# Erin H. Bugbee

Website: erinbugbee.com Email: erin\_bugbee@icloud.com LinkedIn: erinbugbee Google Scholar: bit.ly/ebugbeegs GitHub: github.com/erinbugbee

2020–2025 (Anticipated Defense: April 2025)

## RESEARCH INTERESTS

Sequential decision making, human and machine learning, cognitive modeling, exploration-exploitation, data science, computational social science

## EDUCATION

#### Carnegie Mellon University

Ph.D. Candidate in Cognitive Decision Science

- Dissertation Proposal: "Balancing Exploration and Exploitation: Sequential Decision Making in Humans and Machines" Committee Members: Cleotilde Gonzalez (Advisor), Russell Golman (Co-Advisor), Sudeep Bhatia

#### Carnegie Mellon University

M.S. Social and Decision Sciences (Earned en route to Ph.D.)

 Thesis: "Deciding When to Stop: Cognitive Models of Sequential Decisions in Optimal Stopping Tasks" Committee: Cleotilde Gonzalez, Russell Golman, Stephen Broomell

#### **Brown University**

Sc.B. Statistics and A.B. Behavioral Decision Sciences, GPA: 3.97/4.00, Magna Cum Laude

 Thesis: "Understanding Human and Artificial Decision Makers Using Reinforcement Learning" Advisor: Lorin Crawford

## INDUSTRY EXPERIENCE

Apple	Austin, TX
Machine Learning Engineer Intern	Summer 2024
- Strategic Data Solutions, Applied Data Science Program	

- Developed features and evaluated impact on ML model for fraud detection for Apple Pay Later.

#### Amazon Web Services

#### Applied Scientist II Intern

- Machine Learning University, AWS Deep Learning
- Developed machine learning content at Amazon's Machine Learning University (MLU). Taught machine learning courses on basics of machine learning, responsible AI, and generative AI to approx. 600 Amazon employees. Conceptualized, built, launched, and taught new course on topics in bias and fairness in large language models. Created and launched challenge on gender bias in machine translation. Wrote and developed MLU-Explain articles on Logistic Regression and Reinforcement Learning.

#### Disney

Sales Analytics & Insights Professional Intern

- Consumer Insights, Measurement, & Analytics Organization
- Performed analytics for the Disney Cruise Line, predicted Disneyland Anaheim attendance with machine learning, analyzed flight data for John Wayne Airport, which contributed to the addition of new flights.

Orlando, FL

Summer 2019

er.

Seattle, WA Summer 2022 and 2023

Pittsburgh, PA 2020–2022

Pittsburgh, PA

Providence, RI 2016–2020

#### Microsoft

Explore Intern (Product Management and Software Engineering)

- Microsoft Support Engineering Group, Universal Store Team, Cloud + AI Division
- Developed portal for Microsoft Support case submission with a Virtual Agent and customer service data.

## RESEARCH EXPERIENCE

# Dynamic Decision Making Lab, Carnegie Mellon University Graduate Research Assistant with Cleotilde Gonzalez Sloman Lab, Brown University

