Henry Segerman — *Curriculum Vitae*

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Employment

- **Oklahoma State University**: Assistant Professor, 2013–2018; Associate Professor, 2018–present.
- **University of Melbourne**: Research Fellow, 2010–2013.
- **University of Texas at Austin**: Lecturer, 2007–2010.
- **Stanford University**: Graduate student, 2001–2007.

Research Interests

- Three-manifolds and triangulations
- Hyperbolic geometry
- Mathematical visualisation, 3D printing, virtual and augmented reality

Education

- **Stanford University**, Ph.D. in Mathematics under Steven Kerckhoff. Thesis (2007): *Incompressible Surfaces in Hyperbolic Punctured Torus Bundles are Strongly Detected*
- **University of Oxford**, Master of Mathematics (MS), 2001

Grants

- **NSF Grant DMS-2405684**, for the 2024 Redbud Geometry / Topology conference, with Jonathan Johnson and Neil Hoffman, 2024.
- **NSF grant DMS-2203993**, *Veering Triangulations and Visualization*, 2022–2025.
- **NSF grant DMS-1806896**, for the 2018 Redbud Geometry / Topology conference, with Andy Eisenberg, Robert Haraway and Neil Hoffman, 2018.
- **NSF grant DMS-1708239**, *Three- and Four-Dimensional Triangulations and Mathematical Visualization*, 2017–2021.
- **Simons Collaboration Grants for Mathematicians-519114**, *Triangulations and visualizations*, 2017–2022 (declined due to acceptance of NSF award).
- **NSF grant DMS-1463957**, for the 2015 Redbud Geometry / Topology conference, with Danielle O'Donnol and Sean Bowman, 2015.

Fellowships & Awards

- **Tech Fee Award**, *Update 3D Printing Laboratory for "Geometry and Algorithms in Three-dimensional Modeling"*, award from the College of Arts and Sciences at Oklahoma State University, with Lisa Mantini, 2022.
- **Distinguished Early Career Faculty Award** (one of two awarded across the College of Arts and Sciences at Oklahoma State University), 2020.
- **NSF We Are Mathematics Video Competition Winner** (one of four), for the video *Non-Euclidean Virtual Reality Using Ray-Marching*, 2019.
- **Tech Fee Award**, for construction of a *3D Printing Laboratory for the Mathematics of 3D Design*, award from the College of Arts and Sciences at Oklahoma State University, with Lisa Mantini, 2015.
- **Dean's Award for Excellence in Engagement (Outreach/Science Communication)**, University of Melbourne, June 2013.
- **Research Fellowship** under Australian Research Council grant DP1095760, University of Melbourne and University of Queensland, 2010–2013.
- **RTG Postdoctoral Fellowship**: University of Texas at Austin, 2007–2010.
- **Stanford University Centennial Teaching Assistant award**, June 2007.

Patents

- *Apparatus for Branched Scissor Linkage and Associated Auxetic Mechanisms*, with Will Segerman, US Patent No. US 11,702,327 B2, granted July 18, 2023. International patent

pending, application number PCT/US2018/031815, November 2018.

Publications & Preprints

- **Book**
  - *Visualizing Mathematics with 3D Printing*, Johns Hopkins University Press, July 2016, 186 pages, 150 figures. This is a popular mathematics book, with the innovation that most of the figures in the book are photographs of 3D printed models. These models are available for readers to download and 3D print themselves, or order online, or explore virtually on the book's website 3dprintmath.com.
- **Geometry and Topology**
  - *Connecting essential triangulations I: via 2-3 and 0-2 moves*, arXiv: 2405.03539 [math.GT], with Tejas Kalelkar and Saul Schleimer, 57 pages, 74 figures and subfigures.
  - *Non-standard bi-orders on punctured torus bundles*, arXiv: 2310.13758 [math.GT, math.GR], with Jonathan Johnson, 27 pages, 4 figures.
  - *From veering triangulations to dynamic pairs*, arXiv:2305.08799 [math.GT], with Saul Schleimer, 77 pages, 90 figures and subfigures.
  - *From veering triangulations to link spaces and back again*, arXiv:1911.00006 [math.GT], with Steven Frankel and Saul Schleimer, 127 pages, 99 figures and subfigures.
  - *From loom spaces to veering triangulations*, arXiv:2108.10264 [math.GT], with Saul Schleimer, 42 pages, 31 figures and subfigures. To appear in *Groups, Geometry, and Dynamics*.
  - *Ray-marching Thurston geometries*, *Experimental Mathematics*, **31** (2022), no. 4, pp. 1197–1277, with Rémi Coulon, Elisabetta A. Matsumoto, and Steve J. Trettel, 81 pages, 198 figures and subfigures.
  - *Cohomology fractals, Cannon–Thurston maps, and the geodesic flow*, *Experimental Mathematics*, **31** (2022), no. 4, pp. 1047–1085, with David Bachman, Matthias Goerner, and Saul Schleimer, 39 pages, 80 figures and subfigures.
  - *Essential loops in taut ideal triangulations*, *Algebraic and Geometric Topology*, **20** (2020), no. 1, pp. 487–501, with Saul Schleimer, 14 pages, 6 figures.
  - *Traversing three-manifold triangulations and spines*, *L'Enseignement Mathématique*, **65** (2019), no. 2, pp. 155-206. with J. Hyam Rubinstein and Stephan Tillmann, 41 pages, 42 figures.
  - *Connectivity of triangulations without degree one edges under 2-3 and 3-2 moves*, *Proc. Amer. Math. Soc.*, **145** (2017), no. 12, pp. 5391–5404, 14 pages, 15 figures.
  - *Non-geometric veering triangulations*, with Craig D. Hodgson and Ahmad Issa, *Experimental Mathematics*, **25**, (2016), no. 1, pp. 17–45, 29 pages, 24 figures.
  - *Triangulations of 3-manifolds with essential edges*, with Craig D. Hodgson, J. Hyam Rubinstein, and Stephan Tillmann, *Annales de Mathématiques de Toulouse*, **24**, (2015), no. 5, pp. 1103-1145, 43 pages, 14 figures.
  - *1-efficient triangulations and the index of a cusped hyperbolic 3-manifold*, with Stavros Garoufalidis, Craig D. Hodgson and J. Hyam Rubinstein, *Geometry & Topology*, **19**, (2015), pp. 2619–2689, 71 pages, 28 figures.
  - *Triangulations of hyperbolic 3-manifolds admitting strict angle structures*, with Craig D. Hodgson and J. Hyam Rubinstein, *Journal of Topology*, **5** (2012), no. 5, pp. 887–908, 22 pages, 9 figures.

– *A generalisation of the deformation variety*, *Algebraic and Geometric Topology*, **12** (2012), no. 4, pp. 2179–2244, 66 pages, 26 figures.

– *Pseudo-developing maps for ideal triangulations I: Essential edges and generalised hyperbolic gluing equations*, with Stephan Tillmann, *Topology and Geometry in Dimension Three: Triangulations, Invariants, and Geometric Structures (Proceedings of the Jacofest conference)*, AMS Contemporary Mathematics, **560** (2011), pp. 85–102, 18 pages, 8 figures.

– *Veering triangulations admit strict angle structures*, with Craig D. Hodgson, J. Hyam Rubinstein and Stephan Tillmann, *Geometry & Topology*, **15** (2011), pp. 2073–2089, 17 pages, 9 figures.

– *Incompressible surfaces in handlebodies and boundary compressible 3-manifolds*, with João Miguel Nogueira, *Topology and its Applications*, **158** (2011), no. 4, pp. 551-571, 21 pages, 14 figures.

– *Detection of incompressible surfaces in hyperbolic punctured torus bundles*, *Geometriae Dedicata*, **150** (2011), no. 1, pp. 181–232, 52 pages, 25 figures.

– *On spun-normal and twisted squares surfaces*, *Proc. Amer. Math. Soc.*, **137** (2009), pp. 4259–4273, 15 pages, 13 figures.

· **Mechanisms**

– *A mathematical overview and some applications of gear design*, with Elisabetta A. Matsumoto, *3D Printing in Mathematics*, Proceedings of Symposia in Applied Mathematics, **79**, (2023), pp. 1–17, 18 pages, 48 figures and subfigures.

– *Self-Similar Quadrilateral Tilings and Deployable Scissor Grids*, with Kyle VanDeventer, *Proceedings of Bridges 2022: Mathematics, Music, Art, Architecture, Culture* (2022), pp. 313–316, 4 pages, 19 figures and subfigures.

– *Conjugate shape simplification via precise algebraic planar sweeps*, with Gershon Elber and Jinesh Machchhar, *Computers & Graphics*, **90** (2020), pp. 1–10, 10 pages, 10 figures. Received the SMI-2020 Honorable Mention Award.

