

# Fumiko Futamura

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## EDUCATION

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- Ph.D., M.S. Mathematics, Vanderbilt University* 2002–2007  
*Localized Operators and the Construction of Localized Frames*  
Advisor: Akram Aldroubi
- B.A., Mathematics, Minor: Fine Arts, University of Louisville* 1999–2002  
Summa Cum Laude, 3.94 GPA  
*On the Use of Polygonal Diagrams to Depict Finite Affine Planes*  
Advisor: Robert Powers

## PROFESSIONAL EXPERIENCE

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- Lord Chair of Mathematics and Computer Science 2019–present  
Professor of Mathematics 2018–present  
Board member, Japan-America Society of Greater Austin 2021–present
- Diversity, Inclusion, Belonging, Equity (DIBE) Taskforce 2019–2021  
Chair, Department of Mathematics and Computer Science 2018–2020  
Associate Professor of Mathematics 2013–2018  
Chair, Curriculum Committee 2017–2018  
Chair, Enrollment and Retention Committee 2015–2016  
Co-founder, Co-organizer, Instructor, SU EQUIP Program 2016–2017  
Science Advisor, Studio 360 Science and Creativity Series, Sloan Foundation, NYC 2015–2016  
Advisory Board Member, Art.Science.Gallery, Austin, TX 2013–2016  
Assistant Professor of Mathematics 2007–2013

## GRANTS AND AWARDS

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- Carl B. Allendoerfer Award* 2018  
Annual award for “expository excellence published in Mathematics Magazine”, for paper *A new perspective on finding the viewpoint* published with SU alum Robert Lehr.
- Awarded \$500, Visual Thinking for Engaged Learning Grant* 2014  
A grant, part of the Presidential Innovation Grant, to incorporate visual thinking into Geometry and give a community presentation.

<i>Awarded \$69,432, NSF grant DUE-1140113</i>	2012
A two-year grant to write a textbook, <i>Perspective Geometry: Projective Geometry Applied to Perspective Art</i> (together with co-PI Annalisa Crannell's portion, \$108,414), one of 125 awards out of 1050 TUES-I proposals submitted in May 2011	
<i>Awarded \$4000, AIBL Small Grant</i>	2011
a grant to create an IBL math and art course, Educational Advancement Foundation	
<i>Awarded \$9000, Brown Innovations in Teaching Award</i>	2008
Internal grant to organize a departmental pedagogical seminar, Southwestern University	
<i>B.F. Bryant Prize for Excellence in Teaching</i>	2007
Graduate teaching award, Vanderbilt University	
<i>Selected visual artist participant</i>	2006
Judy Chicago and Donald Woodman's participatory art pedagogy project, Multimedia Project of Discovery, Vanderbilt University	

## PUBLICATIONS

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1. BOOK: A. Crannell, M. Frantz, F. Futamura, *Perspective and Projective Geometry*, Princeton Univ Press, Princeton, NJ (2019).
2. A. Crannell, M. Frantz, F. Futamura, An (isometric) perspective on homographies, *Journal for Geometry and Graphics* **23** no. 1 (2019) 65-83.
3. A. Crannell, M. Frantz, F. Futamura, Factoring a homology to analyze perspective distortion, *J Math Imaging Vis* **61** no. 7 (2019) 967-989.
4. F. Futamura, A. Marr, Taking Mathematics Abroad: A How-To-Guide, *PRIMUS*, **28** no. 9, (2018) pp. 875-889.
5. F. Futamura, R. Lehr, A new perspective on finding the viewpoint, *Mathematics Magazine* **90**, no. 4 (2017): 267-77. (student co-author, class of 2015, received the Carl B. Allendoerfer Award for expository excellence published in *Mathematics Magazine*)
6. A. Crannell, M. Frantz, F. Futamura, The image of a square, *Am. Math. Monthly* **124** no. 2, (2017) 99-115.
7. F. Futamura, (2017, January 23). *TED-Ed Lesson: The Mathematics of Sidewalk Illusions* [Video file]. Retrieved from <https://ed.ted.com/lessons/the-mathematics-of-sidewalk-illusions-fumiko-futamura>
8. A. Crannell, M. Frantz, F. Futamura, The cross ratio as a shape parameter for Dürer's solid, *J. Math. Arts* **8** no. 3-4, (2014) 111-119. (on the shortlist of four papers considered for the 2016 JMA Outstanding Paper Award)
9. A. Crannell, M. Frantz, F. Futamura, Dürer: Disguise, Distance, Disagreements, and Diagonals! reprinted in: *The Best Writing on Mathematics 2015*, Princeton University Press, 2015.
10. A. Crannell, M. Frantz, F. Futamura, Dürer: Disguise, Distance, Disagreements, and Diagonals! *Math Horiz.* **22** no. 2, (2014) 11, 25.

