W. Garrett Mitchener: Curriculum Vitae

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Education

- 1999–2003: Ph.D. from the Program in Applied and Computational Mathematics at Princeton University, Princeton, NJ
  Dissertation: *A Mathematical Model of Human Languages: The Interaction of game dynamics and learning processes*
  Advisor: Martin A. Nowak
- 1995–1999: B.S. in Mathematics and B.A. in Computer Science, *summa cum laude*, with distinction from Duke University, Durham, NC
- 1993–1995: Diploma from the North Carolina School of Science and Mathematics, Durham, NC

Employment

- 2006–present: Assistant professor at the College of Charleston
- 2003–2006: Post-doctoral research associate in the mathematics department at Duke University, Durham, NC

Research Interests

I am an applied mathematician focusing on dynamical systems and stochastic processes, with applications to population dynamics and learning models, specifically mathematical models of human languages. My research combines modeling techniques from ecology and evolutionary biology with up-to-date linguistic knowledge. My dissertation, written under my advisor Dr. Martin Nowak, focused on a continuous selection-mutation model based on the replicator equation. Current research includes: ordinary, partial, and stochastic differential equations and Markov chains for modeling of populations with learning; and statistical models of implicit negative evidence in primary linguistic data.

Grants

- My proposal *Deterministic and Stochastic Dynamics for Language Learning and Change* was funded in 2006 by the National Science Foundation for three years (7/1/2006 to 7/1/2010) as award number 0605042 when I was at Duke and 0734783 when I transferred it to the College of Charleston.

Publications

Annotations: b = before graduate school; P = based on work at Princeton as a graduate student; D = based on work at Duke; C = based on work while at the College of Charleston.

(C) W. G. M. Inferring leadership structure from corpus data reflecting a change in syntax. Submitted.

(DC) W. G. M. A Stochastic model of language change through social structure and prediction-driven instability. Submitted.

(DC) W. G. M. Mean-field and measure-valued differential equation models for language variation and change in a spatially distributed population. Submitted, under revision.

(DC) Misha Becker and W. G. M., A Computational Model of Learning the Raising-Control Distinction. (Dual primary authorship.) 32 pages double spaced. Submitted to a special issue of the *Journal of Child Language* on computational models.

(C) W. G. M. A Cautionary Tale of Caterpillars and Selectional Interference. 24 pages. International Journal of Mathematics, Game Theory and Algebra, 18(4/5), 2009.

(PD) W. G. M., Game Dynamics with Learning and Evolution of Universal Grammar. *Bulletin of Mathematical Biology,* 69(3):1093–1118, 2007.

(D) W. G. M., A Mathematical Model of the Loss of Verb-Second in Middle English. Proceedings of the 13th International Conference for English Historical Linguistics, 2005. Published in: Ritt, Nikolaus et al., eds. *Medieval English and its Heritage: Structure, Meaning, and Mechanisms of Change.* Studies in English Medieval Literature and Language, volume 16, pages 189–202. Peter Lang GmbH, Frankfurt, 2006.

(D) Brian P. Tighe, Joshua E. S. Socolar, David G. Schaeffer, W. G. M., and Mark Huber. Force distributions in a triangular lattice of rigid bars. *Physical Review E,* 72(3) 031306, 2005.

(D) W. G. M., A Simulation of Language Change in the Presence of Non-Idealized Syntax. *Proceedings of the workshop Psychocomputational Models of Human Language Acquisition,* held at the 43rd annual meeting of the Association for Computational Linguistics, June 2005.

(P) W. G. M. and M. A. Nowak, Chaos and language. *Proceedings of the Royal Society: Biological Sciences,* 271(1540):701–704, April 7, 2004.

(P) W. G. M. and M. A. Nowak, Competitive exclusion and coexistence of universal grammars. *Bulletin of Mathematical Biology,* 65(3):67–93, January 2003.

(P) W. G. M., Bifurcation analysis of the fully symmetric language dynamical equation. *Journal of Mathematical Biology,* 46(3):265–285, March 2003.

(b) S. Malone, W. G. M. and J. Mermin, Determining the people capacity of a structure. *The UMAP Journal,* Fall 1999.

(b) W. G. M., J. Mermin and J. Thacker, Grade inflation. *The UMAP Journal,* Fall 1998.

(b) M. Gambrell, W. G. M. and F. Thorne, The world's most complicated payroll. *The UMAP Journal,* Fall 1995.

