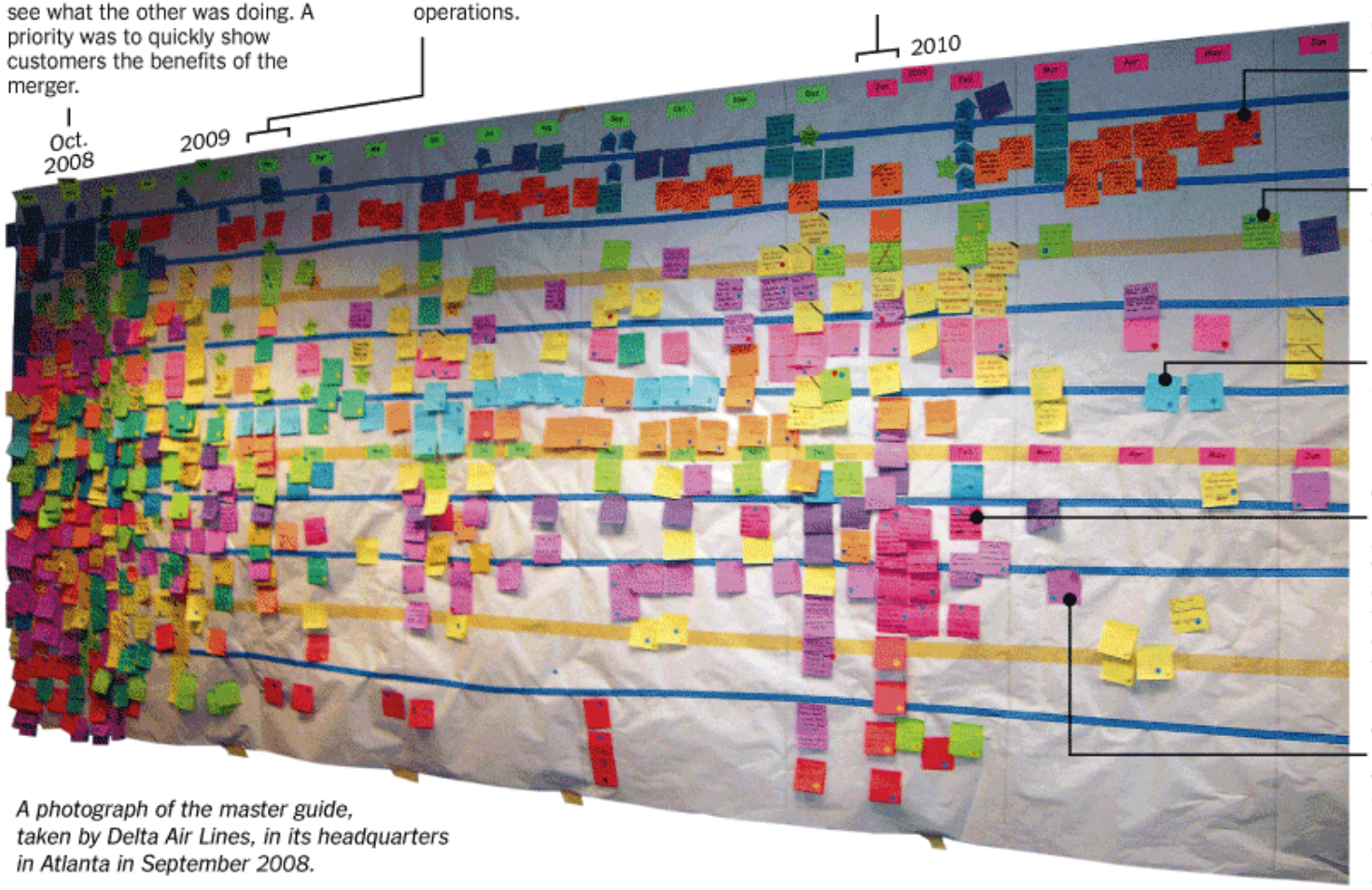
In the months around October 2008, when the merger was closed, there was a flurry of "bridging" projects: opening up access between the airlines' computer systems so each could see what the other was doing. A priority was to quickly show customers the benefits of the merger.

THE NEXT STEP

About five months after the merger, the two airlines began "cross-fleeting," when critical systems like reservations had to start talking to each other. But they remain separate operations.

ONE AIRLINE, ONE BRAND

Delta received final government approval to operate as a single airline in January 2010. At that point, all the computer systems could be switched to unified platforms. Many, like reservations and seat availability and pricing, had to be switched over at the same time.



A photograph of the master guide, taken by Delta Air Lines, in its headquarters in Atlanta in September 2008.