– *Geared jitterbugs*, with Elisabetta A. Matsumoto, *Proceedings of Bridges 2019: Mathematics, Music, Art, Architecture, Culture* (2019), pp. 399–402, 4 pages, 9 figures.

– *Triple gear*, with Saul Schleimer, *Proceedings of Bridges 2013: Mathematics, Music, Art, Architecture, Culture* (2013), pp. 353–360, 8 pages, 19 figures.

· **Mathematical Exposition, Visualization and Art**

– *Surfaces in the Tesseract*, with Manuel Estévez and Érika Roldán, *Proceedings of Bridges 2023: Mathematics, Music, Art, Architecture, Culture* (2023), pp. 441–444, 4 pages, 20 figures and subfigures.

– *Ars Mathemalchemica: From Math to Art and Back Again*, with Susan Goldstine and Elizabeth Paley, *Notices of the American Mathematical Society* **69** (2022), no. 7, pp. 1220–1229, 10 pages, 26 figures and subfigures.

– *The art of illustrating mathematics*, with Edmund Harriss, *Journal of Mathematics and the Arts* **16** (2022), nos. 1–2, pp. 1–10, 10 pages, 3 figures.

– *Rolling Acrobatic Apparatus*, *Notices of the American Mathematical Society* **68** (2021), no. 7, pp. 1106–1118, 13 pages, 49 figures and subfigures.

– *Cohomology fractals*, with David Bachman and Saul Schleimer, *Proceedings of Bridges 2020: Mathematics, Music, Art, Architecture, Culture* (2020), pp. 175–182, 8 pages, 30 figures and subfigures.

– *Non-euclidean virtual reality III: Nil*, with Rémi Coulon, Elisabetta A. Matsumoto, and Steve Trettel, *Proceedings of Bridges 2020: Mathematics, Music, Art, Architecture, Culture* (2020), pp. 153–160, 8 pages, 37 figures and subfigures.

– *Non-euclidean virtual reality IV: Sol*, with Rémi Coulon, Elisabetta A. Matsumoto, and Steve Trettel, *Proceedings of Bridges 2020: Mathematics, Music, Art, Architecture, Culture* (2020), pp. 161–168, 8 pages, 20 figures and subfigures.

– *Möbius cellular automata scarves*, with Elisabetta A. Matsumoto and Fabienne Serriere, *Proceedings of Bridges 2018: Mathematics, Music, Art, Architecture, Culture* (2018), pp. 523–526, 4 pages, 6 figures.

– *Conformally correct tilings*, published as *Pavages effectivement conformes* with Saul Schleimer, *Objets mathématiques* (2017), CNRS Editions, pp. 140–147, 6 pages, 7 compound figures.

– *Numerically balanced dice*, with Robert Bosch and Robert Fathauer, *The Mathematics of Various Entertaining Subjects: Research in Games, Graphs, Counting, and Complexity,* **2** (2017), pp. 253–268, 16 pages, 10 figures.

– *Non-euclidean virtual reality I: explorations of* $\mathbb{H}^3$, with Vi Hart, Andrea Hawksley, and Elisabetta A. Matsumoto, *Proceedings of Bridges 2017: Mathematics, Music, Art, Architecture, Culture* (2017), pp. 33–40, 8 pages, 9 figures.

– *Non-euclidean virtual reality II: explorations of* $\mathbb{H}^2 \times \mathbb{E}$, with Vi Hart, Andrea Hawksley, and Elisabetta A. Matsumoto, *Proceedings of Bridges 2017: Mathematics, Music, Art, Architecture, Culture* (2017), pp. 41–48, 8 pages, 7 figures.

– *Magnetic sphere constructions*, with Rosa Zwier, *Proceedings of Bridges 2017: Mathematics, Music, Art, Architecture, Culture* (2017), pp. 79–86, 8 pages, 10 figures.

– *Visualizing Hyperbolic Honeycombs*, with Roice Nelson, *Journal of Mathematics and the Arts*, **11** (2017), no. 1, pp. 4–39. 36 pages, many figures.

– *Squares that Look Round: Transforming Spherical Images*, with Saul Schleimer, *Proceedings of Bridges 2016: Mathematics, Music, Art, Architecture, Culture* (2016), pp. 15–24, 10 pages, 9 figures with many subfigures.

– *Puzzling the 120-cell*, with Saul Schleimer, *Notices of the American Mathematical Society* **62** (2015), no. 11, pp. 1309–1316, 8 pages, 16 figures. A more detailed version is available at arXiv:1310.3549 [math.GT].

– *Hypernom: Mapping VR Headset Orientation to* S^3, with with Vi Hart, Andrea Hawksley and Marc ten Bosch, *Proceedings of Bridges 2015: Mathematics, Music, Art, Architecture, Culture* (2015), pp. 387–390, 4 pages, 3 figures.

– *The Quaternion Group as a Symmetry Group*, with Vi Hart, *Proceedings of Bridges 2014: Mathematics, Music, Art, Architecture, Culture* (2014), pp. 143–150, 8 pages, 8 figures. **Republished in *The Best Writing on Mathematics 2015*** (2015), Princeton University Press.

– *Developing fractal curves*, with Geoffrey Irving, *Journal of Mathematics and the Arts* **7** (2013), no. 3–4, pp. 103–121. 19 pages, 22 figures.

– *How to print a hypercube*, *Math Horizons* **20** (Feb 2013), no. 3, pp. 5–9, 5 pages, 9 figures.

– *3D printing for mathematical visualisation*, *Math. Intell.* **34** (2012), no. 4, pp. 56–62, 7 pages, 9 figures.

– *Sculptures in* S^3, with Saul Schleimer, *Proceedings of Bridges 2012: Mathematics,*

Music, Art, Architecture, Culture (2012), pp. 103–110, 8 pages, 9 figures.

– *Recent 3D printed sculptures*, *Hyperseeing*, 2011 Fall/Winter, 10 pages, 11 figures.

– *Fractal graphs by iterated substitution*, *Journal of Mathematics and the Arts* **5** (2011), no. 2, pp. 51–70, 20 pages, 20 figures.

– *The Sunflower Spiral and the Fibonacci Metric*, *Proceedings of Bridges 2010: Mathematics, Music, Art, Architecture, Culture* (2010), pp. 483–486, 4 pages, 4 figures.

– *Autologlyphs*, with Paul-Olivier Dehaye, *Mathematical Intelligencer* **26** (2004), no. 2, cover art and pp. 37–39, 3 pages, many figures.

– *100 prisoners and a lightbulb*, with Paul-Olivier Dehaye and Daniel Ford, *Mathematical Intelligencer* **25** (2003), no. 4, pp. 53–61, 9 pages, 3 figures.

· **Reviews**

– *Shaped to roll along a programmed periodic path*, with Elisabetta Matsumoto, *Nature* **620** (2023), pp. 282-283, 2 pages, 1 figure.

– *Hyperbolic Knot Theory, by Jessica S. Purcell*, *MAA Reviews*, 04/4/2021.

Outreach

· ***YouTube*** – I maintain a YouTube channel with expository videos. The channel has **over 23 million views**. Guest appearances on other YouTube channels have another **7.8 million views**.

· *The Dice Lab*, a collaboration with Robert Fathauer to commercially produce mathematically interesting dice designs. Articles on our 120-sided die appeared in The New Yorker, Wired, and Speigel Online. We consulted for Callaway Golf on golfball dimple designs, 2016–2018.

· Many of my 3D printed designs are freely available to download and print from Thingiverse and Printables.

· *The National Museum of Mathematics*, Exhibit Design Charrette, New York City, NY, November 30 - December 2 2018.

· *The National Museum of Mathematics*, Exhibit Design Charrette, New York City, NY, June 14 - 16 2017.

· Also see the sections on Mathematical Exposition, Seminars & Talks, Exhibitions, Installations, and Illustration.

Software & Data

· *Veering*, Regina-python and sage code for working with transverse taut and veering ideal triangulations; with Anna Parlak and Saul Schleimer, 2019–present.

· *3-dimensional.space*, ray-marching simulations of all eight Thurston geometries, with Rémi Coulon, Sabetta Matsumoto, and Steve Trettel, 2019–present.

· *Cohomology fractals*, with David Bachman, Matthias Goerner, and Saul Schleimer, 2019–2021.

· *A census of veering triangulations*, with Andreas Giannopolous and Saul Schleimer, 2018–2019.

· *Hyperbolic virtual reality with ray-marching*, with Roice Nelson and Michael Woodard, 2018–2019.

· *Virtual reality simulation of* $\mathbb{H}^2 \times \mathbb{E}$, with Vi Hart, Andrea Hawksley, Elisabetta Matsumoto, and Mike Stay, 2014–2017.

