

BRET LOWELL JACKSON

bjackson@macalester.edu

Department of Math, Stats, & CS
Macalester College
1600 Grand Ave.
St. Paul, Minnesota 55105

Work: 651.696.6137
<http://www.bret-jackson.com>

EDUCATION

- | | |
|-----------|---|
| 2009–2014 | PhD Computer Science
University of Minnesota, Minneapolis, MN
<i>Expressive Spatial Interfaces for Scientific Visualization and Artistic 3D Modeling</i>
Advisor: Daniel F. Keefe |
| 2013 | M.S. Computer Science
University of Minnesota, Minneapolis, MN
Advisor: Daniel F. Keefe |
| 2004–2008 | B.A. Computer Science
Carleton College, Northfield, MN
Magna Cum Laude |

ACADEMIC EMPLOYMENT

- | | |
|----------------------|---|
| 2016–present | Assistant Professor (tenure-track)
Macalester College, St. Paul, MN |
| 2014–2016 | Visiting Assistant Professor
Macalester College, St. Paul, MN |
| Summer
2015, 2016 | Visiting Assistant Professor
Carleton College Summer Computer Science Institute, Northfield, MN |
| 2010–2013 | Graduate Research Assistant
University of Minnesota, Minneapolis, MN |
| 2010–2012 | Graduate Teaching Assistant
University of Minnesota, Minneapolis, MN
CSCI 1113 – Introduction to C/C++ Programming for Scientists and Engineers, 4 semesters |
| 2010–2011 | Graduate Lab Manager
Virtual Reality Lab, University of Minnesota, Minneapolis, MN |

RELEVANT NON-ACADEMIC EMPLOYMENT

- | | |
|-----------|--|
| 2008–2010 | Software Developer, Ultralingua Inc., Minneapolis MN
Windows, smartphone, and online multilingual dictionary development |
|-----------|--|

PUBLISHED SCHOLARLY WORK

Note: In my research field, conferences are the primary publication venue over journal publication¹. They are just as, if not more, selective and commonly use multiple rounds of double-blind review. As a result, it is now typical for

¹<https://goo.gl/Kpw856>

conference proceedings to be published in journal special issues. Publications and accompanying videos are available online at <http://www.bret-jackson.com/publications.html>. Macalester undergraduate students are indicated with *s next to their names.

REFEREED JOURNAL AND CONFERENCE ARTICLES

Shilad Sen, *Anja Beth Swoap, *Qisheng Li, *Brooke Boatman, *Ilse Dippenaar, *Rebecca Gold, *Monica Ngo, *Sarah Pujol, Bret Jackson, and Brent Hecht. “Cartograph: Unlocking Spatial Visualization Through Semantic Enhancement”. In: *Proceedings of the ACM Intelligent User Interfaces Conference*. ACM, 2017.

This project grew out of a summer research collaboration that my Macalester colleague, Shilad Sen, had with the students listed as co-authors. Although I was not directly involved with creating the algorithm, my main contributions were in designing and performing a user evaluation of the technique. I was also substantially involved in writing the related work and evaluation sections of the paper and co-presenting at the conference. (Acceptance rate: 23%).

Bret Jackson and Daniel F. Keefe. “Lift-Off: Using Reference Imagery and Freehand Sketching to Create 3D Models in VR”. in: *IEEE Transactions on Visualization and Computer Graphics* 22.4 (2016), pp. 1442–1451. **Also presented at the Best of IEEE VR session at SIGGRAPH 2016.**

In this work, we propose a novel 3D user interface for controlled 3D modeling. The initial conceptualization and coding development was a major portion of my dissertation work. After arriving at Macalester, I established an ongoing collaboration with an architect as an expert user. Based on his feedback, I continued to refine the user interface. The architect then completed a longitudinal study using the interface which became the basis for a major evaluation portion of the paper. I consider IEEE Virtual Reality to be the top conference for publishing in the VR field. The proceedings were then published in a special issue of IEEE TVCG. I was also invited to present the paper at SIGGRAPH, the premier graphics conference, at the “Best of IEEE VR session”. (Acceptance rate: 12.6%).