AIRPORTS AND GATES

Orange notes indicate changes in customer service at airport counters and kiosks.

ALLIANCE PARTNERS

Bright green notes were for updates in coordinating with the airlines' partners, like Air France-KLM.

LOYALTY PROGRAMS

Light blue notes show steps in integrating customer loyalty programs.

AIRPORT OPERATIONS

Pink notes represent airlines' interaction with the airports — coordinating gates, flights and communications with the control tower.

AIRCRAFT CONTROL

Light purple notes were for changes in the systems that keep track of where flights are, rerouting and cancellations.

How Do Mortals Deal With Scale and Complexity? Antarctic Drilling Program

Managing Scale and Complexity in Teams

"War" Rooms / Project Rooms help us come together to solve problems that are too complex for us to individually manage.

What Lessons Can We Learn?

- Spread information out
- Organize information in a variety of ways- e.g. spatially
- Link between information
- Work together with others on the information
- Make the result persistent for later referral

EVL Enables Discoveries Through Interdisciplinary Collaborations Using Visualization Technologies

Electronic Visualization Laboratory, University of Illinois at Chicago

SAGE2: Scalable Amplified Group Environment

- Middleware to access, display, and share high-resolution digital media on scalable resolution display environments
- SAGE2 is a total rewrite of SAGE using web technologies
- Multi-touch interaction (one or many people)
- Push laptop windows or laptop screens onto a wall

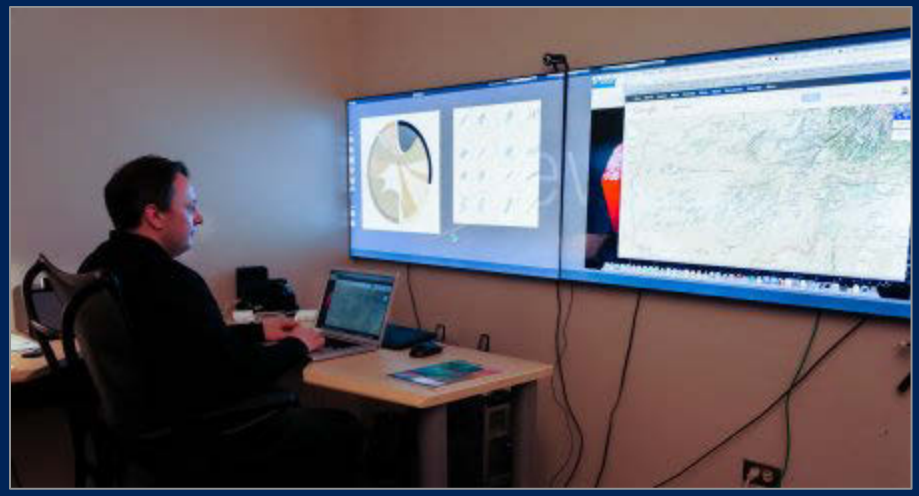
www.sagecommons.org

Electronic Visualization Laboratory, University of Illinois at Chicago

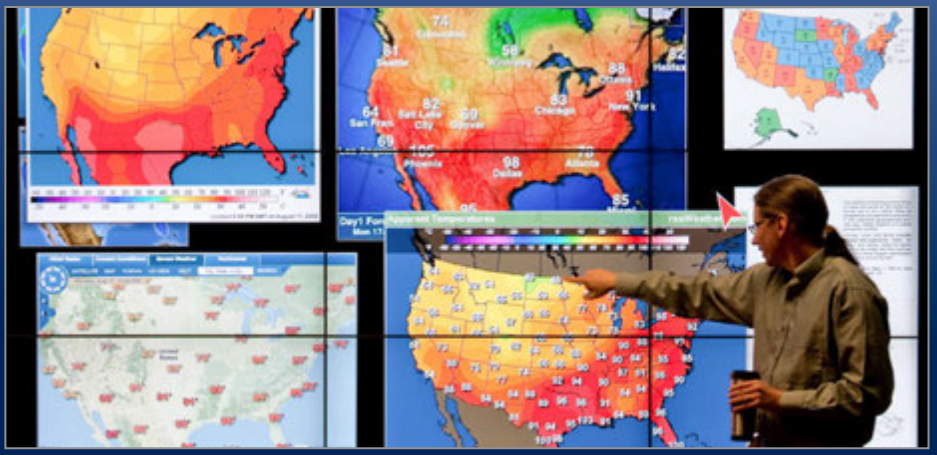
SAGE2: Scalable Amplified Group Environment

