

# Andrew Winslow

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## Research Interests

Computational geometry, algorithmic self-assembly, discrete geometry, computational complexity, recreational mathematics.

## Education

Ph.D. Computer Science, Tufts University, Spring 2014.

*Advisors: Diane Souwaine (Tufts), Erik Demaine (MIT)*

*Ph.D. Thesis: Staged Self-Assembly and Polyomino Context-Free Grammars*

M.S. Computer Science, Tufts University, Spring 2011.

*Advisor: Diane Souwaine*

*Master's Project: Bounded-degree Polyhedronization of Point Sets*

B.S. Mathematics, Computer Science, University of Arizona, Fall 2007.

## Employment

*University of Texas Rio Grande Valley, Department of Computer Science*

Assistant Professor. Fall 2016–Present.

*Université Libre de Bruxelles, Département d'Informatique*

Postdoctoral Researcher in the Algorithms Research Group. Fall 2014–Summer 2016.

*Tufts University, Department of Computer Science*

Postdoctoral Associate. Spring 2014–Summer 2014.

Graduate Research Assistant, Fall 2009–Fall 2013.

Graduate Teaching Assistant, Fall 2010–Spring 2011, Fall 2013.

*Apple Inc.*

Intern in the Interactive Media Group, Summer 2013.

*Arizona State University, GeoDa Center for Geospatial Analysis*

Research Analyst, December 2008–August 2009.

*The Boeing Company*

Real-time Software Engineer, January 2008–November 2008.

*University of Arizona, Department of Computer Science*

Undergraduate Research Assistant, Spring 2007–Fall 2007.

Undergraduate Teaching Assistant, Spring 2006.

## Awards and Honors

UTRGV Outstanding Faculty Award in Computer Science, 2017-2018.

Sheng Yu (Best Paper) Award, 21st International Conference on Implementation and Application of Automata (CIAA) 2016, for [7].

Best Student Paper Award, 17th International Conference on DNA Computing and Molecular Programming (DNA) 2011, for [26].

Outstanding Graduate Research Award, College of Engineering, Tufts University, 2011.

Honorable Mention, NSF Graduate Research Fellowship, 2011.

Dean’s Fellowship, College of Engineering, Tufts University, Fall 2009–Spring 2011.

Outstanding Senior Award, Department of Computer Science, University of Arizona, Fall 2007.

Outstanding Senior Award, Department of Mathematics, University of Arizona, Fall 2007.

## Conference Publications

Authorship order of all publications except [9, 21, 31, 38, 50] follow the convention in theoretical computer science of alphabetical author order. Acceptance rates are provided where available.