Undergraduate Research Assistant with Steven Sloman

Learning, Memory & Decision Lab, Brown University

Undergraduate Research Assistant with Matthew Nassar

#### Summer@ICERM: Topological Data Analysis

Research Experiences for Undergraduates (REU) Participant

PUBLICATIONS

- 1. Bugbee, E. H. & Gonzalez, C. (2024). Feedback Promotes Learning and Knowledge of the Distribution of Values Hinders Exploration in an Optimal Stopping Task. In Proceedings of the Annual Meeting of the Cognitive Science Society (CogSci '24).
  - This research investigates human learning abilities in optimal stopping tasks, focusing on feedback and knowledge of option value distributions. Through an experimental sequential choice task, we demonstrate that experience improves performance, with feedback significantly influencing learning. We also find that awareness of the value distribution reduces the duration of the search.
- 2. Bugbee, E. H., Nguyen, T., & Gonzalez, C. (2024). Applications of Instance-Based Learning Theory: Using the SpeedyIBL Library to Construct Computational Models. In Proceedings of the XI Latin American Conference on Human Computer Interaction (CLIHC '23). Association for Computing Machinery.
  - We present a workshop that teaches how to use the SpeedyIBL Python library to build computational cognitive models for a range of decision making tasks.
- Bugbee, E. H., & Gonzalez, C. (2022). Deciding When to Stop: Cognitive Models of Sequential Decisions in Optimal Stopping Tasks. Master's Thesis, Carnegie Mellon University. https://doi.org/10.1184/R1/20492877
  - We show that a cognitive model of learning from experience can accurately predict human decision making in several optimal stopping tasks.
- 4. Bugbee, E. H., & Gonzalez, C. (2022). Making Predictions Without Data: How an Instance-Based Learning Model Predicts Sequential Decisions in the Balloon Analog Risk Task. In *Proceedings of the Annual Meeting of the Cognitive* Science Society, 44.
  - We present a cognitive model of the Balloon Analog Risk Task, and show that this an Instance-Based Learning (IBL) model can make accurate predictions of human behavior without data. We articulate the benefits of this theory-based modeling in sequential decision making tasks.
- 5. Bugbee, E. H., McDonald, C., & Gonzalez, C. (2022). Leveraging Cognitive Models for the Wisdom of Crowds in Sequential Decision Tasks. *Paper presented at Virtual MathPsych/ICCM 2022*. Via mathpsych.org/presentation/751.
  - In this work, we demonstrate how simulated agents using a cognitive model derived from Instance-Based Learning Theory (IBLT) can produce wisdom of crowds behavior that is similar to wisdom of crowds behavior from human participants in two sequential decision tasks. We demonstrate that the wisdom of crowds performance from simulated groups of agents is better than the performance of most agents and that the Instance-Based Learning (IBL) crowd behavior is similar to the human crowd behavior.

Page 2 of 8

Redmond, WA Summer 2018

Fall 2020–Current

Pittsburgh, PA

Providence, RI Fall 2019–Summer 2020

Providence, RI Spring 2019–Spring 2020

> Providence, RI Summer 2017

- Golman, R., Bugbee, E. H., Jain, A., & Saraf, S. (2022). Hipsters and the Cool: A Game Theoretic Analysis of Identity Expression, Trends, and Fads. *Psychological Review*, 129(1), 4–17. https://doi.org/10.1037/rev0000341
  - We propose a theory of social identity expression based on the opposing, but not mutually exclusive, motives to conform and to be unique among one's neighbors in a social network. We argue that these motives lead to cultural trends and popularity cycles. To do so, we present evidence of the two motives in an analysis of the popularity of given names, and model the social dynamics that result from these motives using social networks.
- McDonald, C., Gonzalez, C., Blaha, L., Lebiere, C., Fiechter, J., Bugbee, E. H., & McCormick, E. N. (2021). Diverse experience leads to improved adaptation: An experiment with a cognitive model of learning. *Paper presented* at Virtual MathPsych/ICCM 2021. Via mathpsych.org/presentation/615.
  - We investigate the Diversity Hypothesis: that acquiring diverse experiences during learning will result in better adaptation to unexpected situations. We conduct a simulation experiment using a cognitive model of learning and decisions from experience based on Instance-Based Learning (IBL) Theory in a Gridworld task, and expose agents to various degrees of diversity in task complexity as they learn. We then observe how these agents transfer their acquired knowledge to a situation of novel decision complexity, and find evidence for the diversity hypothesis.
- Savard, C., Bugbee, E. H., McGuirl, M. R., & Kinnaird, K. M. (2020). SuPP & MaPP: Adaptable Structure-Based Representations For MIR Tasks. In *Proceedings of the 21st International Society for Music Information Retrieval* Conference, 2020, pp. 335–342.
  - We build on McGuirl et al. (2018) and introduce the Surface Pattern Preservation (SuPP), a continuous song representation, and Matrix Pattern Preservation (MaPP), SuPP's discrete counterpart. We show MaPP's success in addressing a variety of Music Information Retrieval tasks.
- McGuirl, M. R., Kinnaird, K. M., Savard, C., & Bugbee, E. H. (2018). SE and SNL diagrams: Flexible data structures for MIR. In *Proceedings of the 19th International Society for Music Information Retrieval Conference*, 2018, (pp. 341-347).
  - This work introduces start-end (SE) diagrams and start(normalized)length  $(S_N L)$  diagrams, two novel structure-based representations for sequential music data. These representations are inspired by topological data analysis. We show how these representations can be used for the cover song task, in which they are used to identify whether songs are covers of the same piece of music.