· *Virtual reality simulation of* $\mathbb{H}^3$, with Vi Hart, Andrea Hawksley, Elisabetta Matsumoto, and Mike Stay, 2014–2017.

- *Editing spherical images and video using Möbius transformations*, 2016.
- *Hypernom*, with Vi Hart, Andrea Hawksley, and Marc ten Bosch, 2014–2015.
- *Monkey see, monkey do*, with Vi Hart, Andrea Hawksley, and Marc ten Bosch, 2013–2015.
- *Dehn surgery images*, with Tracy Hall and Saul Schleimer, 2009–2014.

Conferences organised

- Spring 2024 Redbud Geometry / Topology conference, with Jonathan Johnson and Neil Hoffman, April 2024.
- PCMI Graduate Summer School: Illustrating Mathematics (Online), with Aaron Abrams, Jayadev Athreya, David Bachman, Rémi Coulon, Gabriel Dorfsman-Hopkins, Edmund Harriss, Alexander Holroyd, Sabetta Matsumoto, Laura Taalman, and Glen Whitney, July 2021.
- Spring 2021 Redbud Geometry / Topology conference (Online), with Neil Hoffman, March 2021.
- **Illustrating Mathematics semester program**, ICERM, Brown University, RI, with Kelly Delp, David Dumas, Saul Schleimer, Rich Schwartz, and Laura Taalman (lead organisers), Jayadev Athreya, David Bachman, Keenan Crane, Ellen Eischen, Sarah Koch, Alex Kontorovich, and Katherine Stange, Fall 2019.
- Spring 2018 Redbud Geometry / Topology conference, Oklahoma State University, OK, with Andy Eisenberg, Robert Haraway and Neil Hoffman, April 2018.
- Fall 2016 Redbud Triangulations conference, Oklahoma State University, OK, with Neil Hoffman, November 2016.
- Illustrating Mathematics workshop, ICERM, Brown University, RI, with Kelly Delp, Saul Schleimer, and Laura Taalman, June 2016.
- Spring 2015 Redbud Geometry / Topology conference, Oklahoma State University, OK, with Danielle O'Donnol and Sean Bowman. Supported by NSF award DMS-1463957.

Students Advised

- Brent Bertaux (2022–present), Jaxon Castillo (2022–2023), Ashley Potts (2023), Jake Williams (2024-present), undergraduate students, *Augmented/Virtual Reality Topological Interaction*.
- Manuel Estévez, PhD student, co-advised with Érika Roldán, Max-Planck-Institut für Mathematik in den Naturwissenschaften, 2022–present.
- Kyle VanDeventer, Undergraduate student (Koslow Research Scholar), *Self-Similar Quadrilateral Tilings and Deployable Scissor Grids*, Oklahoma State University, 2021-2022. After graduation, Kyle was hired as an Air Vehicle Engineer Engineer at Aurora Flight Sciences, a subsidiary of Boeing.
- Ryan Tavenner, Undergraduate student, *Visualizing four-dimensional space in virtual reality*, ICERM, 2019.
- Michael Woodard, Undergraduate student, *Simulating three-dimensional hyperbolic space with ray marching*, Oklahoma State University, 2018–2019. After graduation, Michael was hired as a game developer at Magic Leap.
- Mitchell Gampper, Undergraduate student, *Visualizing boundaries of triangulated three-manifolds*, Oklahoma State University, 2017–2018.
- Jesse Berry, Undergraduate student, *Combinatorics of the Fidgitz puzzle*, Oklahoma State University, 2017.
- Andreas Giannopoulos, Masters student, *Constructing veering triangulations*, Oklahoma

State University, 2016–2018.

- Austin Warner, Senior Honors Thesis, *A Group-Theoretic Interpretation of Margolus Neighborhood Cellular Automata on Tori*, Oklahoma State University, 2016.
- Nick Nelsen, Undergraduate student (Wentz Research Grant), *Characteristics of Space-Filling Trees*, Oklahoma State University, 2016. Nick presented a poster on his work at the 2017 Joint Mathematics Meetings, which was awarded a prize for being in the top 15% of posters. He was awarded a Goldwater Scholarship (April 2017). He next studied Mechanical Engineering as a graduate student at Caltech.
- Pengcheng Xu, PhD student, *Pants Block Decompositions of 3-Manifolds*, Oklahoma State University, 2015–2016. Pengcheng is now a lecturer (tenure track) at Guangdong University of Finance.
- Jimmy Hartford, Senior Honors Thesis, *Visualization of Hyperbolic 3-Manifolds*, Oklahoma State University, 2015.
- Rosa Zwier, summer undergraduate research project, *Magnetic sphere constructions*, University of Melbourne, 2012–2013. Rosa is now a programs officer and presenter at Scienceworks, the science museum in Melbourne.

Seminars & Talks

- *Geared Mechanisms*, Gathering 4 Gardner 14, Atlanta, GA, April 2022, with Sabetta Matsumoto; New York Puzzle Party, New York, NY, April 2024.
- *Avoiding inessential edges*, Redbud Geometry/Topology Conference, University of Arkansas, Fayetteville, AR, October 2023; University of Washington, Seattle, WA, November 2023; University of Victoria, Victoria, BC, Canada, November 2023; Columbia Geometric Topology Seminar, Columbia University, New York City, NY, April 2024.
- *Artistic mathematics: truth and beauty*, Proof School, San Francisco, CA, December 2017; Oklahoma State University Math Club, Stillwater, OK, February 2018; University of Virginia, Charlottesville, VA, February 2018; Stanford University Math Camp, Stanford, CA, August 2018; **Pixar**, Emeryville, CA, August 2018; **NYU Abu Dhabi Institute public lecture**, Abu Dhabi, United Arab Emirates, September 2018; A Celebration of Mind: Mathematics, Art, and Magic, Stanford University, Stanford, CA, October 2018; The University of Oklahoma Math Day, The University of Oklahoma, Norman, OK, November 2018; Northeastern Section of the Mathematical Association of America, Fall 2018 Meeting **Christie Lecture**, Southern New Hampshire University, Manchester, NH, November 2018; McNeel Webinar: Visualizing Mathematics in Rhinoceros (Online), November 2018; Imaginary Conference 2018 **(invited speaker), Montevideo, Uruguay**, December 2018; SoCal-Nev MAA Section Meeting, California State University Channel Islands, Camarillo, CA, April 2019; Park City Mathematics Institute summer session, UT, July 2019; Shenzhen Talent Park, **Shenzhen, China**, August 2019; Geometrias'19 Conference (keynote speaker), Department of Mathematics, University of Porto, Porto, Portugal, September 2019; **Sherwood Ebey Mathematics Lecture**, The University of the South, Sewanee, TN, October 2019; **Oxford Mathematics Public Lectures: Hooke Lecture**, Oxford, UK, January 2020; University of Leeds, Leeds, UK, February 2020; Newcastle University, Newcastle, UK, February 2020; The Latymer School, London, UK, February 2020; University of Wyoming, Laramie, WY, March 2020; University of Maryland, MD, March 2020; Beth Tfiloh High School, Baltimore, MD (Online), May 2020; American University, Washington, DC (Online), October 2020; University of Melbourne, Australia (Online), March 2021. International Centre for Mathematical Sciences, Edinburgh, UK (Online), October 2021; Southern Illi-

nois University, Carbondale, IL (Online), October 2021; University of South Alabama, Mobile, AL (Online), November 2021; Colorado College, Colorado Springs, CO (Online), March 2022; **Gordon Lecture**, Denison University, Granville, OH, September 2022; **J.C. Eaves Lecture**, University of Kentucky, Lexington, KY, September 2022; University of Arizona, Tucson, AZ, September 2022; Math & Stats Awareness Month Public Lecture, Texas State University, San Marcos, TX, April 2023; Illustrating Math Virtual Seminar (Online), organized by Aaron Abrams (Washington and Lee University) and Gabriel Dorfsman-Hopkins (St. Lawrence University), October 2023; Topology and Computer Workshop, Hiyoshi Campus, Keio University, Tokyo, Japan, October 2023; University of Iowa, Iowa City, AI, November 2023; Texas Oklahoma Regional Undergraduate Symposium, Southern Nazarene University, Bethany, OK, February 2024; **Distinguished Undergraduate Lecture**, Michigan State University, East Lansing, MI, April 2024; Oklahoma State University Math Club, Stillwater, OK, April 2024; Columbia undergraduate colloquium, Columbia University, New York City, NY, April 2024; CUNY College of Staten Island undergraduate colloquium, College of Staten Island, Staten Island, NY, April 2024.

