Nicole Beckage

Curriculum Vitae

University of Wisconsin
Department of Psychology and
Department of Computer Science
1202 West Johnson Street
Madison, WI 53706

Mobile: (317) 513-3891
E-mail: beckage@wisc.edu
Website: ittc.ku.edu/~beckage/

Education

Ph.D. Joint Computer Science and Cognitive Science, University of Colorado *December 2016*

- Advisors: Prof. Eliana Colunga (Psych) and Michael Mozer (Comp Sci.)
- Thesis Title: Predictive modeling to capture the words a toddler will learn next

M.A. Psychology, University of California Irvine, Department of Cognitive Sciences *2012*

- Advisor: Prof. Mark Steyvers
- Masters Thesis Title: Route Choice in Individuals:Semantic network navigation

B.S. Cognitive Science
B.A. Mathematics, German, and Psychology, Indiana University Bloomington (IUB) *2010*

- Advisors: Profs. Peter Todd, Linda Smith, Rich Shiffrin
- Honors Thesis: Testing sequential patterns in human mate choice using speed-dating

Employment History

Assistant Scientist, Psychology,
University of Wisconsin, Madison *January 2018 – present*

- DARPA funded project modeling Github via integrated cognitive, network, and agent based modeling learning
- Developing generative cognitive models in complex social networks
- Integration of machine learning approaches with complex networks and cognitive modeling.

Assistant Professor, Electrical Engineering and Computer Science,
University of Kansas, Lawrence *August 2016 – July 2018*

- Research at the intersection of complex systems and machine learning
- Using Data Science to understand cognition and decision making
- Teaching courses and advising students on machine learning and data science topics

Research Intern, Microsoft Research Cambridge, Cambridge UK *Summer 2015*

- Extending reinforcement learning algorithms (e.g. DQN) to continuous state and action space
- Using and developing Project Malmo platform

Graduate Researcher, University of Colorado, Department of Computer Science *Fall 2013 – Spring 2016*

- Funded by NSF GRFP and NIH R01 Grant to Prof. Colunga
- Work on machine and statistical learning of first language acquisition
- Experience with analyzing human data in relation to longitudinal and intervention studies

Research Intern, Pearson Knowledge Technologies, Boulder CO *Summer 2013*

- Worked on the Pearson automated essay grading system for essays and short answers
- Utilized machine learning algorithms and statistical analysis on education data

Graduate Research Assistant with Prof. Carter Butts *Fall 2011 – Summer 2012*

- Funded under the NSF grant CDI-Type II: Topology and Function in Computer, Social and Biological Networks

Undergraduate Research Assistant with Prof. Peter Todd *May 2008 – Summer 2010*

- Topic: Sequential decision in human mate choice; Network analysis and language acquisition
- Funded by Hutton Honors College Thesis Grant (Spring 2010), Hutton Honors College Professional Experience Grant (Summer 2009) and Cognitive Science Summer Research Scholarship (Summer 2008,09,10)

Research Grants

Current Grants

NASA: SBIR Phase 1: *Evolving and Certifiable Autopilot for Unmanned Aerial Systems*
PI: Shawn Keshmiri, co-PI: **Nicole Beckage**, Heechul Yun *Awarded Aug 2018* $124,959

CRA-W CREU: *Modeling language learning using child-directed speech*
PI: **Nicole Beckage**, co-PI: Jon Brumberg *Awarded 2017-2018 academic year* $7,500 to support undergraduate research

NSA Science of Security *Science of Cyber-Physical Security*
PI: Perry Alexander, Co-PIs: **Nicole Beckage**, et al. *Awarded Feb 2018* $5,500,000 over 5 years

Select Fellowships and Awards

NSF Graduate Research Fellowship *Fall 2010–Summer 2012; Fall 2013-Summer 2014*

CogSci 2015 Student Travel Grant (UCB) *award from CSS for outstanding papers, Summer 2015*

University of Colorado Graduate School Travel Grant *Summer 2015*

University of Colorado Department of Computer Science Outstanding Service Award *Summer 2015*

Research Community Development Award (UCB) *Fall 2013*

Finalist for DOE Computational Science Graduate Research Fellowship *Fall 2012*

Provost Award for Undergraduate Research (IUB) *Summer 2010*

Cognitive Science Outstanding Contribution Awards *Spring 2010*

Papers

[1] Beckage, N.M., Colunga, E. (Under review in Complexity). Modeling lexical acquisition in toddlers through network analysis.