## WORKING PAPERS

- Bugbee, E. H., & Gonzalez, C. (2024). "A Cognitive Model for Explaining Sequential Decisions and Learning in Optimal Stopping Tasks." In preparation.
  - We propose a theory for how people solve sequential decision making problems, and particularly, the optimal stopping problem in which people decide when to take an action. We formalize this theory with a cognitive model, and demonstrate in four tasks that this model can both accurately predict human behavior and generalize across tasks.
- Gonzalez, C., Aggarwal, P., **Bugbee, E. H.**, & Phan, D. N. (2024). "Cognitively-Inspired Signaling in Security Games to Increase Adversarial Compliance." In preparation.
  - We investigate the effectiveness of signaling in a binary choice treasure hunt game, the box game. We develop an Instance-Based Learning (IBL) model which closely replicates human decisions. We also develop an adaptive signaling stragey, and simulation results show that the cognitively-inspired, dynamic signaling strategy is more effective in reducing adversarial decisions in uncovered boxes than static probability signaling strategies.
- Tatlidil, S., **Bugbee, E. H.**, Dick, M., Hemmatian, B., & Sloman, S. (2024). "Algorithms as Advisors in the Future of the Workplace." In preparation.
  - In a series of experiments, we investigate human trust in algorithmic and human advisors in the workplace.

# WORK IN PROGRESS

- How and When People Decide When to Stop Searching. Work with Cleotilde Gonzalez.
  - Though a series of experiments, we investigate how and when people decide when to stop searching in sequential search.
- Wisdom of Crowds for Optimal Stopping. Work with Cleotilde Gonzalez.
  - We investigate how receiving crowd advice from humans and algorithms influences stopping behavior in an optimal stopping task.

## EDUCATIONAL MATERIALS

- 1. Bugbee, E. H., Kamat, A., & Wilber, J. (2023). *Reinforcement Learning*. MLU-Explain from Amazon's Machine Learning University. https://mlu-explain.github.io/reinforcement-learning/
- 2. Bugbee, E. H., & Wilber, J. (2022). *Logistic Regression*. MLU-Explain from Amazon's Machine Learning University. https://mlu-explain.github.io/logistic-regression/

## TEACHING

• Instructor at Amazon's Machine Learning University Generative AI, Fairness in Large Language Models	Summer 2023
• Instructor at Amazon's Machine Learning University Day One Machine Learning, Tabular Data	Summer 2022
• <b>Teaching Assistant</b> at Carnegie Mellon University 85-232: Thinking in Person vs. Thinking Online, Prof. Danny Oppenheimer	Fall 2020
• Teaching Assistant at Brown University NEUR 1660: Neural Computations Underlying Learning and Decision Making, Prof. Matthew Nasse	Spring 2020
• Head Teaching Assistant at Brown University CSCI 0100: Data Fluency for All, Prof. Amy Greenwald	Fall 2019
• Teaching Assistant at Brown University CSCI 1951a: Data Science, Prof. Ellie Pavlick	Spring 2019
• Teaching Assistant at Brown University CLPS 0220: Making Decisions, Prof. Steven Sloman	Spring 2019
• Teaching Assistant at Brown University APMA 1655: Advanced Statistical Inference I, Prof. Caroline Klivans	Fall 2018
• Teaching Assistant at Brown University PHP 1501: Essentials of Data Analysis, Prof. Roee Gutman	Fall 2018
• Teaching Assistant at Brown University CSCI 0100: Data Fluency for All, Prof. Amy Greenwald	Fall 2017

## PRESENTATIONS

#### Talks

"A Cognitive Model for Deciding When to Stop: Explaining Sequential Decisions and Accounting for Learning in Optimal Stopping Tasks" ELLIS Alicante/DDMLab Workshop on Human-Centered Artificial Intelligence March 2023

