Josh Laison

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he/him

Research interests

Graph theory and discrete geometry, focusing on geometric representations of graphs.

Education

Ph.D. Mathematics, 2001, Dartmouth College
A.M. Mathematics, 1999, Dartmouth College
B.A. Mathematics, 1996, Oberlin College

Teaching experience

Professor, Willamette University, 2018-present
Associate Professor, Willamette University, 2011-2018
Assistant Professor, Willamette University, 2007-2011
Visiting Assistant Professor, St. Olaf College, 2006-2007
Visiting Assistant Professor, Colorado College, 2002-2006
Visiting Assistant Professor, Kenyon College, 2001-2002

Courses taught (2011-present)

College Colloquium Tabletop Game Design; College Colloquium Technically Speaking; Math 130 Contemporary Mathematics; Math 138 Statistics; Math 142 Calculus 2; Math 163 Discrete Mathematics; Math 249 Multivariable Calculus; Math 251W Foundations of Advanced Mathematics; Math 253 Linear Algebra; Math 376 Graph Theory; Math 399 Junior Seminar in Mathematics; Math 456 Abstract Algebra I; Math 470 Topology; Math 476 Modern Geometry; MATH 498 Senior Research Seminar I; Math 499W Senior Research Seminar II

Undergraduate research collaborations (2017-present)

Prior to 2017 I mentored 17 additional undergraduate research projects with 26 students. My undergraduate collaborators are indicated with a *.

- **Visibility Fractions of Polyomino Visibility Graphs** with Taden Bowden*, and Brooks Danielson*, Willamette Mathematics Senior Thesis

- **Variations of Polyomino Visibility Graphs** with Ezekiel Druker* and Chris Olivia*, Willamette Mathematics Senior Thesis
- **3D Polyomino Visibility Graphs** with Dayton Roberts*, and Benjamin Weber*, Willamette Mathematics Senior Thesis
- **Polyomino Visibility Graphs** with Ezekiel Druker*, Clemency Little*, Chris Olivia*, Dayton Roberts*, and Benjamin Weber*, Willamette Mathematics Junior Thesis
- **Corner Rectangle Visibility Graphs** with August Bergquist*, Juni DeYoung*, Ezekiel Jakob Druker*, Jayden Li*, and Lani Southern*, Willamette Mathematics Junior and Senior Thesis
- **Chromatic Peg Solitaire on Graphs** with Ren Daubert*, Gigi Hewitt*, and Corinne Pierson*, Willamette Mathematics Senior Thesis
- **Optimal k-solvable Peg Solitaire** with Taylor Gruber* and Adaela Shearer*, Willamette Mathematics Senior Thesis
- **Isometric Fixing Numbers of Graphs** with Nathan I. Howard* and Alexandra N. Walker*, Willamette Mathematics Senior Thesis
- **Polynomial Difference Graphs** with Steven Howley* and Paige Murray*, Willamette Mathematics Senior Thesis
- **A Variation of Peg Solitaire on Graphs** with Connor Crowley* and Justin Scanlon*, Willamette Mathematics Senior Thesis
- **Graphs Represented by Edge Intersections of Paths on Grids and Uniform Tilings** with Johannes Griesser* and Lucas Perryman-Deskins*, Willamette Mathematics Senior Thesis
- **Super Tuple Edge-Magic Total Graphs** with Gus Mayeno*, Gillian Pringle*, and Lydia Savelli*, Willamette Mathematics Senior Thesis
- **Intersection Graphs of Maximal Convex Sub-Polygons** with Caroline Daugherty*, Rebecca Robinson*, and Kyle Salois*, funded through the Willamette Valley Consortium REU grant
- **Creating Problems** with Zechariah Hazel*, Peri Hildum*, Allison Kerkhoff*, Cayla Skillin-Brauchle, and Arthur Stamey-Mills*, funded through a Willamette University Liberal Arts Research Collective (LARC) Summer Research Collaboration Grant
- **Playtesting, Illustration, and Game Publishing** with Dana Kehrley*, funded through a Willamette University College Colloquium Research Grant
- **Weighted k-Majority Tournaments** with Jeremy Coste* and Dane Miyata*, Willamette Mathematics Senior Thesis
- **Transport Pebbling** with Megan Duff*, Ivy MacDuff*, Kees McGahan*, and Colin Starr, Willamette Mathematics Senior Thesis

- **The Accountable Art Gallery Problem** with Samuel Coste* and Boyuan Lyu*, Willamette Mathematics Senior Thesis
- **Efficient Pentamino Folding** with Taylor Matsumura*, Rufei Men*, and Mattie Wiltbank*, Willamette Mathematics Senior Thesis
- **Mountain Graphs in Origami Crease Patterns** with Katy Ohsiek* and Ana Wright*, Willamette Mathematics Senior Thesis

Publications

My undergraduate co-authors are indicated with a *.