Other Writing

- W. G. M., *Lattices and Sphere Packings.* My senior thesis for Duke University, presented to the department and general public in Spring 1999.

Presentations and Posters

- *Inferring Leadership Structure from Linguistic Data.* A presentation at the SIAM regional meeting, April 4–5 2009, University of South Carolina Columbia, SC.
- *Wavelets, Images, and Language.* An invited presentation at the UNC Charlotte high-school math contest, March 9, 2009, Charlotte, NC. This was about 50 minutes of edu-tainment for the contest participants.
- *Using mathematical models to understand language change.* An hour long invited lecture at the University of California at Irvine, Institute for Mathematical Behavioral Sciences weekly colloquium, November 13, 2008, Irvine, CA.
- *Inferring Leadership Structure from Linguistic Data.* A presentation at the Southeastern Section Meeting of the MAA, March 29, 2008, The Citadel, Charleston, SC.
- *Inferring Leadership Structure from Linguistic Data.* A presentation at the Joint Mathematics Meeting, January 9, 2008, San Diego, CA.
- *Algorithms for learning the raising/control distinction from semantic information.* A presentation with Misha Becker at the workshop on Psychocomputational Models of Human Language Acquisition at the meeting of the Cognitive Science Society. August 1, 2007, Nashville, TN.
- *A stochastic model of language change through prediction-driven instability.* A presentation at the 10th Mathematics of Language Conference. July 27-30, 2007, UCLA, Los Angeles, CA.
- *Deterministic & Stochastic Dynamics of Usage Frequencies in Language.* A presentation at a conference on mathematical biology, held in honor of Michael Reed. May 20–24, 2007, Duke University, Durham, NC.

- *Deterministic & Stochastic Dynamics of Usage Frequencies in Language.* A poster at Dynamics Days, January 3–6, 2007, Boston, MA.
- *Game Dynamics with Learning and Universal Grammar.* An hour long invited lecture at the Duke Computational Biology and Genomics Seminar, October 5, 2005
- *Why language learning requires miscalibration.* A half-hour presentation at SEAMS at UNC Chapel Hill, September 24, 2005.
- *Using Linguistics Problems to Teach Math Modeling.* A 15 minute presentation at the MAA Mathfest, Albuquerque, NM, August 4, 2005.
- *A Simulation of Language Change in the Presence of Non-Idealized Speech.* A half-hour presentation at the Annual Meeting of the Association for Computational Linguistics, Workshop on Psychocomputational Models of Human Language Acquisition, Ann Arbor, MI, June 29, 2005.
- *Game Dynamics with Learning and Universal Grammar.* An hour invited presentation at the summer school on statistical learning theory, Toyota Technology Institute, University of Chicago, May 25, 2005.
- *A Simulation of Language Change in the Presence of Non-Idealized Speech.* A half-hour presentation at the UNC linguistics department spring colloquium, April 16, 2005.
- *A Simulation of Language Change in the Presence of Non-Idealized Speech.* An hour presentation at the UMIACS Computational Linguistics Colloquium, University of Maryland College Park, March 17, 2005.
- *A Simulation of Language Change in the Presence of Non-Idealized Speech.* A half-hour presentation at the MAA Southeast Section Meeting, Meredith College, Raleigh, NC, March 12, 2005.
- *Math Team Coaching, Math Clubs, and Math Contests.* One branch of a workshop for teachers of advanced high school mathematics, MAA Southeast Section Meeting, Meredith College, Raleigh, NC, March 12, 2005.
- *Mathematical Models of Word Order Change in Middle English.* An hour presentation at the Duke mathematics department's weekly faculty/graduate student seminar, November 19, 2004.
- *Mathematical Models of Word Order Change in Middle English.* A half-hour presentation at the South East Atlantic Mathematical Sciences Workshop (SEAMS) at the College of Charleston, September 19, 2004.
- *Mathematical Models of Word Order Change in Middle English.* A half-hour presentation at the International Conference for English Historical Linguistics (ICEHL) in Vienna, August 25, 2004. (For linguists.)
- *A Model of a Word Order Change in English.* An hour-long invited presentation at the differential equations seminar at NC State math department, February 18, 2004.
- *A Model of a Word Order Change in English.* A 15 minute presentation at Dynamics Days at UNC Chapel Hill, January 4, 2004.
- *A Mathematical Model of Human Languages.* A 15 minute presentation at the Duke University Postdoctoral Association Research Day, October 24, 2003.
- *Complex Behavior in a Model of Human Language.* An hour-long presentation at the applied math seminar at Duke University, September 22, 2003.
- *Complex Behavior in a Model of Human Language.* A short presentation given at the AMS-MAA joint math meeting in Baltimore, January 16, 2003.
- *Population Dynamics and Universal Grammar.* At the PACM Conference, September 10, 2002, Princeton University.
- *Template Polynomials and Bifurcation Analysis: What I did when Mathematica gave me a 10 page answer.* At the PACM Graduate Student Seminar, March 1, 2002, Princeton University.
- *Mathematical Models of Human Languages.* Presentation for the PACM general examination, May, 2001.
- *A Chat Room Assignment for Teaching Network Security.* At the ACM SIGCSE Symposium, February 21–25, 2001, Charlotte, NC.