"Making Predictions Without Data: How an Instance-Based Learning Predicts Sequential Decisions in the Balloon Analog Risk Task" Cognitive Science Conference (CogSci 2022)	Model July 2022
"Leveraging Cognitive Models for the Wisdom of Crowds in Sequentia Decision Tasks" International Conference on Cognitive Modeling (MathPsych/ICCM 2022)	d July 2022
"Cognitive Models of Sequential Choice in Optimal Stopping Tasks" Dynamic Decision Making Laboratory Meeting, Carnegie Mellon University	October 2021
"Cognitive Models of Sequential Choice in the Optimal Stopping Task Society for Mathematical Psychology Conference (MathPsych/ICCM 2021)	" July 2021
"Cognitive Models of Sequential Choice in the Optimal Stopping Task Center for Behavioral and Decision Research, Carnegie Mellon University	"April 2021
"Reinforcement Learning in Dynamic Environments for Place Cell Rei Learning, Memory, & Decision Lab, Brown University	mapping" November 2019
"Comparing Songs Without Listening" Brown Math Slam, Society for Industrial and Applied Mathematics/AWM	November 2018
"SE and SNL Diagrams: Flexible Data Structures for MIR" The International Society for Music Information Retrieval Conference	September 2018
Comparing Songs Without Listening Summer@ICERM	August 2017
Poster Presentations	
"Feedback Promotes Learning and Knowledge of the Distribution of V Exploration in an Optimal Stopping Task" Cognitive Science Conference (CogSci 2024)	Values Hinders July 2024
"The Effect of Feedback and Knowledge of the Distribution of Option on Learning in Sequential Search" Society for Judgment and Decision Making Conference	Values November 2023
"Deciding When to Stop: Cognitive Models of Sequential Decisions in Optimal Stopping Tasks" 3rd Workshop on Mental Effort	November 2022
"Algorithms as Advisors in the Future of the Workplace" Society for Judgment and Decision Making Conference	December 2020
"SuPP and MaPP: Novel MIR Data Structures Inspired by TDA" The International Society for Music Information Retrieval Conference	September 2018
"Comparing Songs Using Matrix Pattern Preservation" Women in Data Science Conference	March 2018
"Comparing Songs Using Matrix Pattern Preservation" Joint Mathematics Meetings	January 2018

"Comparing Songs Using Matrix Pattern Preservation" NEMISIG (Northeast Music Informatics Special Interest Group)	January 2018
Workshops	
"Applications of Instance-Based Learning Theory: Using the Speed to Construct Computational Models"	dyIBL Library
CLIHC 2023: XI Latin American Conference on Human Computer Interaction	October 2023
<b>"The Power of Data and Data Visualization"</b> Intern from Home Cohort	June-August 2020
"Introduction to R Programming" Brown Datathon	February 2018

# GRANTS AND FELLOWSHIPS

•	Presidential Fellowship, Tata Consultancy Services	2024
•	Presidential Fellowship, Dietrich College of Humanities and Social Sciences, Carnegie Mellon University	2020 - 2025
•	National Science Foundation Graduate Research Fellowship Program Applicant	2019, 2021
•	Brown Data Science Fellow	2019-2020
•	Collaborate@ICERM Grant: Topological Data Analysis and Music Information Retrieval, ICERM	2019

# Honors and Awards

•	Opportunity Scholar for posit::conf(2023)	2023
•	American Statistical Association (ASA) StatsGrad Award Winner	2020
•	Premium for Excellence in Behavioral Decision Sciences, Brown University	2020
•	Bob Petrocelli Head Undergraduate TAship, Brown University Department of Computer Science	2020
•	Class of '81 Undergraduate TAship for Women in CS, Brown University Department of Computer Science	2019
•	Disney Data & Analytics Women Scholarship Recipient	2019
•	Outstanding Poster Award, Joint Mathematics Meetings	2018

# Conferences and Travel Awards

Society for Judgment and Decision Making Conference	Remote
The Society for Judgment and Decision Making	November 2023

CLIHC 2023: XI Latin American Conference on Human Computer Interaction Puebla, Mexico CLIHC October 2023