1. **Approval Gap of Weighted k-Majority Tournaments**
   with Jeremy Coste*, Breeann Flesch, Erin McNicholas, and Dane Miyata*, *Theory and Applications of Graphs* **11**, no. 1 (May 2024).
2. **Area, Perimeter, Height, and Width of Rectangle Visibility Graphs**
   with John S. Caughman, Charles Dunn, Nancy Ann Neudauer, and Colin L. Starr, *Journal of Combinatorial Optimization* **46**, no. 18 (October 2023).
3. **Intersection Graphs of Maximal Sub-polygons of k-Lizards**
   with Caroline Daugherty*, Rebecca Robinson*, and Kyle Salois*, *Graphs and Combinatorics* **39**, no. 75 (June 2023).
4. **Graph Stamping: Art-Inspired Mathematics**
   with Zechariah Hazel* and Allison Kerkhoff*, *Math Horizons* **28**, no. 4 (April 2021), 24–27.
5. **Base Size Sets and Determining Sets**
   with Erin McNicholas and Nicole Seaders, *Discrete Mathematics* **342**, no. 11 (November 2019), 2994–2999.
6. **Prime Power and Prime Product Distance Graphs**
   with Yumi Kaneda*, Jeffrey Schreiner-McGraw*, and Colin Starr, *Discrete Applied Mathematics* **255** (February 2019), 334–338.
7. **Weighted Pebbling Numbers of Graphs**
   with Stephanie Partlow*, Cameron McLeman, and Kathryn Nyman, *Journal of Combinatorial Mathematics and Combinatorial Computing* **100** (February 2017), 223–244.
8. **Critical Pebbling Numbers of Graphs**
   with Courtney R. Gibbons* and Erick J. Paul*, *Journal of Combinatorial Mathematics and Combinatorial Computing* **99** (November 2016), 199–224.
9. **Finite Prime Distance Graphs and 2-Odd Graphs**
   with Colin Starr and Andrea Walker*, *Discrete Mathematics* **313** (October 2013), no. 20, 2281–2291.

10. **More Directions in Visibility Graphs**
with Ellen Gethner, *Australasian Journal of Combinatorics* **50** (2011), 55–65.

11. **Subspace Intersection Graphs**
with Yulan Qing*, *Discrete Mathematics* **310** (2010), no. 23, 3413-3416.

12. **Triangle, Parallelogram, and Trapezoid Orders**
with Kenneth P. Bogart and Stephen P. Ryan, *Order* **27** (2010), no. 2, 163-175.

13. **Obstacle Numbers of Graphs**
with Hannah Alpert* and Christina Koch*, *Discrete and Computational Geometry* **44** (2010), no. 1, 223-244.

14. **Fixing Numbers of Graphs and Groups**
with Courtney R. Gibbons*, *Electronic Journal of Combinatorics* **16** (2009), no. 1 (electronic).

15. **Dual Unfoldings of Polyhedra**
with John J. Watkins and Lucian Wilson*, *Congressus Numerantium* **191** (2008), 161-172.

16. **Unit and Proper Tube Orders**
Order **25** (2008), no. 3, 237-242.

17. **Seeing Dots: Visibility of Lattice Points**
with Michelle Schick*, *Mathematics Magazine* **80** (2007), no. 4, 274–282.

18. **Bar k-Visibility Graphs**
with Alice Dean, William Evans, Ellen Gethner, Mohammad A. Safari, and William T. Trotter, *Journal of Graph Algorithms and Applications* **11** (2007) no. 1, 45-59.

19. **Tube Representations of Ordered Sets**
Order **21** (2004), no. 3, 209-232.

20. **Free Triangle Orders**
Order **20** (2003), no. 2, 99-108.

21. **Comparability Invariance Results for Tolerance Orders**
with Kenneth P. Bogart, Garth Isaak, and Ann N. Trenk, *Order* **18** (2001), no. 3, 281-294.

Conference proceedings

22. **Minimum Representations of Rectangle Visibility Graphs (Extended Abstract)**
with John S. Caughman, Charles Dunn, Nancy Ann Neudauer, and Colin L. Starr, in Patrick Healy and Nikola S. Nikolov, editors, *Graph Drawing*, volume 8871 of *Lecture Notes in Computer Science*, Springer-Verlag, Berlin, 2014. Revised papers from the 22nd International Symposium on Graph Drawing (GD2014), Würzburg, Germany, September 2014, 527–528.

23. **Bar k-Visibility Graphs: Bounds on the Number of Edges, Chromatic Number, and Thickness (Extended Abstract)**
with Alice Dean, William Evans, Ellen Gethner, Mohammad A. Safari, and William T. Trotter,

in Patrick Healy and Nikola S. Nikolov, editors, *Graph Drawing*, volume 3843 of *Lecture Notes in Computer Science*, Springer-Verlag, Berlin, 2006. Revised papers from the 13th International Symposium on Graph Drawing (GD2005), Limerick, Ireland, September 2005, 73–82.