- [32] C. Chalk, E. Martinez, R. Schweller, L. Vega, A. Winslow, and T. Wylie. “Optimal staged self-assembly of linear assemblies”. *To appear in the Proceedings of the 17th International Conference on Unconventional Computation and Natural Computation (UCNC)*. Vol. ?? LNCS. Springer, 2018, ??
- [1] R. Schweller, A. Winslow, and T. Wylie. “Complexities for high-temperature tile self-assembly”. *Proceedings of the 23rd International Conference on DNA Computing and Molecular Programming (DNA)*. Vol. 10467. LNCS. Springer, 2017, pp. 98–109. (70% acceptance rate)
- [2] R. Schweller, A. Winslow, and T. Wylie. “Verification in staged tile self-assembly”. *Proceedings of Unconventional Computation and Natural Computation (UCNC) 2017*. Vol. 10240. LNCS. Springer, 2017, pp. 98–112. (58% acceptance rate)
- [3] C. Chalk, E. Martinez, R. Schweller, L. Vega, A. Winslow, and T. Wylie. “Optimal staged self-assembly of general shapes”. *Proceedings of the 24th European Symposium of Algorithms (ESA)*. Vol. 57. LIPIcs. Schloss Dagstuhl, 2016. (27% acceptance rate)
- [4] D. Doty and A. Winslow. “Design of geometric molecular bonds”. *Proceedings of the IEEE International Symposium on Information Theory (ISIT)*. 2016, pp. 1789–1793.
- [5] S. Langerman and A. Winslow. “A quasilinear-time algorithm for tiling the plane isohedrally with a polyomino”. *Proceedings of the 32nd International Symposium on Computational Geometry (SoCG)*. Vol. 51. LIPIcs. Schloss Dagstuhl, 2016, 50:1–50:15. (38% acceptance rate)
- [6] M. J. Patitz, T. A. Rogers, R. T. Schweller, S. M. Summers, and A. Winslow. “Resiliency to multiple nucleation in temperature-1 self-assembly”. *Proceedings of the 22nd International Conference on DNA Computing and Molecular Programming (DNA)*. Vol. 9818. LNCS. Springer, 2016, pp. 98–113. (69% acceptance rate)
- [7] S. Seki and A. Winslow. “The complexity of fixed-height patterned tile self-assembly”. *Proceedings of the 21st International Conference on Implementation and Application of Automata (CIAA)*. Vol. 9705. LNCS. Springer, 2016, pp. 248–259. (53% acceptance rate)
- [8] S. Fekete, R. T. Schweller, and A. Winslow. “Size-dependent tile self-assembly: constant-height rectangles and squares”. *Proceedings of the 26th International Symposium on Algorithms and Computation (ISAAC)*. Vol. 9472. LNCS. Springer, 2015, pp. 296–306. (35% acceptance rate)