- *Triangulations of three-manifolds: geometry, dynamics, and topology*, Michigan State University, East Lansing, MI, April 2024.
- *Variants of the 15-puzzle and the effects of holonomy*, New York Puzzle Party (Online), organized by Tom Cutrofello, February 2021; Matrix × Imaginary Conference on the Future of Mathematics Engagement (**invited speaker**) (Online), hosted by the Institut Henri Poincaré, September 2021; Art and Math Seminar, Kansas State University (Online), November 2021; π Fest, Oklahoma State University, Stillwater, OK, March 2022; MOVES Conference, National Museum of Mathematics/The Graduate Center, City University of New York, New York City, NY, August 2022 (Link to video); Denison University, Granville, OH, September 2022; University of New South Wales Mathematics Society, Sydney, Australia (Online), April 2023; STEM Academy, Meridian Technology Center, Stillwater OK, April 2023; AMS Special Session on Serious Recreational Mathematics, Joint Mathematics Meetings, San Francisco, CA, January 2024; Gathering 4 Gardner 15, Atlanta, GA, February 2024.
- *Learning by doing with 3D printing*, AMS Special Session on Using 3D-Printed and Other Digitally-Fabricated Objects in the Mathematics Classroom, Joint Mathematics Meetings, San Francisco, CA, January 2024.
- *Mathematical dice design*, Minnesota State High School Mathematics League, 2021 Summer Mathematics Institute (Online), June 2021; Art and Math Seminar, Kansas State University (Online), November 2021; π Fest, Oklahoma State University, Stillwater, OK, March 2022; Denison University, Granville, OH, September 2022; University of New South Wales Mathematics Society, Sydney, Australia (Online), April 2023; STEM Academy, Meridian Technology Center, Stillwater OK, April 2023; MOVES Conference, National Museum of Mathematics/The Graduate Center, City University of New York, New York City, NY, August 2023; AMS Special Session on Mathematics and the Arts, Joint Mathematics Meetings, San Francisco, CA, January 2024.
- *Drawing Cannon-Thurston maps*, Topology and Computer Workshop, Hiyoshi Campus, Keio University, Tokyo, Japan, October 2023
- *Scissor linkage (and other) mechanisms*, Creative Differences Workshop, London Design Biennale, London, UK, June 2023.
- *From loom spaces to veering triangulations*, Oklahoma State University, Stillwater, OK,

April 2023.

- *Design of hinged 3D auxetic mechanisms*, Symposium on Computational Geometry, University of Queensland, Brisbane, Australia, July 2017; Soft Matter and Physics of Living Systems Seminar, School of Physics, Georgia Tech, September 2017; Gathering 4 Gardner 13, Atlanta, March 2018; Symposium on Computational Fabrication (plenary talk), University of Washington, Seattle, WA, October 2022.
- *Visualizando Matemáticas con Impresión 3D*, Enova Fundación para la Educación, Peru (Online), July 2022.
- *Möbius cellular automata scarves*, Bridges conference on Mathematics and the Arts, Stockholm, Sweden, July 2018 (Link to video); Oklahoma State University Math Club, Oklahoma State University, Stillwater, OK, March 2019; Gathering 4 Gardner 14, Atlanta, GA, April 2022.
- *Designing holonomy mazes*, AMS Special Session on Quaternions, Joint Mathematics Meetings (Online), April 2022.
- *Visualization of Mathematics with 3D printing*, AMS Short Course: 3D Printing Challenges and Applications, Joint Mathematics Meetings (Online), January 2022.
- *Stereographic projection in Mathemalchemy*, Duke University, Durham NC, December 2021.
- *A survey of veering triangulations*, UC Berkeley, Berkeley CA, April 2018; University of Texas at Dallas, Dallas, TX (Online), November 2021.
- *Triangulating the figure 8 knot complement*, Colby College, ME, October 2014 (Link to video); University of Virginia REU in geometry-topology (Online), June 2021.
- *Viewing the Thurston geometries from the inside*, Banff International Research Station Workshop on Geometry: Education, Art and Research (Online), organized by Zohreh Shahbazi, Maliha Ahmed, and Parker Glynn-Adey, February 2021.
- *Essential loops in taut ideal triangulations*, University of Warwick, UK, January 2020; Oklahoma State University, Stillwater OK, February 2021.
- *From veering triangulations to Cannon-Thurston maps*, Geometry and Topology Online (Online), organized by Saul Schleimer (Warwick), May 2020; Oklahoma State University, Stillwater OK, September 2020; AMS Special Session on Algebraic and Geometric Perspectives on Low-Dimensional Topology, Joint Mathematics Meetings (Online), organized by Christine Lee (University of South Alabama) and Melissa Zhang (University of Georgia), January 2021.
- *Ray-tracing and ray-marching simulations of non-euclidean geometries*, Fall 2020 Redbud Topology Conference, University of Oklahoma, Norman, OK (Online), November 2020; Workshop on Topology: Identifying Order in Complex Systems (Online), organised by Randall Kamien (Penn, IAS), December 2020; Warwick Mathematics Colloquium (Online), University of Warwick, January 2021.
- *From veering triangulations to link spaces and back again*, **Oberwolfach workshop on Low-dimensional Topology**, Germany, February 2020; Georgia Institute of Technology, Atlanta, GA, February 2020; Australian Geometric Topology Webinar (Online), organized by Joan Licata (ANU), Daniel Mathews (Monash), Jessica Purcell (Monash) and Stephan Tillmann (Sydney), May 2020; Virtual Seminar on Geometry and Topology (Online), organized by Harry Hyungryul Baik (KAIST) and Sam Sang-hyun Kim (KIAS), June 2020.
- *Squares that look round: Transforming Spherical Images*, Stanford University Math Camp, Stanford, CA, July 2016; Bridges conference on Mathematics and the Arts (**plenary**

talk), University of Jyväskylä, Jyväskylä, Finland, August 2016 (Link to spherical video); Oklahoma State University Math Club, OK, October 2016; MAA Contributed Paper Session on Mathematics and the Arts, Joint Mathematics Meetings, Atlanta, GA, January 2017; Media Arts & Technology Seminar Series, UCSB, Santa Barbara, CA, January 2017; Crystal Flowers in Halls of Mirrors course, Aalto University, Helsinki, Finland, March 2017; Texas A&M University, College Station, TX, April 2017; School of Simulation and Visualisation, The Glasgow School of Art, Glasgow, UK, May 2017; Israel's National Recreational Math, Games and Puzzles Festival and Conference, Davidson Institute of Science Education, Weizmann Institute of Science, Rehovot, Israel, June 2017; The University of the South, Sewanee, TN, October 2019; ICERM, Providence, RI, October 2019; University of Wyoming, Laramie, WY, March 2020.

- *From veering triangulations to pseudo-Anosov flows* (pdf/keynote), UC Berkeley, Berkeley, CA, April 2018; UC Davis, Davis, CA, May 2018; Monash University, Melbourne, Australia, June 2018; University of Melbourne, Melbourne, Australia, June 2018; Classical and quantum three-manifold topology conference, Monash University, Melbourne, Australia, December 2018; University of Southern California, Los Angeles, CA, April 2019; University of Warwick, UK, May 2019; University of Sydney, Australia, May 2019; Southern University of Science and Technology, Shenzhen, China, August 2019; Brown University, Providence RI, November 2019.
- *Stereographic projection demo*, Talking Maths in Public Conference, Isaac Newton Institute, Cambridge, UK, August 2019.
- *Geared Jitterbugs*, with Sabetta Matsumoto, Bridges conference on Mathematics and the Arts, Linz, Austria, July 2019.
- *Transforming immersive video to build impossible worlds*, International Conference for Virtual Reality Professionals, Belfast, UK, June 2019.
- *Ray-marching and ray-tracing in hyperbolic space*, University of Sydney, Australia, June 2019.
- *3D Shadows of 4D art*, Stillwater PechaKucha Night Vol 3, Stillwater, OK, April 2019.
- *Implementing a virtual reality simulation of hyperbolic space with ray marching*, UC Davis, Davis, CA, May 2018; Oklahoma State University, Stillwater, OK, February 2019.
- *Design of 3D printed mathematical art*, Caltech, CA, May 2014; **Symposium on Computational Geometry (invited plenary talk)**, Kyoto, Japan, June 2014 (Link to video); Nara Women's University, Nara, Japan, June 2014; UC Berkeley, CA, November 2014; University of Oklahoma (colloquium), OK, November 2014; Reed College, Portland, OR, February 2015; **Pixar**, CA, February 2015; Kansas State University, KS, March 2015; Park City Mathematics Institute summer session, UT, July 2015, Oklahoma State University (colloquium), OK, September 2015; 35th Annual Mathematics Symposium, (keynote speaker), Western Kentucky University, Bowling Green, KY, November 2015; Ohio State University, Columbus, OH, December 2015; Mathematical Sciences Research Institute, Berkeley, CA, February 2016; **SRI International**, Menlo Park, CA, March 2016; Georgia Tech, Atlanta, GA, March 2016; **International Geometry Summit (public lecture)**, Berlin, Germany, June 2016; Universität Heidelberg, Heidelberg, Germany, July 2016; Young Mathematicians Conference (plenary talk), The Ohio State University, Columbus OH, August 2016; Graphics Seminar, Computer Graphics and Artificial Intelligence Lab, MIT, Cambridge, MA, October 2016; Department of Physics, Oklahoma State University, OK, October 2016; IUPUI, Indianapolis, IN, February 2017; Aalto University, Helsinki, Finland, March 2017; Texas A&M University, College Station,