Expository articles

24. **My Experiences Researching With Undergraduate Mathematicians: The Collaboration Model**
in Joseph A. Gallian, editor, *Proceedings of the Conference on Promoting Undergraduate Research in Mathematics*, American Mathematical Society, 2007.

Submitted

25. **Veto Interval Graphs**
with Breeann Flesch, Jessica Kawana*, Dana Lapides*, and Stephanie Partlow, submitted in August 2022 to *Graphs and Combinatorics*

In progress

26. **Triangle Visibility Graphs** with John S. Caughman, Charles Dunn, Nancy Ann Neudauer, and Colin L. Starr

27. **Corner Rectangle Visibility Graphs** with Juni DeYoung*, Jayden Li*, and Lani Southern*

28. **Mountain Graphs in Origami Crease Patterns**
with Breeann Flesch, Erin McNicholas, Katy Ohsiek* and Ana Wright*

Professional activities

Grants and Awards

- Willamette University Liberal Arts Research Collective (LARC) Summer Research Collaboration Grant with Cayla Skillin-Brauchle, summer 2017
- Principal Investigator, NSF Willamette Mathematics Consortium REU Grant, funding 27 students and 9 faculty in summer research 2015–2017
- Faculty mentor, NSF Willamette Mathematics Consortium REU Grant, summers 2008, 2012, 2014, 2017
- Project NExT (New Experiences in Teaching) Fellow, 2002-2003, Mentor, 2021-2022
- Faculty Merit Award for Teaching, Willamette University College of Liberal Arts, Academic year 2009–2010
- 12 additional internal Willamette University grants awarded for research and course development (Atkinson Research Grant, Hewlett Curriculum Development Grant, College Colloquium Research Grant, Research Travel Grant, Course Development Grant).

Conferences Organized

- MOVES (Mathematics of Various Entertaining Subjects), National Museum of Mathematics, New York, NY, August 2015, August 2017, August 2019, August 2022, August 2023
- Mini-MOVES Gathering, New York, NY and remote, February 2022
- MOVES Meet-up, August 2021, remote
- SSRD (Student Scholarship Recognition Day), Willamette University, April 2018, April 2019, and April 2020
- NUMS (Northwest Undergraduate Mathematics Symposium), Willamette University, November 2018
- Pacific Northwest Section Meeting of the Mathematical Association of America, Willamette University, April 2013
- Pikes Peak Regional Undergraduate Mathematics Conference, Colorado College, February 2005
- Rocky Mountain Discrete Math Days, Colorado College, August 2004
- Rocky Mountain Section Meeting of the Mathematical Association of America, Colorado College, April 2004

Art Exhibitions

- *Point of View*, Hallie Ford Museum of Art, September 2018–September 2019
- *Creating Problems: A Liberal Arts Research Community*, Willamette University, September 2017

Equity, Diversity, and Inclusion

- Funded participant, Quantitative Reasoning Summer Learning Circle: Data Deep Dive into BIPOC Representation in Computing and Data Science, Summer 2023
- Participant, Math Leaders 4 Racial Justice Workshop, University of Texas at Austin (remote), Summer 2022
- Participant, Northwest Five Consortium (NW5C) Historical Representations of Racism and Exclusionism Summer Learning Community, June-August 2021
- Attendee, ParaDIGMS (Diversity in Graduate Mathematical Sciences) Conference, April 2021 and April 2022 (remote)
- Organizer, Willamette Mathematics Department discussion group on advocating for students of color in mathematics, 2021-2023
- Member, Willamette University President's Task Force on Equity and Inclusion, 2016–2017

Other

- Mathematical Association of America Beckenbach Book Prize Committee (awarding a prize for a book published by the MAA each year), 2022-present
- Reviewer for the *Journal of Graph Algorithms and Applications*, *Discrete Mathematics*, *PRIMUS: Problems, Resources, and Issues in Mathematics Undergraduate Studies*, and *Order*
- Board member, MathILy Advisory Amalgam (summer program for mathematically excellent secondary students)
- Local organizer, MegaMenger community art installation project, October 2014
- Attended 18 teaching workshops
- Organized 13 conference sessions, panels, workshops, and seminars
- Organized and wrote six mathematical problem solving competitions
- Wrote 14 reviews for the Mathematical Reviews database (online as mathscinet)

Service to Willamette University

- Willamette University Accreditation Committee, 2022–present
- Learning Assessment Committee, Chair 2022-present, Member 2021–2022
- Chair, Student Scholarship Recognition Day Committee, 2017–2020
- Mathematics Department Chair, 2012–2015 and Fall 2019
- Big Questions General Education Working Group, 2018
- Organizer, Mathematics Department External Review, March 2018
- Teacher, Willamette Academy Summer Camp, July 2018, July 2019, July 2021, July 2023
- Committee for Faculty Development, 2015–2017
- Writing Program Advisory Committee, 2011–2012
- College of Liberal Arts Faculty Secretary, 2009–2010
- Faculty Colloquium Committee, 2008–2010
- Twelve Hiring Committees
- Advisor for student groups: Pi Mu Epsilon National Honorary Society 2008–present, Math Club 2015–present, Board Game Club 2023-present, Esports Club 2018–2022, Millstream Board

Games Collective 2021–2022, Board and Card Game Coalition, 2011–2014, Games Unplugged, 2016–2017.