11. R. Denman, F. Futamura, K. Richards, On sharp frame diagonalization, *Lin. Alg. Appl.*, **438** no. 5, (2013) 2210–2224.
12. F. Futamura, Frame Diagonalization of Matrices, *Lin. Alg. Appl.*, **436** no. 9, (2012) 3201–3214.
13. F. Futamura, Localizable operators and the construction of localized frames, *Proc. Amer. Math. Soc.*, **137** (2009) 4187–4197.
14. F. Futamura, Symmetrically localized frames and the removal of subsets of positive density, *J. Math. Anal. Appl.*, **326** no. 2, (2007) 1225–1235.
15. F. Futamura, Banach framed, decay in the context of localization, *Sampl. Theory Signal Image Process.*, **6** no. 2, (2007) 151–166.

## WORKSHOPS, MINICOURSES, LEARNING SESSIONS ORGANIZED

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1. MAA Minicourse with Annalisa Crannell and Marc Frantz:  
*Visualizing Projective Geometry Through Photographs and Drawings*

MathFest, Cincinnati, OH	Aug 2019
MathFest, Denver, CO	Aug 2018
MathFest, Chicago, IL	Aug 2017
MathFest, Columbus, OH	Aug 2016
Joint Mathematics Meetings, Baltimore, MD	Jan 2014
Joint Mathematics Meetings, New Orleans, LA	Jan 2013
2. Workshop: *Hyperbolic Crochet* Oct 2020  
Southwestern University
3. Learning station on hyperbolic crochet coral reefs: *Hot Science, Cool Talks* Feb 2018  
Environmental Science Institute, UT Austin
4. Learning station on hyperbolic crochet: *Fuzzy Math* Dec 2016  
Thinkery21 at the Thinkery, Austin, TX
5. Learning session: *Mathematics of perspective drawing* Feb 2016  
Operation Math Girls Conference, Sam Houston State University, TX
6. Workshop: *Seeing the Abstract: Visual Thinking for Discovery Learning* Apr 2015  
Southwestern University
7. Community workshop: *Hyperbolic Crochet* Dec 2014  
Art.Science.Gallery, Austin, TX
8. Community workshop: *Mathematical Origami Ornaments* Dec 2013, 2014  
Art.Science.Gallery, Austin, TX
9. Workshop: *Brown Innovations in Teaching Workshop on Teaching and Learning* Fall 2009  
Southwestern University

## PRESENTATIONS

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**Lectures, seminar talks:**

