Olivia J. Chu

Contact Information

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Neukom Institute for Computational Science
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Research Interests

Evolutionary game theory, evolutionary dynamics, complex adaptive networks, social behavior, quantitative social science

Education

Princeton University, Princeton, New Jersey, USA

Ph.D., Quantitative and Computational Biology, September 2021

M.A., Quantitative and Computational Biology, January 2017

- Advisor: Corina E. Tarnita
- Committee: Alin I. Coman, Simon A. Levin, Grigore Pop-Eleches
- Thesis: Heterogeneity in human populations, from structure to personality – a modeling and data approach

New York University, Courant Institute, New York, New York, USA

B.A., Mathematics (highest honors), May 2015

- Advisors: Robert V. Kohn, Trushant S. Majmudar
- Thesis: Analysis of the "euglenoid motion" – locomotion by shape deformations

Stuyvesant High School, New York, New York, USA

Advanced Regents Diploma with Honors, June 2011

Employment

Dartmouth College, Hanover, New Hampshire, USA

Neukom Institute Postdoctoral Fellow, 2021-
Lecturer, Dept. of Mathematics, 2021-

Publications and Working Papers

1. **Olivia J. Chu**, Jonathan F. Donges, Grigore Pop-Eleches, and Graeme B. Robertson (2021). The micro-dynamics of geographic polarization: a model and an application to survey data from Ukraine, *PNAS, 118(50)*.
2. Zachary Nathan* and **Olivia J. Chu**, An evolutionary game theory model of altruism via arrhenotoky, *in prep.*
3. Liam F. Nokes* and **Olivia J. Chu**, Mycorrhizal evolutionary dynamics: games on bipartite networks and applications, *in prep.*
4. Amar J. Scherzer* and **Olivia J. Chu**, Using Infectious Disease Simulations to Model, Quantify, and Predict the Impact of Self-Quarantine and Vaccination on Mpox Spread across the United States, *in prep.*
5. **Olivia J. Chu**, Vítor V. Vasconcelos, and Corina E. Tarnita, The role of loners in the evolutionary dynamics of group structured populations, *in prep.*
6. **Olivia J. Chu**, Atticus W. McWhorter, and Wai-Tong Louis Fan, Heterogeneous Preferences and Personality in Adaptive Network Models, *in prep.*

* indicates an undergraduate co-author.

Teaching

Dartmouth College

Math 76 – Evolutionary Dynamics
Instructor **Winter 2023**

Math/QSS 30.04 – Evolutionary Game Theory and Applications
Instructor **Spring 2022**

Princeton University

MAT 378 – Theory of Games
Assistant in Instruction (AI) **Spring 2018, 2019, 2020**

MAT 104 – Calculus II
Assistant in Instruction (AI) **Summer 2020, Fall 2020**

Courant Institute, New York University

Grader, Mathematics for Economics **Spring 2015**
Mathematics Tutor, Calculus I-III, Discrete Mathematics **Fall 2013, Spring 2014**
Teaching Assistant, Calculus III, Linear Algebra **Summer 2013**
Grader, Calculus II **Spring 2013**
Grader, Calculus I **Fall 2012**

Research Advising and Mentoring

Undergraduate Honors Thesis Advisor

Dartmouth College **2022-present**

- Advisor for the following honors theses:
  - ✦ Arturo F. Serrano Borrero ('24, Mathematics): *Conviction Moderation of the Adaptive Voter Model and its Applications to Political Activism in Panama.*
  - ✦ Sara Catherine Cook ('23, Mathematical Data Science (MDS)): *Too Big to Fail: An Evolutionary Dynamics Approach to Social Media Controversy.*
  - ✦ Amar J. Scherzer ('23, Quantitative Social Science (QSS)): *The role of behavior in mpox dynamics – an SIR model approach* (awarded high honors).

