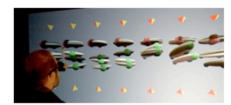
Dan Keefe McKnight Land-Grant Assistant Professor Department of Computer Science and Engineering University of Minnesota



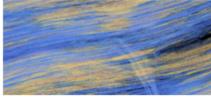
UNIVERSITY OF MINNESOTA'S INTERACTIVE VISUALIZATION LAB

HOME → RESEARCH → PROJECTS

Research Projects



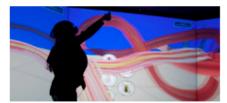
NSF CAREER: Visualizing Scientific Motions



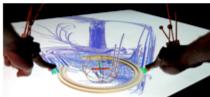
National Academies / Keck Foundation: Intelligent Interactive Imaging (3I)



Art and Design in Visualization



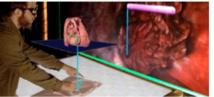
3D Modeling, CavePainting, and Drawing on Air



3D User Interfaces (Multi-Touch, Haptics, Virtual Reality)

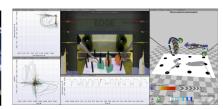


Next Generation Immersive Visualization Environments



Virtual Prototyping of Medical Devices Virtual Classics





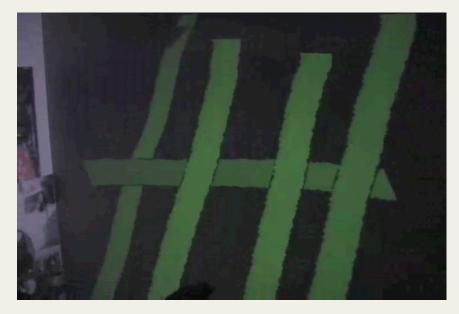
Data-Driven Surgical Training

Our Computer Science Research Computer Graphics Human-Computer Visualizations of Data Interfaces Data-Intensive Computing

What brings me here?

My own art practice - I need at least one foot in this door.

Interest/experience in collaborative research.





CavePainting & Making la Guitarrista Gitana 13D 2001, SIGGRAPH Art Gallery 2002, ...

my art practice: form through movement, the expressiveness of the hand in virtual space



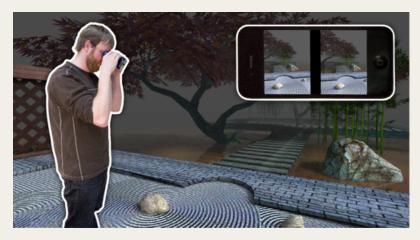
Hiding Spaces with Cynthia Beth Rubin SIGGRAPH 2002, ISEA 2002.







"Advanced Virtual Environments" course:







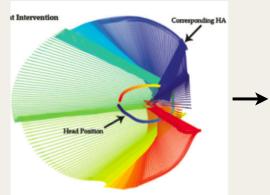






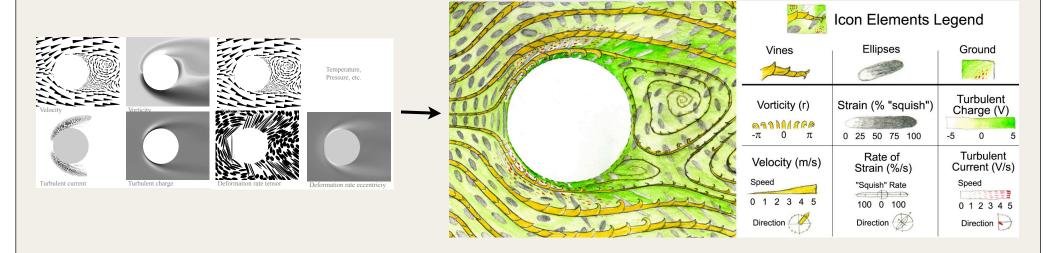
Research on medical data visualization (more on this later):







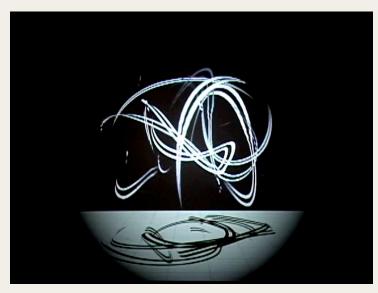
Example multi-variate data visualization assignment:



Former illustration student, Harrison Love:

"The collaboration between science and art is exactly what my art is about."