TX, April 2017; The University of Edinburgh, Edinburgh, UK, May 2017; Universität Regensburg, Regensburg, Germany, May 2017; Center for Graphics and Geometric Computing, Computer Science Department, Technion, Haifa, Israel, June 2017; 3D Printing Workshop, Durham University, Durham, UK, June 2017; Park City Mathematics Institute summer session, UT, June 2017; 2017 SIAM Conference on Industrial and Applied Geometry (plenary talk), July 2017; **The 11th Asian Forum on Graphic Science (invited plenary talk)**, The University of Tokyo, Tokyo, Japan, August 2017; Dartmouth College, Hanover, NH, November 2017; University of San Francisco, San Francisco, CA, November 2017; UNC Greensboro, Greensboro, NC, November 2018.

- *Extensors: Expanding Mechanisms*, Celebration of Mind at Stanford University, Stanford, CA, October 2018; 2018 Celebration of Mind Festival, MSRI, Berkeley, CA, October 2018.
- *Visualizing hyperbolic honeycombs*, Crystal Flowers in Halls of Mirrors course, Aalto University, Helsinki, Finland, March 2017; Bridges conference on Mathematics and the Arts, Stockholm, Sweden, July 2018 (Link to video); 2018 Celebration of Mind Festival, MSRI, Berkeley, CA, October 2018.
- *Illustrating Mathematics at ICERM*, Modern Math Workshop (pre-conference event for the 2018 SACNAS National Conference), San Antonio, TX, October 2018.
- *Visualizing Mathematics with 3D Printing*, Construct3D conference (featured speaker), Georgia Tech, GA, October 2018.
- *Non-euclidean virtual reality*, Crystal Flowers in Halls of Mirrors course, Aalto University, Helsinki, Finland, March 2017; School of Physics, University of Bristol, Bristol, UK, May 2017; Israel's National Recreational Math, Games and Puzzles Festival and Conference, Davidson Institute of Science Education, Weizmann Institute of Science, Rehovot, Israel, June 2017; Bridges conference on Mathematics and the Arts, University of Waterloo, Waterloo, Canada, July 2017; Two Sigma Investments, New York City, NY, October 2017; The National Museum of Mathematics, New York City, NY, December 2017; MAA Contributed Paper Session on Mathematics and the Arts, Joint Mathematics Meetings, San Diego, CA, January 2018; Virtuhoma Virtual and Augmented Reality Symposium, Oklahoma State University, Stillwater OK, September 2018.
- *3D Shadows: Casting Light on the Fourth Dimension*, **The National Museum of Mathematics, Math Encounters public presentation series**, New York City, NY, October 2016; Department of Mathematics, MIT, Cambridge, MA, October 2016; Georgia Tech **Frontiers in Science public lecture**, Atlanta, GA, October 2016; School of the Art Institute of Chicago, Chicago, IL, January 2017; University of Central Oklahoma, College of Mathematics & Science Spring 2017 Seminar Series, Edmond, OK, February 2017; University of Michigan **Saturday Morning Physics public lecture**, Ann Arbor, MI, February 2017; IUPUI, Indianapolis, IN, February 2017; Heureka Science Centre, Helsinki, Finland, March 2017; Kentucky MAA Spring Meeting Invited Address, Berea College, Berea, KY, March 2017; Southwestern Undergraduate Mathematics Research Conference plenary talk, Northern Arizona University, Flagstaff, AZ, April 2017; Texas A&M University, College Station, TX, April 2017; Duke University Public Lectures Unveiling Math series, Durham, NC, April 2017; **Apple Industrial Design team**, Apple Inc., Cupertino, CA, April 2017; Israel's National Recreational Math, Games and Puzzles Festival and Conference, Davidson Institute of Science Education, Weizmann Institute of Science, Rehovot, Israel, June 2017; 3D Printing Workshop, Durham University, Durham, UK, June 2017; Tamura/Lilly public lecture, Oberlin College, Oberlin, OH, September

2017; Mount Holyoke College, South Hadley, MA, October 2017; UC Davis, Davis, CA, May 2018; NYU Abu Dhabi, Abu Dhabi, United Arab Emirates, September 2018.

- *Dehn surgery by shearing*, Oklahoma State University, Stillwater, OK, September 2018.
- *A survey of veering triangulations and computation*, Computational Problems in Low-dimensional Topology Mini Symposium, OIST, Okinawa, Japan, March 2018.
- *From veering triangulations to dynamic pairs*, Oklahoma State University, Stillwater OK, January 2018.
- *Using quaternions to colour the cells of a tiling of* $\mathbb{H}^3$, AMS Special Session on Quaternions, Joint Mathematics Meetings, San Diego, CA, January 2018.
- *From veering triangulations to pseudo-Anosov flows*, Oklahoma State University, Stillwater, OK, November 2017.
- *Artistic mathematics*, Global Math Project Symposium: Uplifting Mathematics for All, Courant Institute of Mathematical Sciences, New York University, New York City, NY, October 2017.
- *Visualizing Mathematics with 3D Printing: Augmenting a Traditional Book with New Media, and Editing Spherical Video with Möbius (and other) Transformations*, Imaginary Conference 2016 (**invited speaker**), Berlin, Germany, July 2016; School of Simulation and Visualisation, The Glasgow School of Art, Glasgow, UK, May 2017; Society for Physics Students, Georgia Tech, September 2017.
- *Brilliant Geometry*, Summerhall, Edinburgh, UK, May 2017.
- *Connectivity of the set of triangulations of a 3- or 4-manifold*, Oklahoma State University, OK, April 2017; Georgia Tech, Atlanta, GA, April 2017; Duke University, Durham, NC, April 2017.
- *Visualizing Mathematics with 3D Printing*, **Shaping the Future 4 EdTech summit**, Center for Educational Technology, Tel Aviv, Israel, March 2017.
- *Puzzling the 120–cell*, **MOVES Conference (plenary talk)**, Museum of Mathematics, New York, NY, August 2013 (Link to video); Gathering 4 Gardner 11, Atlanta, March 2014; New York Puzzle Party, New York, NY, February 2017.
- *Connectivity of triangulations without degree one edges under 2-3 and 3-2 moves*, Oklahoma State University, OK, September 2016; Columbia University, New York City, NY, October 2016; Quantum invariants and low-dimensional topology conference, MATRIX mathematical research institute, Creswick, VIC, Australia, December 2016; University of Michigan Geometry Seminar, Ann Arbor, MI, February 2017.
- *Navigating the three-sphere via quaternions*, AMS Special Session on Quaternions, Joint Mathematics Meetings, Atlanta, GA, January 2017.
- *Design by transformation*, MAA Invited Paper Session on Technical Tools for Mathematical 3D Printing, Joint Mathematics Meetings, Atlanta, GA, January 2017.
- *Visualizing Mathematics with 3D Printing*, Leonardo Art Science Evening Rendezvous talk, UC Berkeley, CA, October 2016.
- *Math plus 3D printing, spherical video, and virtual reality*, Samsung Accelerator, New York City, NY, October 2016.
- *How to make sculptures of 4-dimensional things*, Edison Preparatory High School visit to Oklahoma State University, OK, April 2014; **Hari Shankar Memorial public lecture**, University of Northern Iowa, IA, April 2014 (Link to video); Stillwater High School Math Club, OK, October 2014; University of Oklahoma Math Day invited speaker, OK,

November 2014; University of Oklahoma Math Club, OK, January 2015; Kansas State University, KS, March 2015; Park City Mathematics Institute summer session, UT, July 2015; Geometry Labs United Conference 2015 invited speaker, UIUC, IL, August 2015; Undergraduate Mathematics Symposium invited speaker, UIC, IL, October 2015; Ohio State University, Mansfield, OH, November 2015; Exploratorium, San Francisco, CA, January 2016; Denison University, OH, February 2016, Park City Mathematics Institute summer session, UT, July 2016; George Mason University, VA, September 2016.