- [9] D. Ipparhi, A. Winslow, M. Mastrangeli, and M. Dorigo. “A study of yield predictions for a model of homogeneous self-assembling components”. *Proceedings of the 1st International Symposium on Swarm Behavior and Bio-Inspired Robotics (SWARM)*. 2015, pp. 168–171.
- [10] A. Winslow. “An optimal algorithm for tiling the plane with a translated polyomino”. *Proceedings of the 26th International Symposium on Algorithms and Computation (ISAAC)*. Vol. 9472. LNCS. Springer, 2015, pp. 3–13. (35% acceptance rate)
- [11] A. Winslow, K. Baldauf, B. Lee, J. McCann, E. Demaine, M. Demaine, and P. Houk. “Virtual cane creation for glassblowers”. *Proceedings of SMI 2015 - ISAMA/FASE: Fabrication and Sculpting Event*. Vol. Summer 2015. Hyperseeing. ISAMA, 2015, pp. 17–22.
- [12] E. D. Demaine, M. L. Demaine, S. P. Fekete, M. J. Patitz, R. T. Schweller, A. Winslow, and D. Woods. “One tile to rule them all: simulating any tile assembly system with a single universal tile”. *Proceedings of the 41st International Colloquium on Automata, Languages, and Programming (ICALP)*. Vol. 8572. LNCS. Springer, 2014, pp. 368–379. (28% acceptance rate)
- [13] E. Fox-Epstein, C. D. Tóth, and A. Winslow. “Diffuse reflection radius in a simple polygon”. *Proceedings of the 20th International Computing and Combinatorics Conference (COCOON)*. Vol. 8591. LNCS. Springer, 2014, pp. 239–250. (46% acceptance rate)
- [14] C. Malchik and A. Winslow. “Tight bounds for active self-assembly with an insertion primitive”. *Proceedings of the 22nd European Symposium on Algorithms (ESA)*. Vol. 8737. LNCS. Springer, 2014, pp. 677–688. (26% acceptance rate)
- [15] P.-E. Meunier, M. J. Patitz, S. M. Summers, G. Theyssier, A. Winslow, and D. Woods. “Intrinsic universality in tile self-assembly requires cooperation”. *Proceedings of the 25th Annual ACM-SIAM Symposium on Discrete Algorithms (SODA)*. 2014, pp. 752–771. (28% acceptance rate)
- [16] A. Winslow. “Size-separable tile self-assembly: a tight bound for temperature-1 mismatch-free systems”. *Proceedings of Unconventional Computation and Natural Computation (UCNC) 2014*. Vol. 8553. LNCS. Springer, 2014, pp. 367–378. (39% acceptance rate)
- [17] Z. Abel, E. D. Demaine, M. L. Demaine, S. Eisenstat, A. Lubiw, D. L. Souvaine, G. Viglietta, and A. Winslow. “Algorithms for designing pop-up cards”. *Proceedings of the 30th International Symposium on Theoretical Aspects of Computer Science (STACS)*. Vol. 20. LIPIcs. Schloss Dagstuhl, 2013, pp. 269–280. (21% acceptance rate)
- [18] O. Aichholzer, G. Aloupis, E. D. Demaine, M. L. Demaine, S. P. Fekete, M. Hoffman, A. Lubiw, J. Snoeyink, and A. Winslow. “Covering folded shapes”. *Proceedings of the 25th Canadian Conference on Computational Geometry (CCCG)*. 2013, pp. 73–78.
- [19] G. Barequet, S. M. Cannon, E. Fox-Epstein, B. Hescott, D. L. Souvaine, C. D. Tóth, and A. Winslow. “Diffuse reflection diameter in simple polygons”. *Proceedings of the 7th Latin-American Algorithms, Graphs and Optimization Symposium (LAGOS)*. Vol. 44. ENDM. Elsevier, 2013, pp. 345–350. (46% acceptance rate)
- [20] S. Cannon, E. D. Demaine, M. L. Demaine, S. Eisenstat, M. J. Patitz, R. T. Schweller, S. M. Summers, and A. Winslow. “Two hands are better than one (up to constant factors): self-assembly in the 2HAM vs. aTAM”. *Proceedings of the 30th International Symposium on Theoretical Aspects of Computer Science (STACS)*. Vol. 20. LIPIcs. Schloss Dagstuhl, 2013, pp. 172–184. (21% acceptance rate)
- [21] R. J. Crouser, J. Freeman, A. Winslow, and R. Chang. “Exploring agent-based simulations in political science using aggregate temporal graphs”. *Proceedings of the IEEE Pacific Symposium on Visualization (PacificVis)*. 2013, pp. 177–184. (29% acceptance rate)
- [22] A. Winslow. “Staged self-assembly and polyomino context-free grammars”. *Proceedings of the 19th International Conference on DNA Computing and Molecular Programming (DNA 19)*. Vol. 8141. LNCS. Springer, 2013, pp. 174–188. (48% acceptance rate)
- [23] S. Cannon, D. L. Souvaine, and A. Winslow. “Hidden mobile guards in simple polygons”. *Proceedings of the 24th Canadian Conference on Computational Geometry (CCCG)*. 2012, pp. 161–166.

- [24] O. Aichholzer, G. Aloupis, E. D. Demaine, M. L. Demaine, V. Dujmović, F. Hurtado, A. Lubiw, G. Rote, A. Schulz, and D. L. Souvaine. “Convexifying polygons while maintaining internal visibility”. *Proceedings of the 23rd Canadian Conference on Computational Geometry (CCCG)*. 2011, pp. 229–234.
- [25] E. D. Demaine, M. L. Demaine, S. Eisenstat, A. Lubiw, and A. Winslow. “Algorithms for solving Rubik’s cubes”. *Proceedings of the 19th European Symposium on Algorithms (ESA)*. Vol. 6942. LNCS. Springer, 2011, pp. 689–700. (26% acceptance rate)
- [26] E. D. Demaine, S. Eisenstat, M. Ishaque, and A. Winslow. “One-dimensional staged self-assembly”. *Proceedings of the 17th International Conference on DNA Computing and Molecular Programming (DNA 17)*. Vol. 8141. LNCS. Springer, 2011, pp. 100–114. (27% acceptance rate)
- [27] D. L. Souvaine, C. D. Tóth, and A. Winslow. “Simultaneously flippable edges in triangulations”. *Proceedings of the XIV Spanish Meeting on Computational Geometry (EGC)*. 2011, pp. 137–140.
- [28] D. L. Souvaine, R. Veroy, and A. Winslow. “Face guards for art galleries”. *Proceedings of the XIV Spanish Meeting on Computational Geometry (EGC)*. 2011, pp. 39–42.
- [29] C. D. Tóth, G. T. Toussaint, and A. Winslow. “Open guard edges and edge guards”. *Proceedings of the 23rd Canadian Conference on Computational Geometry (CCCG)*. 2011, pp. 449–454.
- [30] G. Barequet, N. Benbernou, D. Charlton, E. D. Demaine, M. L. Demaine, M. Ishaque, A. Lubiw, A. Schulz, D. L. Souvaine, G. T. Toussaint, and A. Winslow. “Bounded-degree polyhedronization of point sets”. *Proceedings of the 22nd Canadian Conference on Computational Geometry (CCCG)*. 2010, pp. 99–102.
- [31] A. Winslow, Q. Tung, Q. Fan, J. Torkkola, R. Swaminathan, K. Barnard, A. Amir, and A. Efrat. “Studying on the move: enriched presentation video for mobile devices”. *Proceedings of the 28th IEEE International Conference on Computer Communications Workshops (INFOCOM)*. 2009, pp. 1–6.