"Much of the abstract work that I have been creating since my last few years at RISD is, in part, inspired by the work that we did in the Lab at Brown."



Harrison's work utilizing my 3D computer interfaces



Harrison's current work

What is art+science collaboration? Some examples: Koan Baysa Ellen Levy Koan Baysa

Ellen Levy

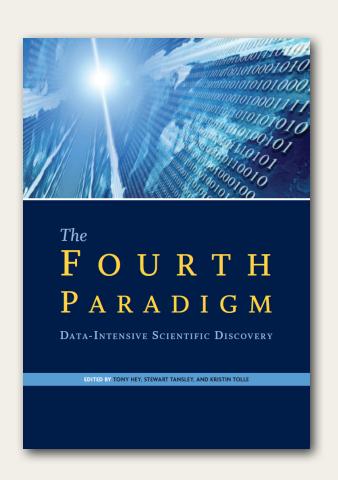
5 Minute Descriptions of Current Research Ann Fink The Sandy Project & Rachel Bernstein Dan Keefe

Ann Fink New York University

Rachel Bernstein New York University

Dan Keefe McKnight Land-Grant Assistant Professor Department of Computer Science and Engineering University of Minnesota

Data-Intensive Science and Engineering: A New Paradigm



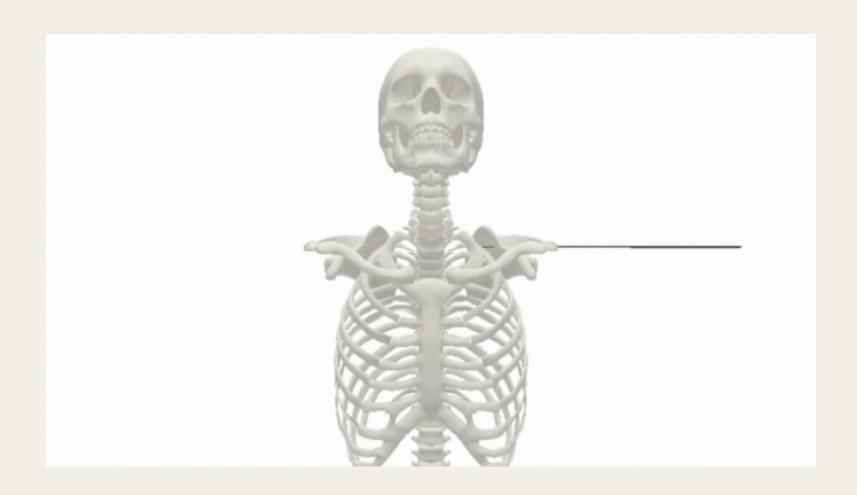
- Rather than looking through telescopes, we are now looking through large-scale, complex simulations and instruments.
- Knowledge is stored in a computer in the form of massive, multidimensional datasets.
- Scientists/engineers analyze using data management, statistics, and visualization.
- Disciplines must adjust; new tools are needed to manage, organize, share, query, visualize, document, validate, and preserve data.