- *3D printed sculptures of 4D things*, Electromagnetic Field 2016, Guildford, UK, August 2016 (Link to video).
- *Rhino and Python Workshop*, Illustrating Mathematics topical session, ICERM, Brown University, RI, June 2016.
- *Two tales of Mathematical Virtual Reality*, **International Geometry Summit (invited plenary lecture)**, Berlin, Germany, June 2016.
- *Spherical image transformations and the Droste effect*, Gathering 4 Gardner 12, Atlanta, GA, March 2016.
- *Hypernom: Mapping VR Headset Orientation to S^3*, Bridges conference on Mathematics and the Arts, Baltimore, MD, August 2015 (Link to video, Link to spherical video); Joint Mathematics Meetings 2016, Seattle, WA, January 2016; Gathering 4 Gardner 12, Atlanta, GA, March 2016.
- *Realising Mathematics: Creating mathematical models through 3D printing*, with David Bachman, University of Arkansas Math Club, AR, October 2015.
- *3D Printing in Mathematics*, Kansas City Regional Mathematics Technology Expo (invited talk), Kansas City, MO, October 2015.
- *Veering Dehn Surgery*, Kansas State University, KS, March 2015, AMS Central Spring Sectional Meeting, Michigan State University, East Lansing, MI, March 2015, Georgia Tech, Atlanta, GA, April 2015. Moab Topology Conference, Moab UT, May 2015, Invariants in Low Dimensional Geometry Conference, Gazi University, Ankara, Turkey, August 2015.
- *Using Mathematica and Rhinoceros to produce 3D printed mathematical models* (workshop notes: Mac/Windows), EViMS: Workshop on the Effective Use of Visualization in the Mathematical Sciences, University of Newcastle, Australia, November 2012; Park City Mathematics Institute summer session, UT, July 2015; Kansas City Regional Mathematics Technology Expo, Kansas City, MO, October 2015; Ohio State University, Mansfield, OH, November 2015.
- *How to make sculptures of 4-dimensional objects*, **American Association for the Advancement of Science Annual Meeting**, San Jose, CA, February 2015.
- *Pachner moves and crushing normal surfaces*, Oklahoma State University, OK, November 2014; UC Berkeley, CA, November 2014; University of Oklahoma, OK, January 2015.
- *The quaternion group as a symmetry group*, Bridges conference on Mathematics and the Arts, Seoul, South Korea, August 2014 (Link to video); Joint Mathematics Meetings, San Antonio, TX, January 2015.
- *Rep-tiles, fractal curves, 3D printing and the 4th dimension*, Colby College, ME, October 2014 (Link to video).
- *Developing fractal curves*, Bridges conference on Mathematics and the Arts, Seoul, South Korea, August 2014 (Link to video).
- *Sculpture in four-dimensions*, Simons Center for Geometry and Physics, Stony Brook

University, NY, June 2014 (Link to video); The University of Edinburgh, UK, August 2014 (Link to video).

- *Structure on the set of triangulations*, Oklahoma State University, OK, February 2014; Rutgers University, NJ, March 2014, Michigan State University, MI, April 2014; Caltech, CA, May 2014; Symposium on Computational Geometry, Kyoto, Japan, June 2014; Nara Women's University, Nara, Japan, June 2014.
- *Regular triangulations and the index of a cusped hyperbolic 3-manifold*, University of Sydney, Australia, January 2013; University of Melbourne, Australia, April 2013; Oklahoma State University, OK, October 2013; University of Arkansas, AK, November 2013; AMS Fall Eastern Sectional Meeting, Temple University, Philadelphia, PA, October 2013; AMS Fall Central Sectional Meeting, Washington University, St Louis, MO, October 2013; Pitzer College, CA, November 2013; Joint Mathematics Meetings, Baltimore, MD, January 2014.
- *Triple gear*, Bridges conference on Mathematics and the Arts, Enschede, The Netherlands, July 2013 (Link to video); Joint Mathematics Meetings, Baltimore, MD, January 2014.
- *Fractal curves, 4-dimensional puzzles and unlikely gears*, Melbourne University Mathematics and Statistics Society, April 2013; Pitzer College, CA, November 2013; Davidson College, NC, November 2013; Washington and Lee University, VA, November 2013.
- *Fractals and how to make a Sierpinski Tetrahedron*, Residential Indigenous Science Experience (RISE), University of Melbourne, Australia, November 2012.
- *Sculptures in* S^3, Bridges conference on Mathematics and the Arts, Towson University, MD, July 2012 (Link to video); OzViz, University of Western Australia, Australia, December 2012.
- *Triangulations of hyperbolic 3-manifolds admitting strict angle structures*, Australian Mathematical Society (AustMS) Meeting, University of Wollongong, Australia, September 2011; AMS Special Session on Hyperbolicity in Manifolds and Groups, Joint Mathematics Meetings, Boston, January 2012; **Oberwolfach workshop on Triangulations**, Germany, May 2012, University of Sydney Geometry Seminar, Australia, July 2012.
- *A generalisation of the deformation variety*, University of Texas Topology Seminar, May 2009; Oklahoma State University Topology Seminar, September 2009; Georgia Tech Topology Seminar, October 2009; AMS 2010 Spring Western Section Meeting, Albuquerque, NM, April 2010; AMS-SMM Eighth International Meeting, Berkeley, CA, June 2010; University of Melbourne Topology Seminar, Australia, October 2010; University of Queensland Topology Seminar, Australia, October 2010; University of Vienna, Austria, May 2012.
- *Fractal graphs by iterated substitution*, Gathering 4 Gardner 10, Atlanta, March 2012.
- *Some Mathematical Sculptures*, Temple University Geometry-Topology Seminar Special Undergraduate Talk, January 2012; New Orleans Center for Creative Arts, January 2012; Melbourne University Mathematics and Statistics Society, March 2012, Virtual Environments guest lecture, Melbourne School of Design, The University of Melbourne, March 2012 and August 2012; National Youth Science Forum, The University of Melbourne, March 2012.
- *Hyperbolic Geometry, Triangulations of 3-manifolds, and Mathematical Art*, Oklahoma State University, January 2012; Wesleyan University, February 2012.
- *Fractal graphs and Rep-tiles*, New Orleans Center for Creative Arts, January 2012.

- *When is a Knot Not a Knot?*, Oberlin College, January 2010; Davidson College, February 2010; University of Queensland, November 2010; Melbourne High School visit to the University of Melbourne, September 2011; Yass High School visit to the University of Melbourne, December 2011; Shelford Girl's Grammar School visit to the University of Melbourne, January 2013.
- *Veering triangulations admit strict angle structures*, University of Texas Topology Seminar, Dec 2010; University of Melbourne Algebra/Geometry/Topology Seminar, March 2011; University of Coimbra Topology Seminar, July 2011.
- *Geometric structures on triangulated 3-manifolds*, University of Warwick, March 2011.
- *The Sunflower Spiral and the Fibonacci Metric*, Bridges conference on Mathematics and the Arts, Pécs, Hungary, July 2010.
- *Autologlyphs: Self Referential Mathematical Typography*, Gathering 4 Gardner 9, Atlanta, March 2010.
- *The Mathfest 2009 Poster Image, Mathematical Art, Design and Education in Second Life*, Mathfest 2009, Portland, August 2009.
- *Drawing knots using computers*, Unknot Conference (Undergraduate Knot Theory Conference), Denison University, July 2009.
- *Extending the deformation variety*, University of Texas Topology Seminar, November 2008.
- *Ideal Triangulations and Components of the Character Variety*, Rice University Topology Seminar, November 2007; University of Texas Topology Seminar, November 2007
- *Incompressible Surfaces in Punctured Torus Bundles, and the Ideal Points They Come From*, UC Davis Geometry/Topology Seminar, April 2006; Southern California Topology Conference, Caltech, January 2007; University of Texas Topology Seminar, March 2007; thesis defence, Stanford, April 2007.
- *When is a Knot Not a Knot?*, Educational Program for Gifted Youth, Stanford, July 2006.
- *Geometric Structures and Dehn Surgery on the Figure 8 Knot Complement*, area exam talk, Stanford, November 2004.
- *Foliation of the Figure 8 Knot Complement in S^3 (with lots of pictures)*, graduate students seminar, October 2003.
- *The Mathematics of Juggling*, graduate students seminar, March 2003; Stanford University Math Camp July 2004 and July 2006; Saturday Morning Math Group (at Texas), February 2008; Melbourne University Mathematics and Statistics Society, September 2010, New Orleans Center for Creative Arts, January 2012; Oklahoma State University Math Club, OK, October 2013; Oklahoma State University High School Math Day, October 2015.