Kyungyoon Kim, Bret Jackson, Ioannis Karamouzas, Moses Adeagbo, Stephen Guy, Richard Graff, and Daniel F. Keefe. “Bema: A Multimodal Interface for Expert Experiential Analysis of Political Assemblies at the Pnyx in Ancient Greece”. In: *Proceedings of the IEEE 10th Symposium on 3D User Interfaces*. 2015, pp. 19–26.

We present a user interface that explores the combination of several classical interaction techniques for navigating in space and time through virtual reconstructions of ancient Greek speaking sites. I started this project as a graduate student in 2012, although it was not part of my dissertation. After arriving at Macalester, I helped mentor Kyungyoon Kim in this project, who at the time was a first year PhD student at the UMN. I had major contributions in writing the code for the system, as well as in writing several sections in the paper. The 3DUI symposium is attached to the IEEE VR conference and is the premier venue for presenting 3D user interface work. (Acceptance rate: 32%).

Bret Jackson, Tung Yuen Lau, David Schroeder, Kimani C. Toussaint Jr., and Daniel F. Keefe. “A Lightweight Tangible 3D Interface for Interactive Visualization of Thin Fiber Structures”. In: *IEEE Transactions on Visualization and Computer Graphics* 19.12 (2013), pp. 2802–2809.

This article introduces a 3DUI interface for navigating visualizations of 3D data such as tissue fibers, fluid flow, or neural pathways in the brain. It represents a chapter in my dissertation, and it brings together work in HCI, visualization, and computer vision for tracking and identifying tissue orientations. It was published at the IEEE Visualization conference, which is the top conference for visualization related work. (Acceptance rate: 24.6%)

Bret Jackson, Dane Coffey, and Daniel F. Keefe. “Force Brushes: Progressive Data-Driven Haptic Selection and Filtering for Multi-Variate Flow Visualizations”. In: *Proceedings of EuroVis 2012*. Vienna, Austria: Eurographics Association, 2012, pp. 7–11.

This paper presents a user interface for filtering and querying a visualization of volumetric data using a haptic force-feedback device. I led the project and was heavily involved in both the coding and writing. EuroVis is one of the top visualization conferences. (Short papers acceptance rate 42%).

Bret Jackson, David Schroeder, and Daniel F. Keefe. “Nailing down multi-touch: anchored above the surface interaction for 3D modeling and navigation”. In: *Proceedings of the 2012 Graphics Interface Conference*. GI '12. Toronto, Ontario, Canada, 2012, pp. 181–184.

This paper introduces a user interface for navigating 3D visualizations using multi-touch and in-air gestures. I led the project in conceptualizing the interface, developing the system code, and writing the paper. My graduate colleague, David Schroeder, worked on implementing hand tracking using a depth-sensing camera. (Acceptance rate 38%).

David Barbella, Sami Benzaid, Janara Christensen, Bret Jackson, Victor Qin, and David Musicant. “Understanding Support Vector Machine Classifications: A Local Approach”. In: *Proceedings of The International Conference on Data Mining (DMIN '09)*. CSREA Press, 2009, pp. 305–311

This paper presented a technique for understanding the results of support vector machine classifications by visualizing the results using a recommender-systems approach. The paper developed from my undergraduate capstone project at Carleton College. I contributed in developing portions of the system code and writing initial drafts of the paper.

REFEREED WORKSHOP PAPERS AND PANELS

Seth Johnson, Bret Jackson, Bethany Tourek, Marcos Molina, Arthur G. Erdman, and Daniel F. Keefe. “Immersive Analytics for Medicine: Hybrid 2D/3D Sketch-Based Interfaces for Annotating Medical Data and Designing Medical Devices”. In: *Proceedings of the 2016 ACM Companion on Interactive Surfaces and Spaces, Immersive Analytics: Exploring Future Interaction and Visualization Technologies for Data Analytics Workshop*. ISS Companion '16. New York, NY, USA: ACM, 2016, pp. 107–113

This paper is an extension to the Lift-Off 3D modeling paper listed above that I worked on collaboratively with Seth Johnson, a PhD student in my former graduate lab at the UMN. The paper presents an evaluation for how the lift-off modeling process could be used in the medical domain. Although Seth led the project, I contributed in its conceptualization, modification of code, and writing the introduction and related work sections of the paper.