NSF Research Grant Example

PROGRAM ANNOUNCEMENT/SOLICITATION NO/CLOSING DATE/If not in response to a program amouncement/solicitation enter NBF 10-1							FC	FOR NSF USE ONLY	
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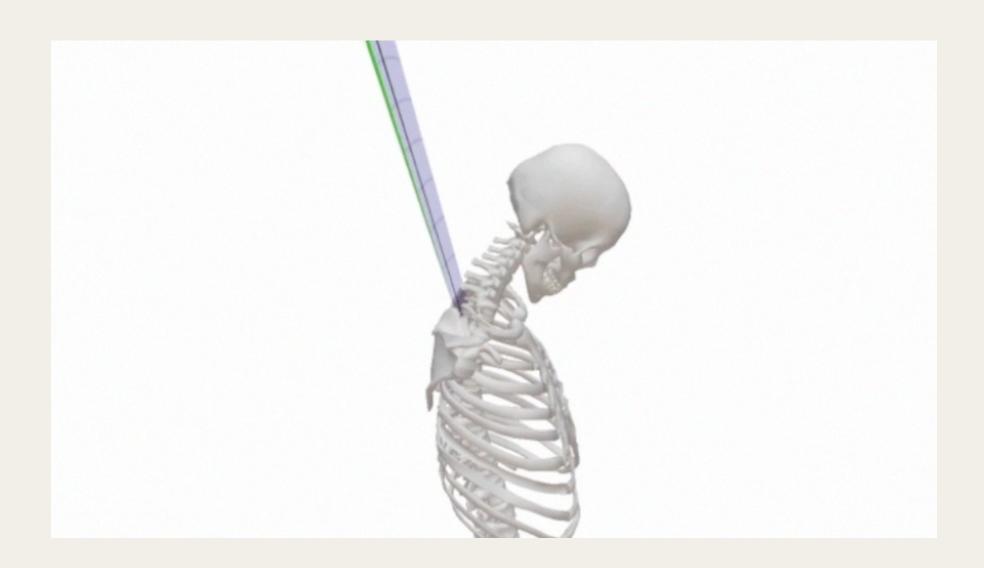
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- "Picturing Motion: Analyzing Multidimensional Time-Varying Data through Perceptually Accurate Exploratory Visualization"
- 47 pages, 5 letters of support from collaborators, maybe 5-20% success rate depending on agency, for this example two submissions to be successful
- Almost \$500,000 ... but that only covers:
 - 1 grad student per year
 - 1/3 of summer research salary
- I have 4 or 5 Ph.D. students in my lab, so need 3 or 4 good grants at all times to keep it running.
- When art connects with the cutting edge science the collaboration can enhance a proposal like this by making it unique and exciting. An art component might also be valued by science funding agencies due to the potential for the work to have broader impact on science and increase participation in science.









How do we scale this up to analyze hundreds or thousands of motions as a group?

- The problem:
 - It's too much data to look at it all at once.
 - Yet, it is so complex that statistical techniques are not sufficient.
- Our approach:
 - Combine human visual processing with computing.
 - Some automatic data processing to at least determine the subsets of the data that are most "interesting".
 - Develop novel interactive computer graphics visualization strategies to depict these subsets.

This is a really hard problem and it shows up everywhere because "making comparisons" is fundamental to science.

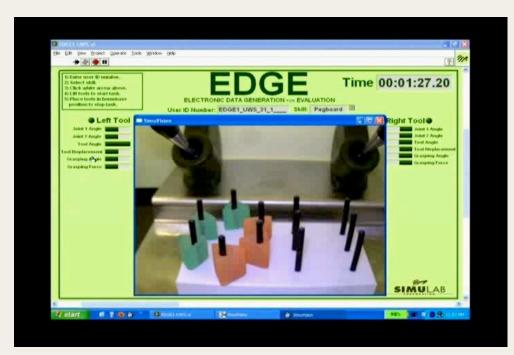


http://en.wikipedia.org/wiki/Laparoscopic_surgery



A simulator logs vast amounts of data from training exercises.

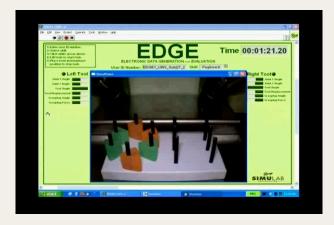
U. of Wash. / Simulab



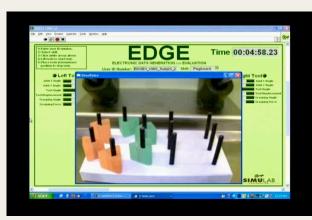
Video taken during a training task.

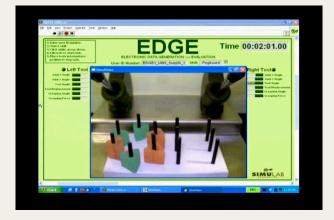




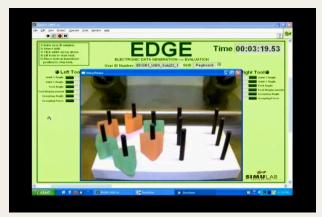


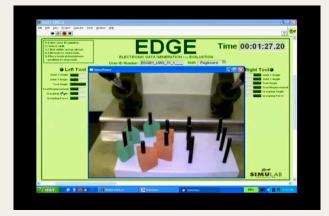












1 task, 104 trials, 428,924 frames = 3.97 hours of video, 12+ variables per frame

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