Teaching
(A * indicates courses taught since August 2006.)

* Mentored independent studies on developing Scrabble-like games in other languages (Blake Matheney) and modeling competition among synonyms (Taylor Hamrick). Summer 2008 to spring 2009.

* Taught discrete mathematical models (Math 450) at the College of Charleston, Spring 2009. Texts: Mooney & Swift, *A Course in Mathematical Modeling;* Chartrand, *Introductory Graph Theory.*

* Taught calculus for business and social sciences (Math 105) at the College of Charleston, two sections each semester, Spring 2009–Fall 2009. Text: Wright, Hurd, & New, *Essential Calculus*, with Hawkes Learning System software.

* Taught ordinary differential equations (Math 323) at the College of Charleston, Fall 2008. Text: Edwards and Penney, *Differential Equations and Boundary Value Problems.*

* Taught undergraduate real analysis/advanced calculus (Math 311) at the College of Charleston, Spring 2008. Text: Bartle and Sherbert, *Introduction to Real Analysis.*

* Taught calculus for business and social sciences (Math 105) at the College of Charleston, two sections each semester, Fall 2006, Spring 2007, Fall 2007, Spring 2008, Fall 2008. Text: Hoffman and Bradley, *Calculus for Business, Economics, and the Social and Life Sciences.*

* Taught master's level real analysis (Math 612) at the College of Charleston, Spring 2007. Mentored a reading course on integration and functional analysis at the Math 612 level for William Baynard and Tim Hansen, Spring 2008. Text: Pugh, *Real Mathematical Analysis,* with additional material from Royden, *Real Analysis.*

* Taught master's level real analysis (Math 511) at the College of Charleston, Fall 2006, Fall 2007. Mentored a reading course on the essentials of real analysis at the Math 511 level for Ibai Basabe, Spring 2007. Text: Pugh, *Real Mathematical Analysis.*

- Taught dynamical systems seminar (Math 132s) at Duke University, Spring 2006, Text: Strogatz, *Nonlinear Dynamics and Chaos.*

- Mentored Adam Chandler and Pradeep Baliga at Duke in a research independent study in Fall 2005 and Spring 2006 on mathematical models of toll roads. This was a continuation of their paper for the 2005 Mathematical Contest in Modeling, which earned an Outstanding rating.

- Taught an independent study in Spring 2005 at Duke on stochastic calculus and option pricing to Ashleigh Price, an undergraduate interested in mathematical finance.

- Taught mathematical modeling seminar (Math 196S) at Duke University, Spring 2005. Material included topics from dynamical systems, probability, and mathematical writing, with applications to linguistics. I designed the course based on my research and experience in the mathematical contest in modeling.

- Mentor for Adam Chandler for a summer research program at Duke called PRUV (Practical Research for Undergraduates with VIGRE). We worked on a model of a sound change taking place in Pennsylvania.

- Taught differential equations (Math 131) at Duke University, Fall 2003, Spring 2004, Fall 2004, and Fall 2005. This class is a thorough introduction to ordinary differential equations, with a short introduction to partial differential equations. Text: Braun, *Differential Equations and their Applications* for Fall 2003; and Edwards and Penney, *Differential Equations and Boundary Value Problems* for 2004 and 2005.