Daniel Acevedo-Feliz, Bret Jackson, Daniel Keefe, Ryan Pavlik, Jurgen Schulze, Bill Sherman, and Alexis Vartanian. *VR Toolkits: Why do We Keep Reinventing the Wheel?* IEEE Virtual Reality 2014 Panel. 2014

I presented on this panel at the IEEE Virtual Reality conference about the MinVR software library that I wrote to support development of VR applications.

Bret Jackson, Dane Coffey, Lauren Thorson, David Schroeder, Arin Ellingson, David Nuckley, and Daniel F. Keefe. *Toward Mixed Method Evaluations of Scientific Visualizations and Design Process as an Evaluation Tool*. BELIV 2012: Beyond Time and Errors: Novel Evaluation Methods for Visualization, Workshop at IEEE VisWeek 2012. 2012

This paper describes an art-critique based approach to evaluating visualization systems that grew out of the challenges we have developing appropriate evaluations of different visualization approaches. I led the project and writing of the paper.

Dane Coffey, Bret Jackson, and Daniel F. Keefe. *Immersive VR Touch Workbenches: Applications in Engineering and Art*. The 3rd Dimension of CHI (3DCHI) Touching and Designing 3D User Interfaces Workshop at CHI 2012. 2012

This paper presents a series of case studies illustrating how a VR touch workbench could address specific domain challenges for 3D work in engineering and art practice. The project was led by Dane Coffey. I contributed to writing one of the case studies.

Bret Jackson and Daniel F. Keefe. *Sketching Over Props: Understanding and Interpreting 3D Sketch Input Relative to Rapid Prototype Props*. IUI 2011 Sketch Recognition Workshop. 2011.

This paper presents a user study evaluating a system of mid-air gestures done in relation to a 3D printed prop that can be used to control a visualization system. It was exciting because it was my first long paper as a graduate student. (Acceptance rate for long papers: 26%)

Bret Jackson, Kyungyoon Kim, Richard Graff, Azadeh Rabbani, Christopher L. Johnstone, and Daniel F. Keefe. *Immersive VR for Visualizing Ancient Greek Rhetoric*. Immersive Visualization Revisited: Challenge and Opportunities Workshop at IEEE VR 2012. 2012

This is a position paper that describes the advantages and challenges of using immersive virtual reality for cultural heritage projects. It setup and has formed the basis for an ongoing collaboration with a scholar of ancient Greece. I formulated the ideas and wrote the majority of the paper.

POSTERS

Kyungyoon Kim, Bret Jackson, Ioannis Karamouzas, Stephen J. Guy, Richard Graff, and Daniel F. Keefe. *Poster: Immersive Visualization and Spatial Analysis of Oratorical Performance Venues in Ancient Greece*. CRA-W Grad Cohort Workshop. 2013

Kyungyoon Kim, Bret Jackson, Ioannis Karamouzas, Stephen J. Guy, Richard Graff, and Daniel F. Keefe. *Poster: Immersive Visualization and Spatial Analysis of Oratorical Performance Venues in Ancient Greece*. Minnesota Supercomputing Institute Research Exhibition. 2013

Bret Jackson, Kyungyoon Kim, Lauren Thorson, Richard Graff, Azadeh Rabbani, Christopher L. Johnstone, and Daniel F. Keefe. *Poster: Visualizing Ancient Greek Rhetoric in Immersive Virtual Reality*. U-Spatial Symposium 2012 (Best Poster Humanities Category). 2012

Kyungyoon Kim, Bret Jackson, Lauren Thorson, Richard Graff, Azadeh Rabbani, Christopher L. Johnstone, and Daniel F. Keefe. *Poster: Visualizing Ancient Greek Rhetoric in Immersive Virtual Reality*. Minnesota Supercomputing Institute Research Exhibition 2012 (Best Poster Finalist). 2012

Vamsi Konchada, Bret Jackson, Trung Le, Iman Borazjani, Fotis Sotiropoulos, and Daniel F. Keefe. *Poster: Supporting Internal Visualization of Biomedical Dataset via 3D Rapid Prototypes and Sketch-based Gestures*. Interactive Graphics and Games 2011. 2011

This was a peer-reviewed poster for a project initially led by Vamsi Konchada, a masters student in my graduate lab. I contributed to the code development and writing for the poster.