1. *The mathematical mysteries of Albrecht Dürer's 1514 engravings*,  
SU 403 Lectures in Mathematics and Computer Science Dec 2020
2. *Factoring Homographies to Analyze Perspective Distortions*,  
Joint Mathematics Meetings, Baltimore, MD Jan 2019
3. *Visualizing Homographies:  
Distortions (or the Lack Thereof) in Photos, Shadows, and Art*, invited talk  
Paideia Connections Talk, Southwestern University Oct 2018
4. *Perspectives of a Mathematician Artist*, invited talk Jun 2018  
Mathworks colloquium, Honors Summer Math Camp, Texas State University
5. *When Artists Become Mathematicians*, invited talk Apr 2018  
Phi Beta Kappa (En)Lightning Talks Houston, TX
6. *How to Mathematically Immerse Yourself in a Work of Art*, invited talk  
Math Awareness Month lecture, Texas State University Apr 2018  
Infinite Horizons Lecture Series, Kennesaw State University Apr 2015  
Mathematics and Statistics Colloquium, Sam Houston State University Mar 2015
7. *Crocheting Hyperbolic Space*  
SU Art Association, invited talk Feb 2018  
SU 107 Lectures in Mathematics Jan 2018
8. *EQUIPping Freshmen STEM Majors Through the EQUIP Program*  
Joint Mathematics Meetings, San Diego, CA Jan 2018
9. *Fractals and Fractal Dimensions* Nov 2017  
SU 107 Lectures in Mathematics
10. *Fractals in Japanese Woodblock Prints*, invited talk Oct 2017  
Japan-America Society of Greater Austin Academic Lecture Series
11. *Frame Diagonalization of Matrices*, invited talk Jun 2017  
R. W. Yeagy Colloquium, Stephen F. Austin State University
12. *Illustrating Abstract Mathematics Through Perspective Drawing*, invited talk Oct 2016  
SU Art History Program's Representations Lecture Series
13. *Finding the Viewpoint at a Museum: a How-To Guide* Jan 2016  
Joint Mathematics Meetings, Seattle, WA
14. *Harmonics in Math, Art and Music*, invited talk Nov 2013  
Nerd Nite, Austin, TX
15. *Harmonics in Math, Art and Music*, invited talk Nov 2013  
THINK! Series, Southwestern University
16. *On Sharp Frame Diagonalization* Jan 2013  
Joint Mathematics Meetings, San Diego, CA
17. *Drawing Chords in Perspective: Harmonic Sets in Math, Music & Art*, invited talk Mar 2012  
Department Seminar, Franklin & Marshall College
18. *The Mathematics of Wonderland* Feb 2012  
MAA Student Chapter, Southwestern University

19. *Drawing Humpty Dumpty in Perspective, Philosophy, Math, Art, Music* Feb 2011  
MAA Student Chapter, Southwestern University
20. *Exploring Diagonalizable and Localizable Operators*, invited talk Jan 2011  
Analysis Seminar, University of Houston
21. *Frame multipliers and commutative Banach algebras*, invited talk Apr 2010  
AMS Sectional Meeting, St. Paul, MN
22. *Approximate Joint Diagonalization of Matrices*, invited talk Oct 2009  
AMS Sectional Meeting, Boca Raton, FL
23. *Drawing Humpty Dumpty in Perspective: Side Topics in Projective Geometry* Aug 2009  
MAA MathFest 2009, Portland, OR
24. *Creating a Culture of Pedagogical Learning* Aug 2009  
MAA MathFest 2009, Portland, OR
25. *On Diagonalizable and Almost Diagonalizable Operators*, invited talk Sept 2007  
Analysis Seminar, University of Houston
26. *Localized Frames and Localizable Operators*, invited talk Aug 2007  
Wavelets XII Conference, SPIE Optics and Photonics, San Diego, CA
27. *Localized Operators and the Construction of Localized Frames*, invited talk  
Analysis Seminar, Texas A&M University Oct 2006  
Computational Mathematics Seminar, Sam Houston State University. Oct 2006  
Analysis Seminar, University of Houston Oct 2006  
Computational Analysis Seminar, Vanderbilt University Sept 2006  
Intl. Conf. of Harmonic Analysis and Applications, San Luis, Argentina Aug 2006
28. *Intersections and Parallels, How an Artist Sees Mathematics*, invited talk Oct 2006  
MAA Student Chapter, Sam Houston State University
29. *Symmetrically Localized Frames* May 2006  
Current Trends in Harmonic Analysis and Its Applications: Wavelets and Frames  
University of Colorado at Boulder
30. *Mathematical Influences in Art, from Picasso to Escher to Man Ray* Oct 2005  
Undergraduate Seminar in Mathematics, Vanderbilt University
31. *Whistling Girls and Crowing Hens: Women in Mathematics from Ancient to Modern Times* May 2005  
joint talk with Dr. Jo Ann Staples,  
Undergraduate Seminar in Mathematics, Vanderbilt University
32. *On Localized Frames*  
Computational Analysis Seminar, Vanderbilt University Mar 2005  
Intl. Conf. on Modern Methods of Time-Frequency Analysis, Strobl, Austria May 2005  
Southeastern Sectional Meeting, Western Kentucky University Mar 2005