Display Walls in Shared Offices and Single Offices

How EVL Developers Work



EVL Local and Remote Collaborations



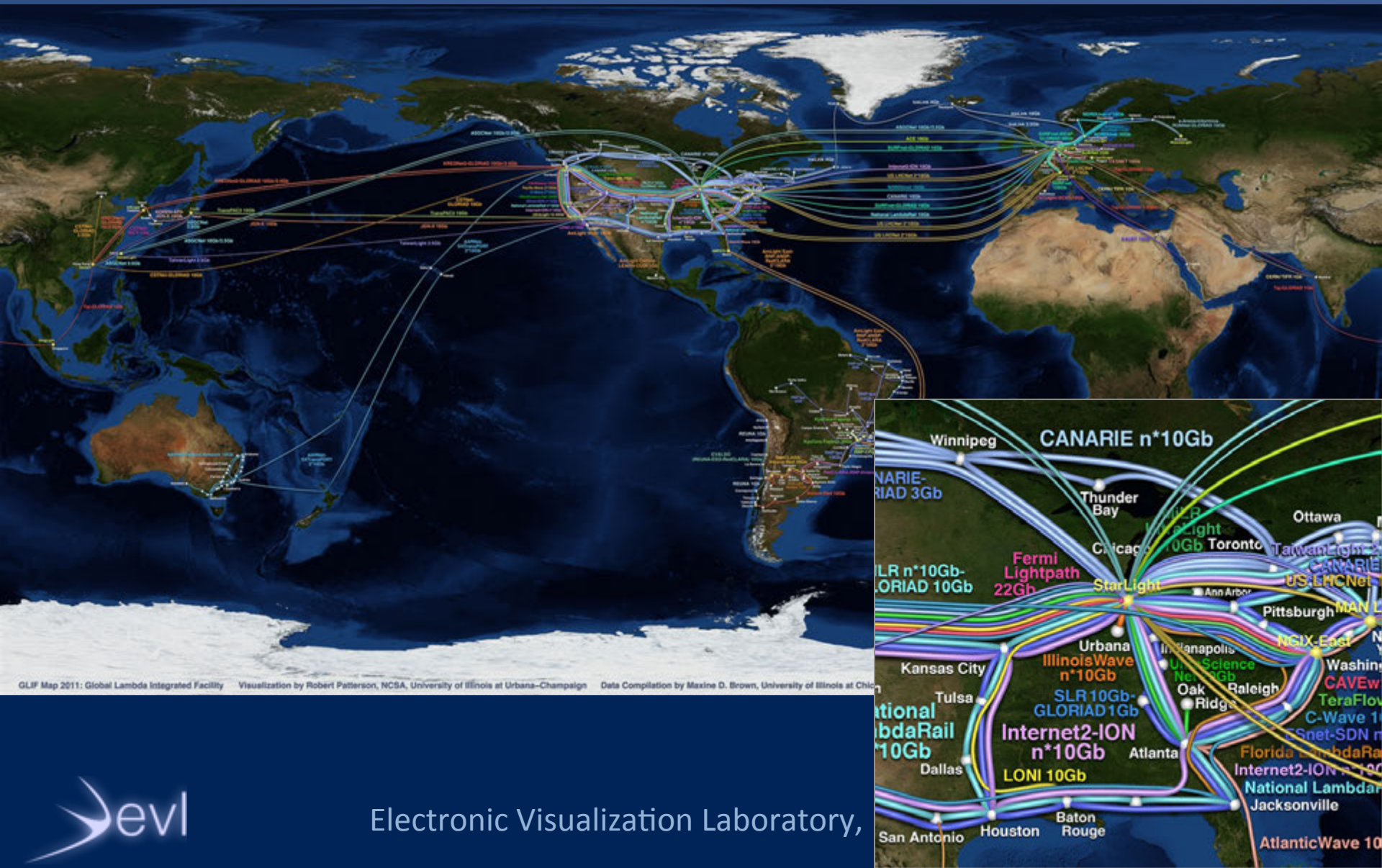
Teaching Visual Analytics Class

EVL Brainstorming Session

Geoscientists Analyze Data

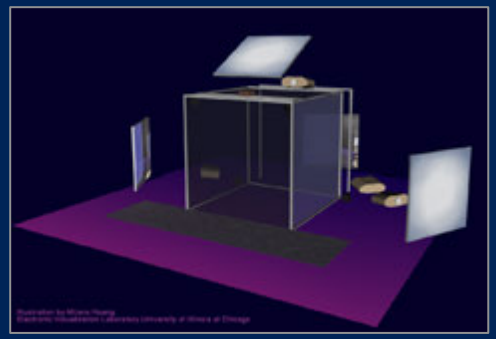
EVL/NCSA Virtual School