ARTICLES IN PREPARATION

Bret Jackson and Daniel F. Keefe. "From Painting to Widgets, 6-DOF Stylus Input Beyond the Pointing Metaphor". Invited book chapter in *VR Programming Gems*, William Sherman, Ed. CRC Press. To be submitted June 2017.

I was invited to contribute a chapter to a new VR Programming Gems book. The book is in the style of the GPU Gems series, a well known and widely distributed collection of books about computer graphics techniques. This will be the start of a new series based on virtual reality techniques, and it has the potential to reach a wide ranging audience in the research community as well as in industry.

Bret Jackson, Oliver Koo*, Jenweil Yang*. "Anchored Gestures – A Spatial Interface for 3D Navigation". To be submitted to *Computer and Graphics* summer 2017.

This journal article will be an extension of my work on the anchored gestures interface, described in Nailing down multi-touch: anchored above the surface interaction for 3D modeling and navigation. It was done in collaboration with two undergraduate Macalester students.

INVITED PRESENTATIONS

The Allegory of the CAVE: Designing a Virtual Reality Display for Immersive Applications in Science and Art. Serie Center's "Conversations About Our Scholarly Lives" program. Macalester College, May 1st, 2017

Time Travel is Possible: Computational Tools to Support Experiential Analysis of Oratorical Venues in Ancient Greece. Archeological Institute of America, Minnesota Chapter. Sept. 22th, 2016

3D Design and Virtual Reality. Bret Jackson and Austin Mason. Macalester Spring Professional Activities Workshop, Digital Liberal Arts Track. May 2016

I co-organized and led this workshop on integrating 3D modeling and virtual reality as pedagogical tools to support classroom learning. The participants rated the workshop an average of 3.8 out of 4 points and all felt that it would be very beneficial to their teaching.

Time Travel is Possible: Computational Tools to Support Experiential Analysis of Oratorical Venues in Ancient Greece. Serie Center's "Conversations About Our Scholarly Lives" Program. Macalester College, Oct. 26th, 2015

Life as a Computer Scientist, Summer Computer Science Institute, Carleton College, Aug. 14th, 2014

Spatial Human-Computer Interaction Techniques for Visualization and Art. Carleton College Computer Science Colloquium, Nov. 1st 2012

Interactive Visualization Research. CSCI 4107 Introduction to Computer Graphics Programming, Guest Lecture, May 2012

Visualization in Virtual Reality. CSCI 5980: Interacting in Virtual Worlds, Guest Lecture, Nov 2011

SOFTWARE AND HARDWARE ARTIFACTS

MinVR

MinVR is a low-level C++ library that supports writing virtual reality applications. It supports interaction with multiple VR input devices and display configurations (e.g. fish-tank VR displays, powerwalls, and CAVE systems), while allowing for integration with a variety of graphics toolkits (e.g. raw OpenGL, GLFW, G3D, Glut, OpenSceneGraph, etc.). It supports multi-threaded rendering with multiple graphics contexts, as well as networked cluster rendering. Version 1 can be found at <https://github.com/minvr/minvr-old>, while the version 2 can be found at <https://github.com/minvr/minvr>.

I developed version 1 of this library while in graduate school. Since arriving at Macalester, I have been collaborating with professors and students at UMN and Brown University to write MinVR2. Although I have done less of the coding on version 2, I have been active in guiding the development of the library, and major portions of the design and code that I wrote in the first version have been integrated into the second version.