Independent Study Advisor

Dartmouth College **2022-present**

- Advisor for the following independent study projects:
  - ✦ Liam F. Nokes ('25, Mathematics), through the James O. Freedman Presidential Scholars Program: *Mycorrhizal evolutionary dynamics: games on bipartite networks and applications* (Summer '23).
  - ✦ Zack Nathan ('23, Computer Science & Mathematics): *An evolutionary game theory model of altruism via arrhenotoky* (Winter, Spring '23).
  - ✦ Brian Wang ('23, Mathematics & Computer Science), Ryan Wu ('23, Computer Science & Quantitative Social Science), and Adi Ogale ('23, Applied Mathematics & Economics), through the Neukom Scholars program: *Meerkats and Alloparenting: Examining why meerkats choose to take care of kids that are not their own* (Winter '23).
  - ✦ Arturo F. Serrano Borrero ('24, Mathematics): *Models of evolution, adaptation, and revolution: understanding political activism in post-COVID Panama* (Summer '22).
  - ✦ Graduate student reading course on adaptive network models (Winter '23).

Undergraduate Honors Thesis Reader

Dartmouth College **2022-present**

- Second reader for the following QSS honors theses:
  - ✦ Max Blum ('23): *Information diffusion in online social networks: a simulation*

experiment.

✦ Max Schindel ('22): *Who wins? A game theoretic approach to three candidate elections in ranked choice voting.*

ReMatch Graduate Mentor

Princeton University **Sept. 2016 - Sept. 2017**

- Research student advised: Ayanna Matthews ('20, Physics)

Honors and Awards

Princeton Center for Health and Wellbeing (CHW) Research Grant for *The creation and evolution of social networks on campus: a case study in how individuals integrate and assimilate into social groups*, 2020

Maple Poster Prize, Society for Mathematical Biology (SMB) Annual Meeting, 2019

National Science Foundation Graduate Research Fellowship (NSF GRFP), Mathematical Sciences – Mathematical Biology, 2017-2020

National Science Foundation Graduate Research Fellowship (NSF GRFP) Honorable Mention, Life Sciences – Biophysics, 2016

Courant Institute, Hollis Cooley Prize for excellence and promise in undergraduate mathematics, 2015

Courant Institute, Highest Honors in Mathematics, 2015

NYU University Honors Scholar, Founder's Day Award, 2015

NYU Undergraduate Research Conference Panel Winner in Mathematics, 2015

NYU Dean's Undergraduate Research Fund Grant, 2014

Courant Institute Summer Undergraduate Research Experience (SURE) Grant, 2014

Invited Talks

1. *Using Conviction-Moderated Adaptive Network Models to Understand Political Activism*, JMM. San Francisco, CA, Jan. 2024 (upcoming)
2. *Heterogeneous Preferences and Personality in Adaptive Network Models*, JMM. San Francisco, CA, Jan. 2024 (upcoming)
3. *Altruism and Arrhenotoky with Evolutionary Game Theory*, MAA MathFest. Tampa, FL, Aug. 2023
4. *Altruism and Arrhenotoky with Evolutionary Game Theory*, Society for Mathematical Biology Annual Meeting (SMB). The Ohio State University, July 2023
5. *An adaptive voter model in heterogeneous environments*, SIAM Conference on Applications of Dynamical Systems. Portland, OR, May 2023
6. *The role of loners in the evolution of cooperation in group-structured populations*, Smith College Thursday Lunch Seminar. Northampton, MA, March 2023
7. *An evolutionary game theory model of altruism via arrhenotoky*, AMS Spring Sectional Meeting. Georgia Tech, March 2023
8. *An adaptive voter model in heterogeneous environments and the microdynamics of spatial polarization*, JMM. Boston, MA, Jan. 2023
9. *The role of loners in the evolution of cooperation in group-structured populations*, Mathematics Colloquium. University of Central Florida, Oct. 2022
10. *An adaptive voter model in heterogeneous environments and the microdynamics of spatial polarization*, AMS Fall Sectional Meeting. UMass Amherst, Oct. 2022
11. *The role of loners in the evolution of cooperation in group-structured populations*, SIAM LS Meeting. Pittsburgh, PA, July 2022