Global Lambda Integrated Facility



CAVE: Local and Remote Collaboration

CAVE, introduced 1992



Rem Koolhaas, IIT and SARA

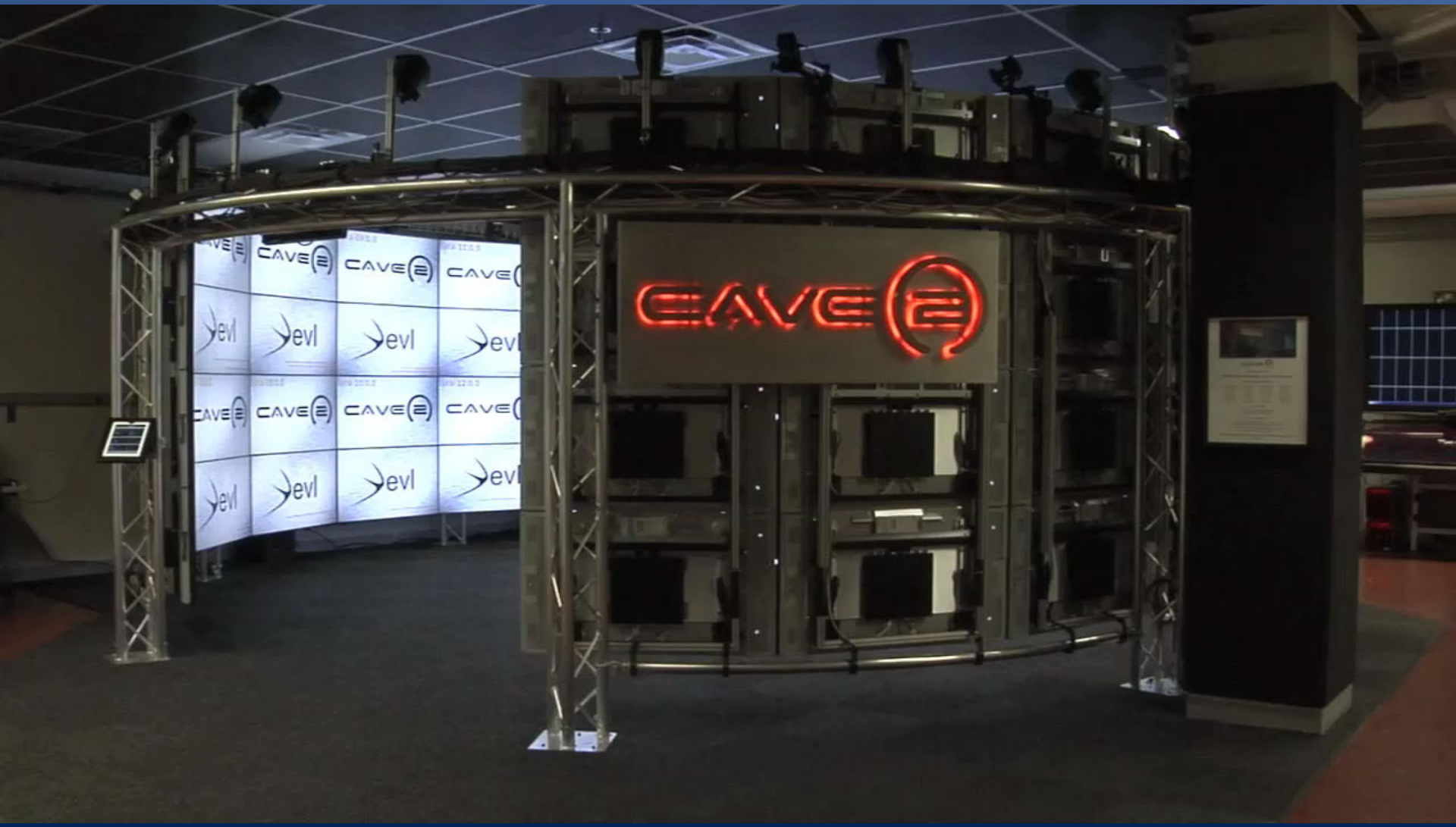
Virtual Harlem, with U Missouri

General Motors Research

NCSA and Caterpillar

CAVE2™ Merges Benefits of Immersive Virtual Reality with Ultra High Resolution Tiled Display