<pre>posit::conf(2023) Posit (formerly RStudio)</pre>	Chicago, Illinois September 2023
CascadiaR Conference	Seattle, Washington
Fred Hutch Cancer Center	August 2023

-Cascadia R<br/> Scholarship

<b>ELLIS Alicante/DDMLab Workshop on Human-Centered AI</b>	Alicante, Spain
European Laboratory for Learning and Intelligent Systems (ELLIS) Alicante	March 2023
<b>3rd Workshop on Mental Effort</b>	Providence, Rhode Island
Brown University	November 2022
CogSci 2022	Toronto, Ontario
Cognitive Science Society	July 2022
MathPsych/ICCM 2022	Remote
Society for Mathematical Psychology	July 2022
CogSci 2021	Remote
Cognitive Science Society	July 2021
MathPsych/ICCM 2021	Remote
Society for Mathematical Psychology	July 2021
Society for Judgment and Decision Making Conference	Remote
The Society for Judgment and Decision Making	December 2020
<b>ISMIR 2020</b> International Society for Music Information Retrieval - ISMIR Student Travel Grant	Remote October 2020
ASA Women in Statistics and Data Science 2020	Remote
Women in Data Science Conference	October 2020
<ul> <li>ASA WSDS Student Havel Award</li> <li>ASA Women in Statistics and Data Science 2019</li> <li>Women in Data Science Conference</li> <li>ASA WSDS Student Travel Award, Brown Data Science Initiative Travel Grant</li> </ul>	Bellevue, WA October 2019
Disney Data & Analytics Conference (DDAC)	Orlando, FL
The Walt Disney Company	August 2019
News vs. Truth Seminar with Jon Klein and Steven Sloman	Providence, RI
Brown University	Spring 2019
Collaborate@ICERM 2019 ICERM — ICERM Grant	Providence, RI January 2019
Machine Intelligence Conference	Cambridge, MA
MIT Media Lab	November 2018
<b>ISMIR 2018</b> International Society for Music Information Retrieval – ISMIR Student Travel Grant, Brown Data Science Initiative Travel Grant	Paris, France September 2018
Disney Data & Analytics Conference (DDAC) The Walt Disney Company — Disney Data & Analytics Women Scholarship	Orlando, FL August 2018

Women in Data Science (WiDS)	Worcester, MA
Worcester Polytechnic Institute	March 2018
Northeast Music Information Special Interest Group (NEMISIG)	Providence, RI
Brown University and Spotify	January 2018
Joint Mathematics Meetings The American Mathematical Society and the Mathematical Association of America – JMM Student Travel Grant, ICERM Travel Grant	San Diego, CA January 2018

## PROFESSIONAL AFFILIATIONS AND ACTIVITIES

• Department of Social and Decision Sciences, Carnegie Mellon University Climate Committee Graduate Representative	2022–Current
• Society for Mathematical Psychology Trainee Member	2021–Current
• Women of Mathematical Psychology Trainee Member	2021–Current
• Society for Judgment and Decision Making Student Member	2020–Current
• Cognitive Science Society Student Member	2020–Current
American Statistical Association     Student Member	2018–Current
• Brown Data Science Club President (2019–2020) Marketing Team Leader (2018–2019) Outreach Team Member (2017–2018) Club Member (2016–2017)	2016-2020
• Center for Statistical Sciences and Department of Biostatistics Diversity & Inclusion Committee Undergraduate Representative	2018-2020
• Statistics Departmental Undergraduate Group Leader	2018-2020
Science Tour Guide     Leader	2017-2020
• The Brown Daily Herald <i>Copy-Editor</i>	2016-2020

### Skills

- Programming: Python, R, MATLAB, Spark, SQL, Snowflake SQL, Java, Javascript, HTML, CSS, Svelte
- Tools: R Markdown, Quarto, Shiny, Jupyter Notebooks, LATEX, Git, Github
- Behavioral Experiments: Qualtrics, Amazon Mechanical Turk, Prolific, Cognitive Walkthroughs
- Data Visualization: ggplot2, Matplotlib, Pandas, Tableau, D3.js