

**Dissertation Title:** *Physical Rendering Processes for More Graspable Extended Reality Data Visualizations*

**Research Themes:** Extended reality visualization, data physicalization, creativity support tools

## EDUCATION

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2018-2024	<b>Ph.D., Computer Science</b> ‣ Advisor: Daniel F. Keefe	UNIVERSITY OF MINNESOTA – Minneapolis, MN
2018-2020	<b>M.S., Computer Science</b>	UNIVERSITY OF MINNESOTA – Minneapolis, MN
2014-2018	<b>B.S., Computer Science</b> ‣ Mathematics minor	UNIVERSITY OF MINNESOTA – Minneapolis, MN
Spring 2017	<b>Study Abroad</b> ‣ Courses: Computer Graphics, User Interface Design, New Zealand Conservation, Māori Language	UNIVERSITY OF AUCKLAND – Auckland, New Zealand

## RESEARCH AND PROFESSIONAL EXPERIENCE

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2018-2024	<b>Assistant Director for Systems and Software</b> Interactive Visualization Lab ‣ Created augmented reality physicalizations with medical device data and climate data ‣ Developed and evaluated sensing techniques for multi-touch input on data physicalizations ‣ Led a software team of graduate and undergraduate students for developing cross-platform user interfaces and graphics techniques for use by artists to create engaging data visualizations ‣ Created a software architecture for mixed reality visualizations with artist-made visual media ‣ Collaborated on multi-disciplinary projects involving teams at the University of Minnesota Twin Cities, the University of Texas at Austin, and other universities	UNIVERSITY OF MINNESOTA – Minneapolis, MN
Summer 2022	<b>R&amp;D Engineer – Human Factors</b> ‣ Designed and developed new augmented reality tools for cardiac mapping software	ABBOTT LABORATORIES, INC., CARDIAC DIVISION – St. Paul, MN
Summer 2018	<b>Software Development Intern</b> ‣ Made contributions to open-source blockchain projects Hyperledger Sawtooth and Sawtooth PBFT Consensus	BITWISE IO, INC. – Minneapolis, MN
2016-2018	<b>Undergraduate Research Assistant</b> Interactive Visualization Lab ‣ Proposed a set of design guidelines for 3D printing a field of glyphs on top of a data-driven surface ‣ Built a toolkit of Python scripts for generating 3D-printed data visualizations	UNIVERSITY OF MINNESOTA – Minneapolis, MN
Spring 2017	<b>Undergraduate Research Assistant</b> ‣ Developed a series of scripts to automate photogrammetry of irregular 3D models and lighting	UNIVERSITY OF AUCKLAND – Auckland, NZ

## TEACHING EXPERIENCE

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F19-23, S23	<b>Teaching Assistant</b> Course: Programming Interactive Computer Graphics and Games – CSCI 4611 <ul style="list-style-type: none"><li>› Created new assignments to reinforce course learning outcomes for 150+ students</li><li>› Graded assignments and hosted office hours</li></ul>	<b>UNIVERSITY OF MINNESOTA – Minneapolis, MN</b>
S23	<b>Guest Lecturer</b> Course: CSCI 8002 – Introduction to Research in Computer Science II <ul style="list-style-type: none"><li>› Hosted Q&amp;A with first-year graduate students about research topics</li></ul>	<b>UNIVERSITY OF MINNESOTA – Minneapolis, MN</b>
S22	<b>Assistant Instructor</b> Course: Visualization – CSCI 5609 <ul style="list-style-type: none"><li>› Designed and taught class sessions for 75 students in hybrid virtual/in-person mode</li><li>› Created course assignments that integrate with my own research in artist-driven visualization</li><li>› Assisted lead instructor with in-class critique for student visualization projects</li></ul>	<b>UNIVERSITY OF MINNESOTA – Minneapolis, MN</b>
F20	<b>Instructor</b> Course: Introduction to Computing and Programming Principles – CSCI 1133 <ul style="list-style-type: none"><li>› Designed and taught remote lectures for 40 students</li><li>› Created learning assessment materials</li><li>› Administered remote oral exams</li><li>› Managed a team of undergraduate TAs</li></ul>	<b>UNIVERSITY OF MINNESOTA – Minneapolis, MN</b>
F18	<b>Teaching Assistant</b> Course: Virtual Reality and 3D Interaction – CSCI 5619 <ul style="list-style-type: none"><li>› Wrote three tutorials on developing virtual reality applications with Unity and Unreal game engines</li><li>› Led aforementioned tutorials for two-hour sessions with about 50 students</li><li>› Graded student programming assignments</li></ul>	<b>UNIVERSITY OF MINNESOTA – Minneapolis, MN</b>
F15-S18	<b>Undergraduate Teaching Assistant</b> Course: Introduction to Computing and Programming Concepts – CSCI 1133 <ul style="list-style-type: none"><li>› Led lab sections of about 30 students</li><li>› Formulated new course material for labs</li><li>› Graded weekly programming assignments, quizzes, exams</li><li>› Developed collaborative Python homework-grading script</li></ul>	<b>UNIVERSITY OF MINNESOTA – Minneapolis, MN</b>