- Organizer, Annual Pacific Northwest Intercollegiate Ginormous Blokus Tournament, 2011-2019, 2024

Presentations (2017-present)

Prior to 2017 I gave 89 additional conference presentations and colloquium talks.

Conference presentations

1. Gathering for Gardner, *Graphs of Rectangles Looking Diagonally*, Atlanta, GA, [February 2024]
2. Invited speaker, Pacific Northwest Section Meeting of the Mathematical Association of America, Special Session on Undergraduate Research, *Finding a Student Research Topic in Graph Theory: The Lightning Round*, Newberg, OR, April 2023
3. Invited speaker, Joint Mathematics Meetings, Special Session on Presenting Research Mathematics through Visual Storytelling: Slides without Words and Equations, *Intersection graphs of convex sub-polygons of a polygon, a story in pictures*, April 2022
4. Joint Mathematics Meetings, *Stamping Numbers of Graphs*, Denver, CO, January 2020
5. SIAM Discrete Mathematics Conference, *Variations on the Graph Pebbling Game*, June 2018
6. Joint Mathematics Meetings, *Veto Interval Graphs and Variations*, San Diego, CA, January 2018
7. Coast Combinatorics Conference, *Determining Sets and Base Size Sets of Groups*, Kona-Kailua, HI, February 2017
8. Joint Mathematics Meetings, *Base Size Sets and Determining Sets*, Atlanta, GA, January 2017

Public communication and outreach

9. Skype a Scientist, *Graph Theory*, Venice High School, May 2024 (12th grade class)
10. Bay Area Mathematics Adventures, *Puzzles in Geometric Graph Theory*, May 2023 (General audience)
11. Skype a Scientist, *Graph Theory*, Snoqualmie Elementary School, April 2022 (3rd grade class)
12. Willamette University Faculty Colloquium, *Scaling Lizards and Seeing Rectangles: Two Problems in Geometric Graph Theory*, February 2022 (Non-STEM faculty)
13. Hua Summer Math Workshop, *Circuit Crossing Puzzles*, July 2021 (K-12 math teachers)
14. Skype a Scientist, *Graph Theory*, Murtaugh Elementary School, April 2021 (4th grade class)

15. Skype a Scientist, *Graph Theory*, Leighton Elementary School, December 2020 (4th grade class)

16. Willamette University Faculty Summer Workshop, *Encouraging Students to Think Outside the Box Using Lessons from Music and Math*, July 2020, co-presented with James Miley (Non-STEM faculty)

17. Hua Summer Math Workshop, *Pebbling Problems and Puzzles*, June 2020 (K-12 math teachers)

18. Hua Summer Math Workshop, *The Chaos Game*, June 2020 (K-12 math teachers)

19. Skype a Scientist, *Graph Theory Problems and Applications*, Silver Creek Central School, June 2020 (two presentations, 9th and 10th grade math classes)

20. Family Weekend Mini-University Session, Willamette University, *Exploring Graph Pebbling Puzzles and Problems*, October 2019 (Parents of Willamette students)

21. Family Weekend Mini-University Session, Willamette University, *Exploring Graph Pebbling Puzzles and Problems*, October 2017 (Parents of Willamette students)

Colleges and universities

22. Lewis and Clark Mathematical Sciences Colloquium, *Scaling Lizards and Seeing Rectangles: Two Problems in Geometric Graph Theory*, October 2021

23. Mathematics Department Colloquium, Willamette University, *Distinguishing, Determining, Fixing, Stamping, and Otherwise Breaking Graph Symmetries*, March 2019

24. Mathematics Department Colloquium, Pacific University, *Prime Distance Graphs*, November 2018

25. Mathematics Department Colloquium, Willamette University, *Prime Distance Graphs*, October 2018

26. Featured speaker, Pi Mu Epsilon Induction Ceremony, Western Oregon University, *Variations of Graph Pebbling*, May 2017

27. Northwest Undergraduate Mathematics Symposium (NUMS), *Puzzling Showdown*, McMinnville, OR, April 2017

28. Math Club Seminar, Carnegie Mellon University, *Star Numbers of Geometric Shapes*, March 2017