[2] Beckage, N.M., Colunga, E., Mozer, M. (Under review in IEEE TCDS) Quantifying the role of vocabulary knowledge in predicting future word learning.

[3] Shukla, D., Keshmiri, S., Beckage, N.M. (under review in AAAI 2019) Imitation Learning for Joint Guidance-Navigation-Control in Fixed-wing Unmanned Aerial Systems. (D. Shukla is a PhD student co-advised by S. Keshmiri and myself)

[4] Siew, C.S.Q., Wulff, D.U., Beckage, N.M., Kenett, Y.N. (Under review in Complexity). Cognitive Network Science: A review of research on cognition through the lens of network representations, processes, and dynamics.

[5] Stella, M, Beckage, N.M., Brede, M., De Domenico, M. (2018). *Scientific Reports, 8.* Multiplex model of mental lexicon reveals explosive learning in humans. (M Stella was my research visitor at KU)

[6] Stella, M, Beckage, N.M., Brede, M. (2017). Multiplex lexical networks reveal patterns in early word acquisition in children. *Scientific Reports, 7*. (M Stella was my research visitor at KU)

[7] Beckage, N.M., Colunga, E. (2015). Language Networks as Models of Cognition: Understanding Cognition through Language. In A. Mehler, P. Blanchard, B. Job, S. Banisch (Eds.), *Towards a Theoretical Framework of Analyzing Complex Linguistic Networks*. Springer Publishing. (Invited Book Chapter).

[8] Beckage, N.M., Smith, L.B., Hills, T. (2011). Small worlds and semantic network growth in typical and late talkers. *Public Library of Science: PLOS ONE*.

Refereed Conference Proceedings

[9] Fathan, M.I, Renfro, E., Austerweil, J.L., Beckage, N.M. (submitted, 2018) Do Humans Navigate via Random Walks? Modeling Navigation in a Semantic Word Game *Proceedings of the 40th Annual Conference of the Cognitive Science Society*. Austin, TX: Cognitive Science Society.

[10] Beckage, N.M., Mozer, M., Colunga, E. (2015) Predicting a child's trajectory of lexical acquisition. In M. Knauff, M. Pauen, N. Sebanz, & I. Wachsmuth (Eds.), *Proceedings of the 37th Annual Conference of the Cognitive Science Society*. Austin, TX: Cognitive Science Society. (acceptance rate $\sim$28%, won travel award related to paper quality and reviews).

[11] Beckage, N.M., Aguilar, A., Colunga, E. (2015) Modeling lexical acquisition through networks. In M. Knauff, M. Pauen, N. Sebanz, & I. Wachsmuth (Eds.), *Proceedings of the 37th Annual Conference of the Cognitive Science Society*. Austin, TX: Cognitive Science Society. (accepted as poster, acceptance rate $\sim$44%).

[12] Beckage, N.M., Colunga, E. (2013) Using the words toddlers know now to predict the words they will learn next. In M. Knauff, M. Pauen, N. Sebanz, & I. Wachsmuth (Eds.), *Proceedings of the 35th Annual Conference of the Cognitive Science Society*. Austin, TX: Cognitive Science Society. (acceptance rate $\sim$28%)

[13] Beckage, N.M., Steyvers, M. & Butts, C.T. (2012). Route choice in Individuals–Semantic network navigation. In N. Miyake, D. Peebles, & R. P. Cooper (Eds.), *Proceedings of the 34th Annual Conference of the Cognitive Science Society*. Austin, TX: Cognitive Science Society. (acceptance rate $\sim$38%)