12. *Heterogeneity in human populations, from structure to personality – a modeling and data approach*, Inaugural AIMS Seminar (Applied Interdisciplinary Mathematics and Sociology). University of Central Florida, Virtual, April 2022
13. *The role of loners in the evolution of cooperation in group-structured populations*, JMM. Virtual, April 2022
14. *Heterogeneity in human populations, from structure to personality – a modeling and data approach*, Applied and Computational Mathematics Seminar. Dartmouth College, March 2022
15. *The microdynamics of spatial polarization: A model and an application to survey data from Ukraine*, Santa Fe Institute CounterBalance Seminar. Virtual, Feb. 2022
16. *The Emergence and Stability of Population Structure: Two Approaches*, Society for Mathematical Biology Annual Meeting (eSMB). Virtual, Aug. 2020
17. *Polarization and Adaptive Voter Models*, Political Polarization Workshop. Virtual, Aug. 2020
18. *An Adaptive Voter Model in Heterogeneous Environments*, AMS Spring Western Sectional Meeting. California State University, Fresno, May 2020 (postponed due to COVID-19).
19. *Evolutionary Dynamics in Set Structured Populations*, Applied and Computational Mathematics Seminar. Dartmouth College, Oct. 2019

Contributed Talks

1. *The Micro-dynamics of Geographic Polarization: a Model and an Application to Survey Data from Ukraine*, Society for Mathematical Biology Annual Meeting. Virtual, June 2021
2. *The Micro-dynamics of Geographic Polarization: a Model and an Application to Survey Data from Ukraine*, APS March Meeting. Virtual, Mar. 2021
3. *The Emergence and Stability of Population Structure*, QCB Colloquium. Princeton University, Nov. 2020
4. *An Adaptive Voter Model Applied to Polarization Data*, Theoretical Ecology Lab Tea. Princeton University, Nov. 2020
5. *Evolutionary Dynamics in a Group Population Structure with Barriers to Group Entry*, SIAM Conference on the Life Sciences (cancelled due to COVID-19), June 2020
6. *An Adaptive Voter Model in Heterogeneous Environments*, SIAM Conference on the Life Sciences (cancelled due to COVID-19), June 2020
7. *Evolutionary Dynamics in a Group Population Structure*, Joint Mathematics Meetings (JMM). Denver, CO, Jan. 2020
8. *An Adaptive Voter Model with Optimal Distinctiveness*, Theoretical Ecology Lab Tea. Princeton University, Oct. 2019
9. *Evolutionary Dynamics in a Group Population Structure*, Social Decisions Workshop. University of Houston, Oct. 2019
10. *Evolutionary Dynamics in a Group Population Structure* (poster), Society for Mathematical Biology Annual Meeting. Montréal, QC, Canada, July 2019
11. *Optimal Distinctiveness and its Effects on Network Formation and Social Integration*, CoCCoN Workshop on the Social Modulation of Risk & Collective Cognition. Humboldt University, Berlin, Germany, July 2019
12. *Evolutionary Dynamics in a Group Population Structure*, SIAM Conference on Applications of Dynamical Systems. Snowbird, UT, May 2019

- Talk recording and slides: https://bit.ly/2Zp8BmD

13. *Evolutionary Dynamics in a Group Population Structure*, APS March Meeting. Boston, MA, Mar. 2019
    - Featured in the conference's media materials: https://phys.org/news/2019-03-approach-cooperate.html
    - Participated in a press conference with members of the media
14. *Evolutionary Dynamics on Sets with Barriers to Entry*, Theoretical Ecology Lab Tea. Princeton University, Dec. 2017
15. *Evolutionary Dynamics on Sets with Barriers to Entry*, NIH NHGRI Annual Meeting. St. Louis, MO, Apr. 2017
16. *Evolutionary Dynamics on Sets with Barriers to Entry*, QCB Colloquium. Princeton University, Apr. 2016
17. *Analysis of the "Euglenoid Motion" – Locomotion by Shape Deformations*, NYU Dean's Undergraduate Research Conference. Apr. 2015
18. *Analysis of the "Euglenoid Motion" – Locomotion by Shape Deformations*, Courant Institute Undergraduate Research Conference. Oct. 2014