Teaching

- **Oklahoma State University**
  - Assistant and Associate Professor (each course approx. 36 hours of class time)
    - *General Topology*, Fall 2023.
    - *Calculus III*, Spring 2014 (one Honours section), Fall 2014, Fall 2015, Spring 2016, Spring 2018, Spring 2019, Fall 2020, Spring 2021, Spring 2022, Fall 2022, Spring 2023, Fall 2023.
    - *Geometry & Algorithms in Three-Dimensional Modelling*, Spring 2016–2019, Spring 2021–2023.
    - *Geometric Topology* (core graduate course), Fall 2014, Fall 2016, Fall 2018, Fall

2020, Fall 2021, Fall 2022.
  - *Calculus II*, Fall 2013 (two sections), Fall 2017 (two sections), Fall 2018, Fall 2021.
  - *Algebraic Topology* (core graduate course), Spring 2015 & 2017.
  - *Linear Algebra*, Fall 2016.

· **Mathematical Sciences Center, Tsinghua University, Beijing**
  · Minicourse (11 hours of class time)
    - *Ideal triangulations of 3-manifolds and the deformation variety*, April 2012.

· **University of Texas at Austin**
  · Lecturer (each course approx. 36 hours of class time)
    - *Hyperbolic Geometry and Triangulations of 3-Manifolds*, Spring 2010.
    - *Differential Calculus*, Fall 2009.
    - *Real Analysis I*, Spring 2009.
    - *Multivariable Calculus*, Fall 2008.
    - *Introduction to Number Theory*, Spring 2008.
    - *Discrete Mathematics*, Fall 2007.

· **Stanford University**
  · Teaching Assistant (each course approx. 33 hours of class time)
    - *Linear Algebra and Calculus of Several Variables* (Accelerated Calculus for Engineers TA[1]), Spring 2006, Spring 2007.
    - *Calculus II*, (Accelerated Calculus for Engineers TA), Winter 2007 & 2006.
    - *Calculus I*, (Accelerated Calculus for Engineers TA), Fall 2006.
    - *Linear Algebra and Calculus of Several Variables* (Admin. TA), Fall 2005.
    - *Linear Algebra and Calculus of Several Variables*, Winter 2005, Fall 2003.
    - *Calculus I*, Fall 2002
  · Course Assistant (office hours only)
    - *Algebraic Topology*, Spring 2005
    - *Differential Topology*, Spring 2004
    - *Matrix Theory and Applications*, Spring 2003
    - *Modern Algebra I*, Fall 2001

· **New Orleans Center for Creative Arts**[2]
  · Served on the "NOCCA Advisory Council", a group convened to help guide the transition of NOCCA from a half-day arts school to a full-day diploma-granting institution covering all subjects, whilst preserving the creativity and spirit of this highly successful school, April 2009.
  · Worked with NOCCA writing the curriculum framework for their mathematics program.

· **Other**
  · Stanford University Math Camp TA/Live-In Counsellor, July 2004
  · Putnam Competition Seminar, Fall 2004
  · Work on creating mathematical learning experiences based around mathematical sculp-

[1] The Accelerated Calculus for Engineers program is one of a number of recruitment and retention programs run by Stanford's School of Engineering, geared towards increasing breadth and diversity in engineering.

[2] NOCCA, the New Orleans Center for Creative Arts, is a pre-professional arts training center that offers secondary school-age children intensive instruction in dance, media arts, music, theatre arts, visual arts and creative writing.

tures in the virtual world Second Life, funded by the New Media Consortium[3], September 2006.

Math Art Exhibitions

- Joint Mathematics Meetings 2024, January 2024: Cannon-Thurston map for the complement of the figure-eight knot and Cannon-Thurston map for the SnapPy manifold s227 (with Saul Schleimer and Will Segerman; the s227 piece won the **Best Photograph, Painting, or Print** prize).
- *Seeing the Unseen: Math and Art*, Wignall Museum of Contemporary Art, Chaffey College, Rancho Cucamonga, CA, January 9 – March 9, 2024, Thurston geometries (with Rémi Coulon, Sabetta Matsumoto, and Steve Trettel).
- *Unusual Geometries*, OSU Museum of Art, Stillwater, OK, October 17 – December 16, 2023, Cohomology fractals (with David Bachman and Saul Schleimer), Stereographic projection (grid).
- Bridges Conference 2023, Dalhousie University, Halifax, Canada, July 2023, Cannon-Thurston map for the complement of the figure-eight knot (with Saul Schleimer and Will Segerman), An unknot and a trefoil disguised as an unknot, and in the short film festival: Impossible triangles.
- Bridges Conference 2022, Aalto University, Helsinki, Finland, August 2022: Kinetic cyclic scissors (with Kyle VanDeventer), Hyperbolic 29 puzzle, and in the short film festival: Where do these circles come from?
- *Intersections = Math + Art*, Cascadia College Mobius Art Gallery, Bothell, WA, May 9 – June 3, 2022, five Hyperbolic Honeycombs: $(3, 5, 5)$, $(3, 10, 7)$, $(20, 3, 6)$, $(20, 4, 20)$, and $(\infty, \infty, 4)$ (with Roice Nelson).
- *Art by Number*, Peninsula School of Art, Door County, WI, October 9 – November 27, 2021, (2,3,5) triangle tiling (with Saul Schleimer); Stereographic projection (grid).
- For the Love of Math, Suzanne Zahr gallery, Mercer Island, WA, October 1 – November 24 2021, Cohomology Fractals (with David Bachman and Saul Schleimer), 15+4 Puzzle, and Hyperbolic 29 Puzzle.
- **Mathematics: Vintage and Modern**, SFO Museum, San Francisco International Airport, San Francisco, CA, July 30, 2021 – May 01, 2022, Developing Terdragon Curve and Developing Sierpiński Arrowhead Curve.
- Bridges conference[4] 2021 (Online), August 2021: Jupiter Gyroid (with Jason Krugman and Sabetta Matsumoto), and 15 + 4 puzzle.
- Joint Mathematics Meetings 2021 (Online), January 2021: Closed cohomology fractals (with David Bachman, Matthias Goerner, and Saul Schleimer).
- Bridges Conference 2020, Aalto University, Helsinki, Finland, August 2020 (moved online due to COVID-19): Cohomology fractals (with David Bachman and Saul Schleimer).
- ICERM Illustrating Mathematics semester program, Providence, RI, September 4-December 6, 2019: (3,3) Seifert Surface and (3,3) Seifert Surface with Fibers (with Saul Schleimer), Cannon-Thurston Maps (with David Bachman and Saul Schleimer), Figure-eight knot complement (with François Guéritaud and Saul Schleimer), and Möbius Cellular Au-

[3]The New Media Consortium is an international 501(c)3 not-for-profit consortium of nearly 200 leading colleges, universities, museums, corporations, and other learning-focused organizations dedicated to the exploration and use of new media and new technologies.

[4]The Bridges conference is an annual international meeting on connections between art and mathematics, featuring invited speakers, full and short paper presentations, educational workshops, and a juried art exhibition.

tomata Scarves (with Sabetta Matsumoto and Fabienne Serriere).

- Bridges conference 2019, Linz, Austria, July 16-19, 2019: Geared Jitterbugs (with Sabetta Matsumoto), and in the short movie festival: Non-euclidean virtual reality using ray marching.
- Mathapalooza!, Decatur, GA, March 9, 2019: Tetrahedral racks (with Saul Schleimer) and Developing Hilbert Curve.
- Joint Mathematics Meetings 2019, Baltimore, MD, January 16-19, 2019: Cannon-Thurston Ball (with David Bachman), and Five axis racks (with Sabetta Matsumoto).
- Bridges conference 2018 Nominee's Gallery, Stockholm, Sweden, July 25-28, 2018: Möbius Cellular Automata Scarves (with Sabetta Matsumoto and Fabienne Serriere), and in the short movie festival: Peace for Triple Piano and The Making of "Peace for Triple Piano" (both with Vi Hart).
- Joint Mathematics Meetings 2018, San Diego, CA, January 10-12, 2018: Trefoil spine (with Saul Schleimer), and Juggling motion.
- Bridges conference 2017 General Exhibition, University of Waterloo, Waterloo, Canada, July 27-30, 2017: Tetrahedral racks and Borromean racks (both with Saul Schleimer).
- **Brilliant Geometry: An interactive exhibition**, Summerhall, Edinburgh, UK, 13 May – 4 June 2017, solo exhibition with Saul Schleimer, Peter Reid, Mark Reynolds and Sabetta Matsumoto.
- Joint Mathematics Meetings 2017, Atlanta, GA, January 4-7, 2017: Tetrahedral racks, and Borromean racks (both with Saul Schleimer).
- *Mysterium Tremendum: collecting curiosity*, CU Art Museum, University of Colorado, Boulder, CO, August 9 - December 17, 2016: Round Möbius strip (with Saul Schleimer), Developing terdragon curve.
- *The Mobile: Composition in Motion*, The Carrack Gallery, Durham, NC, November 9 – 19, 2016: Mobile 4.1, Quaternary Tree Mobile (Level 5), Mobile 1, (all with Marco Mahler).
- Bridges conference 2016, University of Jyväskylä, Jyväskylä, Finland, August 9-12, 2016: Klein Quartic, (with Saul Schleimer), and in the short movie festival: Spherical Droste video, and Illuminating hyperbolic geometry (with Saul Schleimer).
- *Illustrating Mathematics*, Mathematical Sciences Research Institute, Berkeley, CA, February 25 – March 6, 2016: 10 pieces (with Saul Schleimer and Will Segerman).
- Joint Mathematics Meetings 2016, Seattle, WA, January 6-9, 2016: Klein quartic, and (2,3,5) triangle tiling (with Saul Schleimer); Stereographic projection (grid).
- *In the Realm of Forms*, Pearl Conard Art Gallery, Ohio State University, Mansfield Campus, OH, October 7 – November 20, 2015: Conformal Chmutov, Seifert surface for (2,2) torus link, Seifert surface for (2,2) torus link with fibers, Seifert surface for (3,3) torus link, Seifert surface for (3,3) torus link with fibers (all with Saul Schleimer), November 9 – December 8, 2015.
- *MathThematic: a fine art exhibition*, Esther Klein Gallery, Philadelphia, PA: Quaternary Tree Mobile (Level 5), (with Marco Mahler).
- Bridges conference 2015: Hypernom, (with Vi Hart, Andrea Hawksley and Marc ten Bosch), Monkey See, Monkey Do (with Vi Hart, Andrea Hawksley, Will Segerman and Marc ten Bosch), Hyperbolic Catacombs and $\{\infty, \infty, \infty\}$ (with Roice Nelson), and in the short movie festival: Torus knots and Seifert surfaces (both with Saul Schleimer).