## Journal Publications

- [33] C. Chalk, E. Martinez, R. Schweller, L. Vega, A. Winslow, and T. Wylie. “Optimal staged self-assembly of general shapes”. *Algorithmica* 80(4) (2018), pp. 1383–1409.
- [34] “Resiliency to multiple nucleation in temperature-1 self-assembly”. *Natural Computing* 17(1) (2018), pp. 31–46.
- [35] D. Doty and A. Winslow. “Design of geometric molecular bonds”. *IEEE Transactions on Molecular, Biological, and Multi-Scale Communications* 3(1) (2017), pp. 13–23.
- [36] B. Hescott, C. Malchik, and A. Winslow. “Tight bounds for active self-assembly with an insertion primitive”. *Algorithmica* 77(2) (2017), pp. 537–554.
- [37] D. Ipparthy, M. Mastrangeli, and A. Winslow. “Dipole codes attractively encode glue functions”. *Theoretical Computer Science* 671 (2017), pp. 19–25.
- [38] D. Ipparthy, A. Winslow, M. Sitti, M. Dorigo, and M. Mastrangeli. “Yield prediction in parallel homogeneous assembly”. *Soft Matter* 13 (2017), pp. 7595–7608.
- [39] S. Seki and A. Winslow. “The complexity of fixed-height patterned self-assembly”. *International Journal of Foundations of Computer Science* 28(5) (2017), pp. 465–482.
- [40] G. Barequet, S. M. Cannon, E. Fox-Epstein, B. Hescott, D. L. Souvaine, C. D. Tóth, and A. Winslow. “Diffuse reflection diameter in simple polygons”. *Discrete Applied Mathematics* 210 (2016), pp. 123–132.
- [41] E. Fox-Epstein, C. D. Tóth, and A. Winslow. “Diffuse reflection radius in a simple polygon”. *Algorithmica* 76(4) (2016), pp. 910–931.
- [42] A. Winslow. “Size-separable tile self-assembly: a tight bound for temperature-1 mismatch-free systems”. *Natural Computing* 15(1) (2016), pp. 143–151.
- [43] A. Winslow. “Staged self-assembly and polyomino context-free grammars”. *Natural Computing* 14(2) (2015), pp. 293–302.

- [44] O. Aichholzer, G. Aloupis, E. D. Demaine, M. L. Demaine, S. P. Fekete, M. Hoffman, A. Lubiw, J. Snoeyink, and A. Winslow. “Covering folded shapes”. *Journal of Computational Geometry (JoCG)* 5(1) (2014), pp. 150–168.
- [45] G. Barequet, N. Benbernou, D. Charlton, E. D. Demaine, M. L. Demaine, M. Ishaque, A. Lubiw, A. Schulz, D. L. Souvaine, G. T. Toussaint, and A. Winslow. “Bounded-degree polyhedronization of point sets”. *Computational Geometry* 26(2) (2013), pp. 148–153.
- [46] E. D. Demaine, S. Eisenstat, M. Ishaque, and A. Winslow. “One-dimensional staged self-assembly”. *Natural Computing* 12(2) (2013), pp. 247–258.