- Taught two sections of calculus (Math 103) at Princeton University, Fall 2002. The class covered differential calculus, and basic integral calculus. The instructors worked together to write and grade the midterm and final examinations, and individually to write and grade weekly quizzes for their sections. The instructors met weekly to ensure we covered the same syllabus, and to discuss issues of fairness and teaching techniques. Text: Stein and Barcellos, *Calculus and Analytic Geometry.*

- Graded for APC503/AST557, a graduate level course on asymptotic techniques, at Princeton University. Material included power series, dominant balances, approximation of integrals, WKB theory, Heading's rules, and boundary layer analysis of ODEs. My job was to grade weekly homeworks, answer questions, and run a review session. Text: Bender and Orszag, *Advanced Mathematical Methods for Scientists and Engineers.*

- Attended a teaching workshop in the spring of 2002 at the McGraw Center for Teaching and Learning at Princeton University. Topics included lecturing techniques and problems in the classroom.

Professional and Service Activities

- Faculty advisor for the College of Charleston Math Club, including practice sessions for the Mathematical Contest in Modeling, Fall 2007 to the present.
- Working with Elizabeth Martinez-Gibson and other faculty to develop the linguistics minor, Fall 2006 to the present.
- Assisted with the College of Charleston Math Meet, Spring 2007, 2008, 2009.
- Participated in the hiring committees for statistics and the open positions, Fall 2007 to Spring 2008. Helped interview candidates at the Joint Math Meeting, January 2008, in San Diego, CA.
- Participated in faculty discussion on the general education requirements, Spring 2007 to the present.
- Refereed an article for *SIAM Journal on Mathematical Analysis,* June 2007, and February 2008.
- Refereed an article for *Cognitive Science,* December 2007.
- Refereed an article for *Journal of Theoretical Biology,* June 2007.
- Refereed an article for *Computational Statistics and Data Analysis,* February 2007.

Outreach activities

- Tutored pre-algebra students at St. Andrews Middle School, Charleston, SC, starting winter 2006. (Unpaid volunteer work, about an hour a week.)
- Assisted with NC state math contest and practice for NC ARML team, 2005–2006.

Professional Memberships

- American Mathematical Society
- Mathematical Association of America, and SIGMAA on Teaching Advanced High-School Mathematics
- Linguistic Society of America

Other work experience

- Research in speech analysis at JAARS, Waxhaw, NC, as an intern during the summers of 2000 and 2001. JAARS writes speech analysis software for SIL International and the Wycliffe Bible Translators. My job was to experiment with algorithms for breaking up a stream of speech into linguistic segments.
- Teaching assistant for algebra 1 at the Talent Identification Program, Davidson College Branch, summer 1998. I was asked to fill in for two weeks when one of the TAs became ill and had to leave.
- Research on the sphere packing problem, summer 1998, Duke University. This research was in preparation for my senior thesis.
- Developed course material for computer science class at Duke University through the DROOL project, summer 1996, 1997, and 1999. My job was to create interesting assignments and sample solutions. In 1999, I wrote a networking package for LEGO Mindstorm robots, and a chat room with two different security systems. I presented the chat room at the 2001 SIGCSE Symposium of the Association for Computing Machinery, and a short paper describing it was published in the proceedings. In 1996, I wrote an animation program in Java to be used for illustrating algorithms. In 1997, I wrote a detailed solution to a file cataloging assignment for CPS108, a computer science course on software engineering and object-oriented programming.
- Undergraduate Teaching Assistant for CPS108 at Duke University, spring 1997 to spring 1999. Responsibilities included grading assignments and helping programming teams.

- Editor and writer for *Duke Math News,* the math department newsletter at Duke University, fall 1995 to spring 1999.

Honors and Awards

- Won an "Outstanding" rating from the Mathematical Contest in Modeling, once while at the North Carolina School of Science and Math in 1995, and at Duke University in 1998 and 1999. In each case our team was one of the highest ranked world wide. Our papers were published in The UMAP Journal. Won a "Meritorious" rating at Duke University in 1996 and 1997.
- Barry M. Goldwater scholarship, 1998.
- Member of Phi Beta Kappa since my junior year, spring 1998.
- Member of Golden Key honor society, spring 1998. Received a small scholarship and was asked to speak at the induction dinner.
- Member of Phi Eta Sigma, a freshman honor society, spring 1996.
- Duke Math Scholarship, 1995.

Skills

- Considerable computer skills, including experience with Linux and UNIX. Able to program in C, C++, Java, Python, Scheme, Haskell, and Mathematica, with some skills in Prolog, Matlab, and Maple. Desktop publishing, including LaTeX, HTML, CSS, and XML. Basic experience with Adobe Illustrator, Photoshop, and GIMP.
- Studied French for six years total in high school and at Duke University.

August 3, 2009