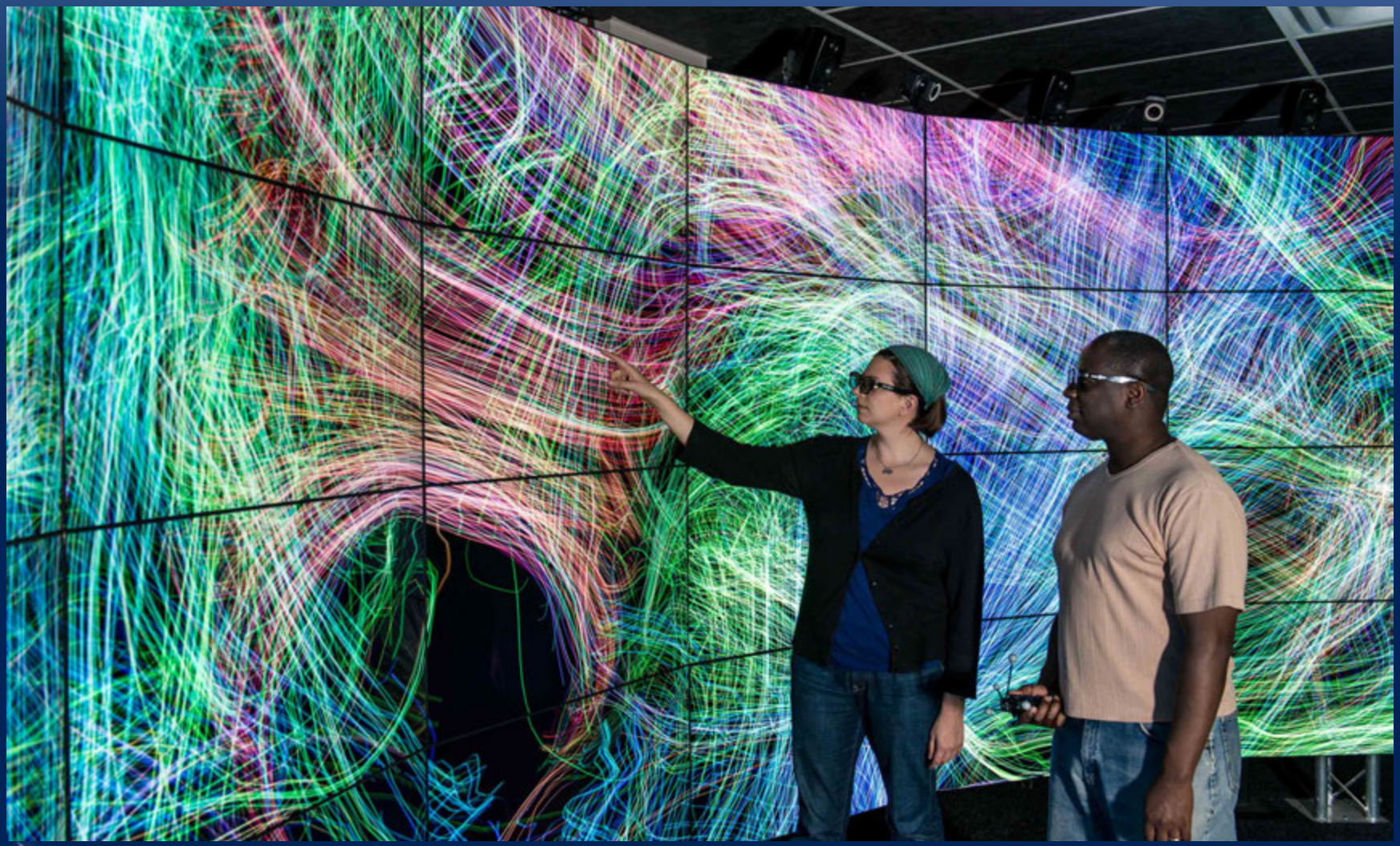
CAVE2 Applications



5-Million Atom Simulation from Argonne Leadership Computing Facility for Nanoscale Material Science Research

Connectome: Map of Brain's Neural Connections

Streamlines Depict White Matter Fiber Tracts in the Brain (MRI Diffusion Tensor Images), Color-Coded by their Primary Direction



NASA ENDURANCE Project

Environmentally **N**on-**D**isturbing **U**nder-ice
Robotic **AN**tarcti**C** **E**xplorer

UIC Hands-on Automated Nursing Data System (HANDS)

Patients' Care During Nurse Hand-Offs Studied to Understand Care vs. Outcomes in Standardized Formats Across Time and Units.

City of Chicago, Office of CIO

City-Wide Understanding of Crime Data

Electronic Visualization Laboratory, University of Illinois at Chicago

EVL Sponsors

- Funding from Federal agencies, industry and non-profit institutions
- Fostering early adoption by supporting user communities
- Providing educational experiences to students, who receive jobs upon graduation

Thank You!

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