- Joint Mathematics Meetings 2015: Hilbert Sphere (with David Bachman and Robert Fathauer), Hyperbolic Catacombs and Regular {4,6,4} $\mathbb{H}^3$ Honeycomb (with Roice Nelson) and More fun than a hypercube of monkeys (with Will Segerman).
- *MoSAIC*[5] exhibition of mathematical art: Triple gear (with Saul Schleimer).
- Bridges conference 2014: Developing Fractal Curves, More fun than a hypercube of monkeys (with Will Segerman), "Buckyball" Buckyball (with Rosa Zwier).
- **Illustrating Geometry Art Exhibition**, ***Simons Center for Geometry and Physics***, Stony Brook, NY, solo show with Saul Schleimer, 19 June – 1 August 2014. Catalog (26 pieces), Posters, Walkthrough video.
- Joint Mathematics Meetings 2014: Triple gear (with Saul Schleimer).
- *First Annual Museum of Mathematics Gala*, The National Museum of Mathematics, New York, NY, October 2013, 49 colour 3D prints designed as table centerpieces.
- Bridges conference 2013: Triple gear (with Saul Schleimer; won the **Most Innovative** People's Choice Award, one of four awards given), Seifert surfaces for (3,3) and (4,4) torus links (with Saul Schleimer), "Bunny" Bunny (with Craig S. Kaplan).
- *Edinburgh International Science Festival, City Art Centre Exhibition 2013*: ten sculptures.
- *Joint Mathematics Meetings 2013*: Seifert surfaces for torus knots and links (with Saul Schleimer), Developing Fractal Curves.
- Bridges conference 2012: Dual Half 120- and 600-Cells (with Saul Schleimer; won the **Most Effective Use of Mathematics** People's Choice Award, one of four awards given.)
- Joint Mathematics Meetings 2012: Round Möbius strip, Round Klein bottle (with Saul Schleimer).
- Bridges conference 2011: Space filling graph 1, Octahedron fractal graph, Cuboctahedral fractal graph.
- Bridges conference 2010: Sphere autologlyph, Torus autologlyph.

Math Art Installations

- *Mathemalchemy*, joint work with 23 other mathematicians and artists, led by Ingrid Debauchies (Duke) and Dominique Ehrmann (independent). This is a room-sized installation artwork, completed in 2021. The first showing was at the National Academy of Sciences in Washington, DC, in the first half of 2022.
- *Department of Mathematics, Colby College*, Glass interest panel depicting a space filling curve based on the pinwheel tiling, 2014.
- *Department of Mathematics and Statistics, The University of Melbourne*, Five large 3D printed sculptures, of surfaces and 4–dimensional polytopes in S^3, 2012.

Mathematical Illustration

- Our image, *Bleu Hyperbolique*, was one of two winners of the Grand Jury Prize of the *La preuve par l'image 2022* competition, organized by CNRS and Acfas. With Rémi Coulon, Sabetta Matsumoto, and Steve Trettel, 2022.
- A photo of my sculpture *Dual circles (stereographic projection)* was published on page 52 of *Putting two and two together: Selections from the Mathologer Files*, by Burkard

[5] MoSAIC is a series of interdisciplinary mini conferences and festivals on mathematical connections in science, art, industry, and culture, held in colleges and universities around the United States and abroad. MoSAIC is sponsored and funded by MSRI (Mathematical Sciences Research Institute) and administered by the Bridges organization.

Polster and Marty Ross, American Mathematical Society, 2021.

- A photo of my sculpture *Topology joke* (with Keenan Crane) appears as Figure 18.8 in *Visual differential geometry and forms*, by Tristan Needham, Princeton University Press, 2021.
- A photo of my sculpture *Five axis racks* (with Sabetta Matsumoto) appears in the AMS *2020 Calendar of Mathematical Imagery*.
- My two-dimensional design illustrating the Hopf fibration appears in *Visions of the Universe: A Coloring Journey Through Math's Great Mysteries*, by Alex Bellos and Edmund Harriss, published November 2016.
- A chapter heading for *Playing with Math*, edited by Sue VanHattum, features a photograph of my sculpture "Hopf Fibration 1", published March 2015.
- A photograph of a sculpture of a tesseract, by Saul Schleimer and me, was featured in *50 Visions of Mathematics*, edited by Sam Parc, published July 2014.
- The cover of *Maths in 100 Key Breakthroughs* by Richard Elwes, features a design of mine (the second "0"), published December 2013.
- Cover image for the November 2013 issue of the *College Mathematics Journal*, supporting the Mathematics of Planet Earth initiative, MPE 2013.
- The cover of *L'impression 3D*, by Mathilde Berchon and Bertier Luyt features a photograph of my sculpture (with Craig S. Kaplan), "Bunny" Bunny, published June 2013.
- Cover image and all illustrations for *Blast into Math!*, by Julie Rowlett, published January 2013.
- Cover image for *Number Theory Through Inquiry*, by David C. Marshall, Edward Odell & Michael Starbird, published December 2007.
- Cover design and some illustrations for *A Mathematical Mosaic: Patterns & Problem Solving (Revised Edition)*, by Ravi Vakil, published October 2007.

Service

- **Associate Editor** for the *Journal of Mathematics and the Arts*, 2012–present.
- Special issue editor (with Edmund Harriss), *The Art of Mathematical Illustration*, *Journal of Mathematics and the Arts*, **16**, Issue 1-2 (2022).
- Carus Monographs Editorial Board, 2019–present.
- AMS-MAA Mathfest Joint Lecture Committee, 2019–2021 (Chair in 2020).
- Editor (with David Bachman and Saul Schleimer) of the *ICERM Illustrating Mathematics Exhibition 2019* art catalog.
- Program Committee member for the Bridges 2012 – 2022 conferences.
- Program Committee member for the Shape Modeling International 2012, 2013, 2015 – 2022 conferences.
- Scientific Committee member for the SIS-Symmetry Congress, 2022.
- Program Committee member for the Symposium on Solid and Physical Modeling (SPM), 2020.
- Program Committee member for the Geometrias 2019 conference.
- Oklahoma State Mathematics Department Personnel Committee, 2022.
- Oklahoma State Mathematics Department Undergraduate Committee, 2013–2014, 2018–2022.
- Oklahoma State Mathematics Department Graduate Comprehensive Review Committee,

2016–2017.

- Oklahoma State Mathematics Department Graduate Committee, 2015–2016.
- Oklahoma State Mathematics Department Hiring Committee, 2014–2015.
- Oklahoma State Math Club Committee, 2013–2020.
- University of Melbourne Department of Mathematics and Statistics Recruitment Publicity Committee, 2012–2013.

Other Activities

- Various graphic design/art/math crossover projects. Of particular interest: *3D printed sculpture*, *Escher's Printgallery at Stanford*, *Book Covers and Posters*, *T-shirts* and *"Autologlyphs."*
- **University of Melbourne**
  - *Melbourne University Mathematics and Statistics Society*, 2010–2013.
- **University of Texas at Austin**
  - *UT Math Club*, 2007–2010.

Personal

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