UMN Interactive Visualization Lab VR CAVE The IVLab CAVE is a four-walled, eight projector, stereoscopic, virtual reality display. Built using off-the-shelf components, it is a comparably low cost CAVE display system designed to be installed and used daily in a research lab at the University of Minnesota. It has been used in many interdisciplinary research projects, and has been featured in many university tours and significant research demos including with: Medtronic (Vice President of Research and Development and team), Minneapolis Institute of Arts, Director of Technology, Walt Disney Imagineering Virtual Reality Group, Boston Scientific Corporation (9 Vice Presidents and other leadership invited by UMN President Erik Kaler), US Congressman Erik Paulsen, and University of Minnesota President Eric Kaler.

I was responsible for designing and building the CAVE display. This included modeling the system in AutoCAD, identifying and ordering parts, construction, and calibration.

Macalester VR CAVE A four-walled, eight projector, stereoscopic virtual reality display designed as a second iteration of the UMN IVLab CAVE.

The design and construction of this CAVE has taken almost a year. Due to small space requirements in my lab, the design needed to be substantially modified. I plan on using this system in my research as well as integrating it into several of my classes including courses on visualization, game design, and computer graphics.

Wireless Interaction Stylus The UMN interaction styluses are novel devices designed to be ultra-low powered 3D user input devices for a CAVE VR display. Each stylus contains two buttons, an micro-controller, and an RF radio inside a 3D printed sleeve. Shaped like a large pen, these styluses have enabled a variety of software advances in the form of new user interfaces and data visualization strategies (e.g. the Lift-Off 3D modeling interface referenced above). The design has been shared, and copies of the styluses are now in use at multiple universities.

HONORS & AWARDS

2013-2014	University of Minnesota Doctoral Dissertation Fellowship (151 fellowships awarded from 284 department nominations. Nominations represent 11.5% of eligible students)
2013	IEEE Virtual Reality Doctoral Consortium Participant (Acceptance rate: 38%)

RESEARCH GRANTS

“Visualizing Uncertainty in Reconstructions of Ancient Greek Speaking Sites”, \$4,950, Macalester College Collaborative Summer Research Grant Program, May 29th, 2017 to August 4th, 2017.

International travel grant, \$3960, Macalester College Wallace Scholarly Activities, Fall 2016

Department award to support 24 undergraduate women summer researchers in computer science, \$228,792, Clare Booth Luce 2017-2019

“Supporting Exploratory Visualization of Multidimensional Data Using Anchored Multitouch Gestures”, \$12,850, Macalester College Collaborative Summer Research Grant Program, May 18th, 2015 to July 24th, 2015.

TEACHING EXPERIENCE

COMP494	Data Visualization	Macalester College	Fall 2017
COMP124	Object-Oriented Programming and Data Structures	Macalester College	Fall 2017
COMP494	Interactive Computer Graphics	Macalester College	Spring 2017
COMP225	Software Design and Development	Macalester College	Spring 2017
COMP124	Object-Oriented Programming and Data Structures (2 Sections)	Macalester College	Fall 2016
COMP225	Software Design and Development	Macalester College	Spring 2016
COMP124	Object-Oriented Programming and Data Structures (2 Sections)	Macalester College	Spring 2016
COMP124	Object-Oriented Programming and Data Structures (2 Sections)	Macalester College	Fall 2015
COMP124	Object-Oriented Programming and Data Structures (2 Sections)	Macalester College	Spring 2015
COMP394	Interactive Computer Graphics	Macalester College	Spring 2015
COMP346	Internet Computing	Macalester College	Fall 2014
COMP124	Object-Oriented Programming and Data Structures	Macalester College	Fall 2014
SCSI	Virtual Reality	Carleton College	
		Summer Comp. Sci. Institute	Summer 2016
SCSI	Virtual Reality	Carleton College	
		Summer Comp. Sci. Institute	Summer 2015

ADVISING AND MENTORING

ACADEMIC ADVISOR

Vihan Agarwal
Jennifer Arnold
Gabriel Brown
David Colby
Mark Coretsopoulos
Trevor Cramer
Amanda Doan
Kyler Fullerton
Sara Rose Havener
Marie Julstrom
Khin Kyaw
Carl Liu
Kassandra Munguia
Roland Munsil
Courtney Overland
Paige Pfeiffer
Julia Romare
Emerald Thole
Kai Walberg