## ADVISING

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Summer 2023	Wanbo Geng, University of Minnesota. <ul style="list-style-type: none"><li>› Project: Evaluating the efficiency of artist-created glyph-based visualizations.</li></ul>
2020-2021	Maxwell J. Omdal, University of Minnesota. <ul style="list-style-type: none"><li>› Project: Optimizing image tracking layouts for augmented reality visualizations.</li></ul>
Summer 2020	Claire Weissman, Whitman College (REU). <ul style="list-style-type: none"><li>› Project: Automatic generation of data legends for multivariate artist-created visualizations.</li></ul>
Summer 2019	Clara Richter, Mt. Holyoke College (REU). <ul style="list-style-type: none"><li>› Project: Multi-touch input detection for data physicalizations.</li></ul>
Fall 2018	Irwin Sowah, University of Minnesota. <ul style="list-style-type: none"><li>› Project: Designing spatial input devices for precise selection and manipulation.</li></ul>

## PUBLICATIONS

### PEER REVIEWED PUBLICATIONS

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- 2022 D. F. Keefe, **B. Herman**, J. W. Nam, S. Johnson, and D. Orban, “Hybrid Data Constructs: Interacting with Biomedical Data in Augmented Spaces,” in *Making Data: Materializing Digital Information*, pp. 169–182, Bloomsbury Publishing Plc, first ed., 2022
- 2021 **B. Herman**, M. Omdal, S. Zeller, C. A. Richter, G. Abram, F. Samsel, and D. F. Keefe, “Multi-touch querying on data physicalizations in immersive AR,” in *Proceedings on Human Computer Interaction*, ACM, 2021
- 2020 **B. Herman**, F. Samsel, A. Bares, S. Johnson, G. Abram, and D. F. Keefe, “Printmaking, puzzles, and studio closets: Using artistic metaphors to reimagine the user interface for designing immersive visualizations,” in *Transactions on Visualization and Computer Graphics*, IEEE, 2020
- 2019 S. Johnson, F. Samsel, G. Abram, D. Olson, A. J. Solis, **B. Herman**, P. J. Wolfram, C. Lenglet, and D. F. Keefe, “Artifact-based rendering: Harnessing natural and traditional visual media for more expressive and engaging 3d visualizations,” *IEEE Trans. on Visualization and Computer Graphics*, vol. 11, no. 1, pp. 492–502, 2019

### WORKSHOP PAPERS AND POSTERS

- 2022 M. L. Turner, **B. Herman**, M. Broske, and K. D. F., “Poster: Linked spatial and temporal normalization for analysis of cyclical 4d skeletal motion data.” IEEE VIS Posters, 2022
- 2020 C. Weissman, **B. Herman**, S. Zeller, F. Samsel, and D. F. Keefe, “Poster: Automatic generation of data legends for multi-variate artist driven visualizations.” IEEE SciVis Posters, 2020. SciVis Best Poster Award
- 2018 **B. Herman** and D. F. Keefe, “Workshop paper: Boxcars on potatoes: Exploring the design language for tangible visualizations of scalar data fields on 3d surfaces.” Toward a Design Language for Data Physicalization: Workshop at IEEE VIS 2018, 2018

## PRESENTATIONS

### CONFERENCE PRESENTATIONS

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- November 2021 ACM Interactive Surfaces and Spaces Talk: *Multi-Touch Querying on Data Physicalizations in Immersive AR*. Łódź, Poland, virtual.
- October 2020 IEEE VIS Arts Program Talk: *Printmaking, Puzzles, and Studio Closets: Using artistic metaphors to reimagine the user interface for designing immersive visualizations*. Salt Lake City, Utah, USA, virtual.
- October 2019 IEEE VIS Poster: *Linked View Visualization Using Clipboard-Style Mobile VR: Application to Communicating Forestry Data*. Vancouver, British Columbia, Canada.
- October 2018 IEEE VIS Workshop Lightning Talk: *Boxcars on potatoes: Exploring the design language for tangible visualizations of scalar data fields on 3d surfaces*. Berlin, Germany.

### WORKSHOPS AND TUTORIALS

- July 2021 WeTeach\_CS Summit Tutorial: *Sculpting Vis: A Puzzle-piece approach to teaching scientific visualization*. Austin, Texas, USA, virtual.
- October 2020 IEEE VIS Workshop: *Artifact-Based Rendering: VR Visualization by Hand*. Salt Lake City, Utah, USA, virtual.

## REVIEWING

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- 2020-2024 IEEE Transactions on Visualization and Computer Graphics  
2022 IEEE Conference on Virtual Reality and 3D User Interfaces

## VOLUNTEERING

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- 2019-2023 | Instructor, Audio Engineer, Board Member, Transport. Coord. MINNESOTA BRASS, INC. – St. Paul, MN  
➤ Class A CDL