## Book Chapters

- [47] M. Al-Jubeh, G. Barequet, M. Ishaque, D. L. Souvaine, C. D. Tóth, and A. Winslow. “Constrained tri-connected planar straight line graphs”. *Thirty Essays on Geometric Graph Theory*. Springer, 2013, pp. 49–70.

## Publications without Peer Review

- [48] A. Winslow. “A brief tour of theoretical tile self-assembly”. *Proceedings of the 22nd International Workshop on Cellular Automata and Discrete Complex Systems (AUTOMATA)*. Vol. 9664. LNCS. Springer, 2016, pp. 26–31. (Invited paper)
- [49] A. Winslow. “Self-Assembly with General Shaped Tiles”. *Encyclopedia of Algorithms*. Springer, 2015.
- [50] A. Winslow. “Staged Assembly”. *Encyclopedia of Algorithms*. Springer, 2015.

## Invited Talks

Algorithmic problems in tiling (5×1-hour lectures) Université de Montréal Centre de Recherche Mathématiques, Combinatorics on Words and Tilings School, Montréal, Canada, March 27-31, 2017.

A quasi-linear time algorithm for tiling isohedrally with a polyomino, Université de Liège Discrete Math Seminar, Liège, Belgium, June 21, 2016.

A tour of DNA tile self-assembly, Invited talk, 22nd Annual International Workshop on Cellular Automata and Discrete Complex Systems (AUTOMATA), Zurich, Switzerland, June 17, 2016.

Tiling isohedrally with a polyomino, Mittagssseminar, ETH Zurich, August 18, 2015.

Nanoscale staged self-assembly, IRIDIA Seminar, Université Libre de Bruxelles, Brussels, Belgium, October 24, 2014.

The limits of a simple model of active self-assembly, Boston University Theory Seminar, Boston, USA, October 3, 2014.

The limits of a simple model of active self-assembly, LIAFA Algorithms and Complexity Workshop: Natural Algorithms, Paris, France, September 12, 2014.

The power of seeds in tile self-assembly, Molecular Programming Project Seminar, California Institute of Technology, Pasadena, USA, June 15, 2012.

Hidden guards in art gallery problems, Geometry Seminar, Courant Institute of Mathematical Sciences, New York City, USA, February 7, 2012.

Old and new problems in polygon visibility, Tufts SIAM Student Chapter Seminar, Medford, USA, December 7, 2011.

## Invitation-Only Workshops Attended

Bellairs Research Institute Winter Workshop on Computational Geometry: “Reconfiguration”, Holetown, Barbados, March, 2018.

Bellairs Research Institute Winter Workshop on Geometry and Graphs, Holetown, Barbados, March 2017.

Bellairs Research Institute Winter Workshop on Computational Geometry: “Reconfiguration”, Holetown, Barbados, January, 2017.

Schloss Dagstuhl: “Algorithmic Aspects of Programmable Matter”, Wadern, Germany, July, 2016.

Bellairs Research Institute Winter Workshop on Computational Geometry: “Folding”, Holetown, Barbados, March, 2016.

Bellairs Research Institute Winter Workshop on Geometry and Graphs, Holetown, Barbados, March 2016.

Bellairs Research Institute Winter Workshop on Computational Geometry: “Hardness Proofs”, Holetown, Barbados, March, 2015.

Bellairs Research Institute Winter Workshop on Geometry and Graphs, Holetown, Barbados, March 2015.

Bellairs Research Institute Winter Workshop on Computational Geometry: “Folding + Self-Assembly”, Holetown, Barbados, March, 2014.

Bellairs Research Institute Winter Workshop on Computational Geometry: “Computational Origami”, Holetown, Barbados, March, 2013.