[14] Beckage, N.M., Smith, L.B., Hills, T. (2010). Semantic connectivity is related to vocabulary growth rate in children. In S. Ohlsson & R. Catrambone (Eds.), *Proceedings of the 32th Annual Conference of the Cognitive Science Society*. Austin, TX: Cognitive Science Society. (acceptance rate $\sim$30%)

[15] Beckage, N.M, Todd, P.M, Penke, L., & Asendorpf, J.B. (2009). Testing sequential patterns in human mate choice using speed-dating. In N.A. Taatgen & H. van Rijn (Eds.), *Proceedings of the 31th Annual Conference of the Cognitive Science Society*. Austin, TX: Cognitive Science Society. (acceptance rate $\sim$32%)

Invited Talks

[1] Beckage, N.M. (2016, November). Microsoft Research Asia Faculty Summit 2016 Building truly intelligent AI: Modeling infant language acquisition, Yonsei University and Microsoft Research Asia, Seoul, South Korea.

[2] Beckage, N.M. (2015, October). Network Growth Models Applied to Language Acquisition, University of Warwick.

[3] Beckage, N.M. (2014, April). Non-parametric Bayesian Models: Understanding the Chinese Restaurant Process and the Indian Buffet Process: Lecture for Graduate Machine Learning Course.

[4] Beckage, N.M, Butts C.T. & Smith, L. (2012, December). Semantic Diffusion: explaining child language acquisition. Modeling Linguistic Networks: from Language Structures to Communication Processes, Goethe-University Frankfurt am Main Germany.

[5] Beckage, N.M, Smith, L & Butts, C.T. (2012, October). Using dynamic network models to capture child language acquisition processes. Workshop: Small world of words. Leuven, Belgium.

[6] Beckage, N.M., Butts, C.T. & Smith L. (2012, June). Network growth models of semantic acquisition. NetSci satellite Symposium Language and Network Science, Chicago, IL.

Organized Workshops

[1] Beckage, N.M., Kenett, Y., Stella, M. & Vitevitch, M., (2017, June). Cognitive Network Science symposium. NetSci 2017, Indianapolis, IN.

[2] Beckage, N.M. & Hills, T.T. (2015, June). Language and Network Science Symposium. NetSci 2015, Zaragoza Spain.

[3] Beckage, N.M., Vitevitch, M., Mehler, A. & Colunga, E., (2013, August). Using Complex Network Analysis in the Cognitive Sciences tutorial. Cognitive Science Conference, Humbolt University Berlin.

[4] Beckage, N.M., Murdock, J, Thevenow-Harrison, J.H., (2009, April) IU's Midwest Undergraduate Cognitive Science Conference.

Selected Talks

[1] Beckage, N.M.(2018, March) Multiplex network optimization to capture attention to features. Talk presented at Human, Animal, and Machine Learning: Experimetn and Theory, University of Wisconsin, Madison.

[2] Beckage, N.M., & Colunga E. (2016, September) Predictive modeling of language acquisition using network growth models. Talk presented at the 2016 Conference on Complex Systems, Amsterdam, Netherlands.

[3] Beckage, N.M., Mozer, M. & Colunga E. (2015, August) Predicting a child's trajectory of lexical acquisition. Talk presented at the 2015 Cognitive Science Conference, Pasadena, California.

[4] Beckage, N.M, & Colunga, E. (2015, June) Explaining the "vocabulary burst" in early acquisition through network analysis. Talk presented at NetSci, Zaragoza, Spain.

[5] Beckage, N.M., Steyvers, M. & Butts, C.T. (2012, August) Route choice in individuals–Semantic network navigation. Talk presented at the 2012 Cognitive Science Conference, Sapporo, Japan.

[6] Beckage, N., Smith, L.B., Hills, T., (2010, August). Statistical Dependencies among children: Late vs. Typical Talkers. Talk presented at the Cognitive Science Conference, Portland, OR.