**Invited Participant:**

- Workshop, "Frames for the finite world: Sampling, coding and quantization" Aug 2008  
American Institute of Mathematics, Palo Alto, CA, 2008

Poster presentation, *Localized Operators and the Construction of Localized Frames* Jan 2007  
 AWM Workshop for Women Graduate Students and Recent PhDs,  
 Joint Mathematics Meetings, New Orleans, LA

**Art Exhibits:**

*Weaving together geometry and biology - hyperbolic surfaces in the natural world* Mar 2021  
 crocheted lichen, yarn and tree branch, 25 in×12 in×8 in  
 crocheted coral reef wall hanging, 25 in×20 in  
 joint work with 10 other students and staff, Southwestern University

*Hyperbolic Crochet Coral Reef* Mar 2018  
 crocheted sculpture, yarn and polyfill, 6 in×3 in  
 joint work with 10 other students, faculty and faculty spouse, Southwestern University

*Dissected Pigeon* Mar 2012  
 crocheted sculpture, yarn and polyfill, 6 in×3 in  
 Interdisciplinary Craft as Art, a King Creativity Project  
 headed by M.A. Atkins, A. Budincich, and E. Manning, Southwestern University

*Self-Portraits as Other People's Preconceptions* Apr 2006  
 installation of eight paintings, oil on canvas, 60 in×36 in  
 Evoke/Invoke/Provoke, A Multimedia Project of Discovery  
 Headed by Judy Chicago and Donald Woodman, Vanderbilt University

**TEACHING EXPERIENCE**

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**Courses Taught:**

*Explorations in Mathematics (Paideia Representing Gender cluster course)*  
*Mathematical Concepts (as Mathematical Influences in Art)*  
*Introduction to Statistics*  
*Elementary Function Theory*  
*EQUIP Summer Program and Fall Semester Course*  
*Hidden Perspectives: Mathematics in Art and Art in Mathematics*, First Year Seminar  
*Mathematical Influences in Art*, London Semester Program  
*Victorian Mathematics and Society in Wonderland and Flatland*, London Semester Program  
*Modern Calculus I*  
*Calculus I*  
*Calculus II*  
*Calculus III*  
*Accelerated Calculus I*, Vanderbilt University  
*Accelerated Calculus II*, Vanderbilt University  
*Differential Equations*  
*Linear Algebra*  
*Advanced Linear Algebra and its Applications to Digital Technology*

*Real Analysis I*  
*Real Analysis II*  
*Algebraic Structures I*  
*Algebraic Structures II*  
*Projective Geometry*  
*Geometry*  
*Frame Theory*

**Independent Study:**

*Investigating COVID-19 data at Southwestern University*  
*Algebraic Structures II*  
*3D Slices of Quaternion Julia Sets*  
*Mathematics of Wonderland*  
*Image Processing: Fourier Analysis, Wavelet Analysis and Compressed Sensing*  
*Projective Geometry: Perspective Drawing, Philosophy, Axiomatic Proof, Algebraic Geometry*  
*Mathematical background for an iphone app: geometry and music*  
*Mathematics of Wonderland*

**Research Advisor:**

*Simulation and Analysis of Monopoly Speed*, summer research  
 Nicholai Benko, Mercedes Gonzalez 2021  
*Simulation and Analysis of Monopoly Speed*, summer research  
 Nicholai Benko, Mercedes Gonzalez 2020  
*Diagonalizing the Undiagonalizable Through Eigenlifting*, SCOPE research  
 Sarah Friday, Jordan Smith, Aaron Waclawczyk 2019-21  
*Instruments in Ones and Zeros: Computers Mimic Timbre*, alternate capstone  
 Amy Jenkins 2017  
*On the Convergence of Infinite Series and Products*, honors thesis  
 Sean Watson 2010  
*Super Resolution Image Construction*, honors thesis  
 Tommy Rogers 2010