CAPSTONE / THESIS ADVISOR

Eloise Terry
B.A. in computer science, Macalester College, 2017
Uncovering Alzheimer's Disease in fMRI images Using an Artificial Neural Network (Awarded MSCS Capstone Prize),

Connor Valenti
B.A. in computer science, Macalester College, 2017
140 Characters to the White House: An Analysis of the 2016 Presidential Election on Twitter

Mitchell Peterson
B.A. in computer science, Macalester College, 2017
Music and Subjectivity: Classifying Musical Genre using Machine Learning

Hyun Uk Jeong
B.A. in computer science, Macalester College, 2017
Analyzing Human Language with Computers

Oliver Koo
B.A. in computer science, Macalester College, 2016
Multi-Finger Anchored Gestures

Asra Nizami
B.A. in computer science, Macalester College, 2016
Computational Creativity: Evaluating the impact of 3D human-computer interfaces

Jenweil Yang
B.A. in computer science, Macalester College, 2016
Gestures for 3D Human-Computer Interaction

Chan Hyun Park
B.A. in computer science, Macalester College, 2016
Optical Character Recognition Using the Discrete Cosine Transform

Tyler Skluzacek
B.A. in computer science, Macalester College, 2016
myBivy: A wearable sleeping solution

HONORS ADVISING AND REVIEW COMMITTEES

Haihan Lin
Expected B.A. in compute science, Macalester College, 2018
Interactive Tracking and Rendering of 3D Models with Articulations
Advisor

Jeffrey Lyman
B.A. in computer science, Macalester College, 2016
Blossom, a Language Built to Grow
Committee member

INDEPENDENT STUDY SUPERVISOR

Jennifer Arnold
Asra Nizami
Will Kent-Daggett

INTERNSHIP LIAISON

Julia Romare
B.A. in computer science, Macalester '19
Research and Web Development Intern, Gaddr

Qinxi Wang
B.A. in computer science, Macalester '18
Web Development Intern, Similarity

Ivana Marincic
B.A. in computer science, Macalester '15
Software Development Intern, Work Effects

SERVICE

Conference Organization

Program Committee, IEEE Symposium on 3D User Interfaces, 2015, 2016, 2017
Session Chair, IEEE Symposium on 3D User Interfaces, 2017

Doctoral Consortium Chair, IEEE Virtual Reality 2014

PAPER REVIEWING FOR JOURNALS AND CONFERENCES

Reviewer – IEEE Visualization 2017

Reviewer – Computers & Graphics Journal 2016, 2017

Reviewer – IEEE Symposium on 3D User Interfaces 2015, 2016, 2017

Reviewer – ACM Symposium on Virtual Reality Software and Technology 2016

Reviewer – Journal of Behavior and Information Technology 2015, 2016

Reviewer – Computer-Aided Design 2015, 2016

Reviewer – Informatics, 2016

Reviewer – Journal of Innovative Optical Health Sciences 2016

Reviewer – IEEE Pervasive Computing 2015

Reviewer – ACM Symposium on Spatial User Interaction 2015, 2016

Reviewer – IEEE Virtual Reality 2014, 2015

Reviewer – ACM CHI Conference on Human Factors in Computing Systems 2013

Reviewer – Computers and Graphics Journal special issue on Touching the 3rd Dimension 2012

Reviewer – Computers and Graphics Journal special issue on Graphics Interaction 2012

Reviewer – Foundations of Digital Games Conference (FDG) 2012

COLLEGE AND DEPARTMENT SERVICE

Macalester College MSCS Department Seminar Co-organizer, 2015–2016, 2016–2017, 2017–2018

Macalester College MSCS Department Webmaster 2017–2018

Committee Member, AIA-Sciences Search 2017

Volunteer Assistant Coach, Macalester Water Polo 2014–present

PUBLIC OUTREACH

Graduate Lab open house event for 35 K-12 students participating in a TRIO Upward Bound program, 2013

Graduate Q&A welcome panel for potential computer science graduate students, 2011

Research demonstration for the University of Minnesota building, Minnesota State Fair 2011

Virtual reality lab tours for over 700 students of a variety of ages from local elementary schools, middle schools, and high schools, as well as prospective undergraduate students. 2010-2011