[7] Beckage, N., Smith, L.B., Hills, T., (2009, October) Structural differences in late and early talkers vocabulary. Talk presented at the pre-Conference to the Cognitive Development Society Conference, San Antonio, TX.

[8] Beckage, N., Todd, P.M., Penke, L., and Asendorpf, J.B. (2009, August). Testing sequential patterns in human mate choice using speed dating. Talk presented at Proceedings of the 2009 Cognitive Science Conference.

Teaching

Undergraduate Machine Learning – Primary Instructor *Spring 2017*

Graduate Machine Learning – Primary Instructor *Spring 2017*

Data Science (new course) – Primary Instructor *Fall 2016, 2017*

Machine Learning – Grader *Spring 2014, 2015*

Tutorial on Network Science Cognitive Science Conference, Berlin *Summer 2013*

Cognitive Psychology – Teaching Assistant *Spring 2013*

Introduction to (UG) Statistics – Teaching Assistant *Fall 2012*

Foundations of Cognitive Science – Teaching Assistant *Spring 2010*

Service and Mentorship

Masters Project Advisor, PhD thesis Advisor	*through July 2018*
Erick Odunyi and Rebekah Manweiler (UG)	CREU students
Rahul Baid (MS)	Project chair, graduated
Mohammad Isyroqi Fathan (MS)	Thesis chair
Tejaswini Jagarlamundi (MS)	Project chair
Daksh Shukla (PhD, Aerospace)	Co-chair
Venkat Vadulla (MS)	Project chair
Ethan Ward (UG)	Undergraduate Honors

Founding Faculty Member of KU Women in Computing *August 2016–July 2018*

Guest Editor, Complexity Journal Special Issue on Cognitive Network Science *current*

IFIP Networking Technical Program Committee *2018*

International Conference on Computational Social Science Program Committee *2017*

Graduate representative to CS Executive Board (UCB) *Fall 2015- Spring 2016*

Co-Chair of Computer Science Graduate Student Faculty Candidate Committee (UCB) *Spring 2015*

Graduate Summer Schools and Relevant Course Work

Complex Systems Summer School *Summer 2016*
Santa Fe Institute, Santa Fe New Mexico

ICERM Workshop on Stochastic Graph Models *March 2014*
ICERM Semester Program on Network Science, Brown University

Graduate Summer School on Probabilistic Learning *Summer 2011*
Institute for Pure and Applied Mathematics, University of California Los Angeles

Bounded Rationality Summer School Max Planck Institute, Berlin Germany *Summer 2009*

Computer Science Courses

- Probabilistic Models of Human and Machine Intelligence
- Neural Networks
- Natural Language Processing
- Design and Analysis of Algorithms
- Fundamentals of Programming Languages

Statistics Courses

- Intermediate Probability and Statistical Theory
- Statistical Methods I: Linear Models
- Computational Statistics

Cognitive Science Courses

- Mathematical Models of Cognition
- Advanced Bayesian Cognitive Modeling
- Computational Neuroscience

Network Analysis Courses

- Social Network Theory
- Analysis of Social Network Data
- Social, Economic, and Engineering Networks

References:

Prof. Eliana Colunga
Department of Psychology and Neuroscience
Institute of Cognitive Science
University of Colorado
Boulder, CO 80309
(303) 492-4282
eliana.colunga@colorado.edu

Prof. Michael Vitevitch
Department of Psychology
University of Kansas
Lawrence, KS 66044
(785) 864-9312
mvitevit@ku.edu

Prof. Shawn Keshmiri
Department of Aerospace Engineering
University of Kansas
Lawrence, KS 66044
(785) 864-2974
keshmiri@ku.edu

Prof. Michael Mozer
Department of Computer Science
Institute of Cognitive Science
University of Colorado
Boulder, CO 80309
(303) 517-2777
mozer@colorado.edu

Prof. James Sterbenz
Department of Electrical Engineering
and Computer Science
University of Kansas
Lawrence, KS 66044
(785) 864-8846
jpgs@ittc.ku.edu