**Project Advisor:**

*Interpreting the Fourth Dimension Through Ceramics* 2018-2019  
 Jacob Jimerson, Aiden Steinle  
*SU Hyperbolic Crochet Coral Reef Exhibit* 2018  
 11 SU students, faculty and faculty spouse  
*Solar Powered Lounge Chair* 2014-2015  
 Keeley Coburn, Amir Hessabi, Chandler Johnson, Creativity Paideia Cohort  
*AIDS Through Music*, King Creativity Project 2013  
 Phil Wozny, Rachel DeLong, Michelle Moses, Winston Myers, Stinson Seuser

**Paideia Program Instructor:**

*Participant in new Paideia. Theme: Representing Gender* 2013-2016  
*10 student cohort. Theme: Creativity* 2012-2015

**UNIVERSITY SERVICE**

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**University Service:**

<i>Member</i> , Diversity, Inclusion, Belonging, Equity (DIBE) Taskforce	2019-2021
<i>Natural Science rep.</i> , Diversity Enrichment Committee	2018-2019
<i>Chair</i> , Curriculum Committee	2017-2018
<i>Elected Natural Science rep.</i> , Curriculum Committee	2016-2018
<i>Outside Member</i> , Hiring Committee for Political Science Tenure Track position	2017
<i>Member</i> , Hiring Committee for Director of Advising and Retention Position	2016-2017
<i>Member</i> , Curriculum Reform Summer Working Group	2016
<i>Chair</i> , Enrollment and Retention Committee	2015-2016
<i>Natural Science rep.</i> , Enrollment and Retention Committee	2014-2016
<i>Member</i> , Hiring Committee for Mathematics Visiting Assistant Professor Position	2014
<i>Natural Science rep.</i> , Staff Affairs Council	2009-2010, 2014
<i>Natural Sciences rep.</i> , Brown Scholars Committee	2012-2013
<i>Natural Sciences rep.</i> , President's Retirement-Events Planning Committee	2012-2013
<i>Natural Sciences rep.</i> , Paideia Committee	2010-11
<i>Natural Sciences rep.</i> , Interdisciplinary QEP Proposal Committee	2010
<i>Editor</i> , Staff Affairs Council Newsletter	2009-2010
<i>Natural Sciences rep.</i> , Student Media Board	2008-2009
<i>Member</i> , Hiring Committee for Tenure-track Computer Science Position	2007

**Retention, Recruitment, Outreach at SU:**

<i>Conversationalist</i> , Facebook Live Event on academics at Southwestern	2018
<i>Presenter</i> , Top Scholar Weekend parent presentation: <i>Connecting STEM and the Liberal Arts: Developing Skills for the 21st Century</i>	2017, 2018
<i>Letter Writer</i> , Letter Writing to Admitted Students	2015, 2018
<i>Co-founder, Co-organizer, Mentor</i> , EQUIP Program	2016–present
<i>Volunteer with FYS students to teach math through origami and perspective drawing</i> Benold Middle School, Georgetown, TX	2010
<i>Volunteer to teach origami and platonic solids</i> After school program at Cooper Elementary and Forbes Middle School, Georgetown, TX	2010

**Departmental Service:**

<i>Chair</i> , Hiring Committee for Statistics Tenure Track position	2021
<i>Department chair</i> , Mathematics and Computer Science	2018-2020
<i>Chair</i> , Hiring Committee for CS Tenure Track position	2019-2020
<i>Chair</i> , Hiring Committee for Math Tenure Track position	2019-2020
<i>Member and Diversity Advocate</i> , Hiring Committee for Math Tenure Track position	2017-2018
<i>Webmaster</i> , Department Website	2008-2015
<i>Faculty advisor</i> , Southwestern University Math Club MAA Chapter	2007-2014

**ADDITIONAL INFORMATION**

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Citizenship: Japan; U.S. permanent resident.

Computer Skills: html, css, Matlab, LaTeX, Maple, Mathematica, R

Languages Spoken: English (native), Japanese (proficient), Spanish (basic)

Professional Memberships: Mathematical Association of America, Association for Women in Mathematics, National Association for Mathematicians