Bellairs Research Institute Winter Workshop on Computational Geometry: “Self-Assembly”, Holetown, Barbados, February, 2012.

Bellairs Research Institute Winter Workshop on Computational Geometry: “Folding and Unfolding”, Holetown, Barbados, February, 2011.

International Mid-Winter Workshop on Computational Geometry: “Geometric (Hyper)Graphs and the Combinatorics of Points and Lines”, Fortaleza, Brazil, January, 2011.

## Teaching

As an Assistant Professor at University of Texas Rio Grande Valley:

Spring 2018: Algorithms & Data Structures. 68 students. Rated 4.73/5.0.

Fall 2017: Algorithms & Data Structures. 35 students. Rated 4.60/5.0.

Fall 2017: Computer Science II. 29 students. Rated 4.58/5.0.

Spring 2017: Discrete Data Structures. 41 students. Rated 4.92/5.0.

Spring 2017: Computer Science II. 34 students. Rated 4.49/5.0.

Fall 2016: Discrete Data Structures. 38 students. Rated 4.49/5.0.

Fall 2016: Computer Science II. 43 students. Rated 4.31/5.0.

As a Postdoctoral Associate at Tufts University:

Summer 2014: Data Structures.

Spring 2014: Discrete Mathematics (co-taught with Greg Aloupis).

Spring 2014: Advanced Algorithms (co-taught with Greg Aloupis).

## Student Advising

Isaac Ruiz, UTRGV.

Luis Garcia, UTRGV.

Austin Luchsinger, UTRGV.

Caleb Malchik, Tufts – now a Ph.D. student at Yale.

Sarah Allen, NYU Polytechnic – now a Ph.D. student at Carnegie Mellon.

Sarah Cannon, Tufts – now a Ph.D. student at Georgia Tech.

Abbie Gibson, Appalachian State University – now an application programmer at Wells Fargo.

Michelle Ichinco, Tufts – now a Ph.D. student at Washington University.

Jiahao Li, Wuhan Foreign Languages School – now an undergraduate at MIT.

Hongtong Lin, Tufts – now a software engineer at Pegasystems.

## Service

PC member of CCCG 2018: 30th Canadian Conference on Computational Geometry.

PC member of DNA 2018: 24th International Conference on DNA Computing and Molecular Programming.

PC member of SMI-FASE 2017: Shape Modeling International - Fabrication and Sculpting Event.

PC member of DNA 2016: 22nd International Conference on DNA Computing and Molecular Programming.

PC member of SMI-FASE 2016: Shape Modeling International - Fabrication and Sculpting Event.

Reviewer for

*Algorithmica*,

*International Workshop on Cellular Automata (AUTOMATA)*,

*Canadian Conference on Computational Geometry (CCCG)*,

*Computational Geometry: Theory and Applications (CGTA)*,

*International Conference on Developments in Language Theory (DLT)*,

*European Conference on Combinatorics (EUROCOMB)*,

*IEEE Symposium on Foundations of Computer Science (FOCS)*,

*IEEE Transactions on Information Theory*,

*International Colloquium on Automata, Languages, and Programming (ICALP)*,

*International Journal on Computational Geometry and Applications (IJCGA)*,

*International Journal of Foundations of Computer Science (IJFCS)*,

*International Symposium on Algorithms and Computation (ISAAC)*,

*International Symposium on Information Theory (ISIT)*,

*Journal of Computer and System Sciences (JCSS)*,

*Journal on Combinatorial Optimization (JOCO)*,

*Journal on Computational Geometry (JOCG)*,

*Latin American Theoretical Informatics Symposium (LATIN)*,

*Natural Computing (NACO)*,

*SIAM Journal on Discrete Mathematics* (SIDMA),  
*ACM-SIAM Symposium on Discrete Algorithms* (SODA),  
*International Symposium on Computational Geometry* (SOCG),  
*ACM Symposium on the Theory of Computing* (STOC),  
*Scandinavian Symposium and Workshops on Algorithm Theory* (SWAT),  
*International Conference on Unconventional Computing and Natural Computing* (UCNC).