Other Presentations

An Introduction to Evolutionary Game Theory, cSplash, Courant Institute. Apr. 2019
Topics in Quantitative and Computational Biology, NYU Courant Institute Mathematics Society. Nov. 2015
Calculus Crash Course: Biology and Medicine, cSplash, Courant Institute. Apr. 2014, 2016
Fourier Series and Their Applications to Music, cSplash, Courant Institute. Apr. 2013

Invited Workshops

Collective Adaptation in a Turbulent World, *Santa Fe Institute*, Sept. 2023

CoCCoN Workshops (Cooperation and Collective Cognition Network)
- Humboldt University, Berlin, Germany – Nov. 2017, July 2019
- Princeton University, Princeton, NJ – May 2017, Jan. 2019

Langfeld Meeting, *From Micro-Level Cognitive Phenomena to Large-Scale Social Dynamics*, Princeton University, May 2017

Leadership, Service, and Volunteering

Minisymposium Organizing

AMS Spring Sectional Meeting

Georgia Tech **March 2023**

- Co-organized a special session on "Multiscale Approaches to Modeling Ecological and Evolutionary Dynamics".

Joint Mathematics Meetings (JMM)

Boston, MA **Jan. 2023**

- Co-organized a special session on "Mathematical Modeling of Ecology and Evolution: From Infectious Disease to the Evolution of Cooperation".

AMS Fall Sectional Meeting

UMass Amherst **Oct. 2022**

- Co-organized a special session on "Game-Theoretic and Agent-Based Approaches to Modeling Biological and Social Systems".

eSMB

Society for Mathematical Biology Annual Meeting (online) **June 2021**

- Co-organized a mini-symposium on "Collective Behavior and Social Evolution".
- Served as session chair for a Population Dynamics & Evolution (EVOP) Contributed Talk session.

SIAM Dynamical Systems (DS)

SIAM DS Meeting (online) **May 2021**

- Co-organized a mini-symposium on "Dynamical Systems Approaches for Biological and Cultural Evolution".

eSMB

Society for Mathematical Biology Annual Meeting (online) **Aug. 2020**

- Co-organized a mini-symposium on "The Emergence and Stability of Population Structure and Biological Aggregates Across Scales".

AMS Spring Sectional Meeting

Tufts University **March 2020, March 2022**

- Co-organized a special session on "Mathematical Methods for Ecology and Evolution in Structured Populations".

Peer Mentoring

QCB Peer Mentor

Princeton University **Sept. 2017 - Sept. 2021**

- Co-founded the QCB Peer Mentoring Program; mentored five first-year graduate students.

Undergraduate Peer Mentor

Courant Institute, New York University **Sept. 2012 - May 2015**

Service and Volunteering

Undergraduate Student Poster Session Judge

MAA MathFest, Tampa, FL **Aug. 2023**

Undergraduate Poster Session Judge

Dartmouth College Dept. of Math **May 2023**

Math department DEI committee

Dartmouth College **2022-present**

Judge for the AWM "biographies of contemporary women in mathematics" essay contest

Dartmouth College **2022-present**

Student Poster Session Judge

Joint Mathematics Meetings (JMM), Denver, CO **Jan. 2020**

- Judged and provided feedback on undergraduate and high school researchers' posters

in mathematical biology.

Courant Splash (cSplash)

Courant Institute, New York University **Sept. 2012 - Sept. 2015**

- cSplash is an annual one-day lecture series for advanced high school students interested in STEM. Served as Advertising coordinator from 2012-2013, Logistics Coordinator from 2013-2014, and co-director from 2014-2015.

Reviewing

Grant Reviewer **Jan. 2023**

- Grant reviewer for the University of Tennessee's internal grant competition through the Center of Excellence in Computational Science and Engineering (CEACSE).

Seminar Organizing

Theoretical Ecology Lab Tea, Princeton University **Fall 2018**

PROFESSIONAL AFFILIATIONS

SIAM, AWM, AMS, MAA

TECHNICAL SKILLS

- Proficient in MATLAB, R, Mathematica, and LaTeX.
- Knowledgable in Python and ImageJ.