Ethan Holdahl

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Work Experience

Williams College *Williamstown, Massachusets*

Visiting Assistant Professor *July 2024 - Present*

I am teaching EC 251: Intermediate microeconomic theory and EC 385: Games and Information. In the spring I will teach two sections of EC 110: Principles of Microeconomics.

University of California Irvine *Irvine, California*

Postdoctoral Scholar *June 2023 - July 2024*

Supervisor: John Duffy
Worked on experiments examining the effect of selection pressure on behavior in strategic environments.

University of Oregon *Eugene, Oregon*

Graduate Employee *September 2019 - June 2023*

I taught 6 courses as an independent instructor including Resource and Environmental Economic Issues, Intermediate Microeconomic Theory, and Game Theory. I also helped develop an experimental subject pool for the economics department to facilitate future experimental research.

Education

University of Oregon *Eugene, Oregon*

PhD Economics *June 2023*

Fields: Game Theory, Experimental, Behavioral, Econometrics
Advisor: Jiabin Wu

St. Olaf College *Northfield, Minnesota*

B.A. Math, Economics *June 2018*

- Minor in Statistics

Research

Job Market Paper

Selection Pressure in Repeated Contests (with John Duffy, Stephan Jagau, and Francisco Klapp)

> Competition for scarce resources in the face of birth and death (the struggle for survival) has shaped social and economic interaction since the beginnings of mankind. This research is the first to induce selection pressure in controlled strategic decision-making experiments using performance-based replacement of participants over time. Strategic decision-making with and without selection pressure is considered in repeated Tullock-type rent seeking contests. Tullock contests' incentive structure drives a wedge between profit maximization and survival. Moreover, there is a large number of past experiments without selection pressure demonstrating a willingness to compete that cannot be justified by profit maximization alone and thus seemingly supports evolutionary game-theoretic predictions. Surprisingly, we find that the intensity of competition in repeated contests does in fact *decrease* once selection pressure is added. Participants' behavior under selection pressure is well-approximated by the finite population evolutionarily stable strategy (ESS) of the stage game. This happens because a significant share of contestants quickly adapt to survive under selection pressure at the expense of new entrants. By contrast, when selection pressure is absent, we observe a large variance in competitiveness and frequent competition far beyond profit-maximizing levels. Selection pressure has a disciplining effect on contestants' decision-making, boosting not only the lifespans of successful contestants but also average round payoffs across the entire population.

Publications

Holdahl, E., & van den Nouweland, A. (2024). Minimally incomplete sampling and convergence of adaptive play in 2× 2 games. Economic Theory Bulletin, 12(1), 1-14.

> Adaptive learning explains how conventions emerge in populations in which players sample a sufficiently small portion of the recent plays and best reply to those samples. We establish that in 2×2 coordination games any degree of incomplete sampling is sufficient for a convention to be established and that the degree of sampling does not affect which conventions are most likely to emerge in the long run. Thus, the bound that players sample at most half of the plays available to them, which is prevalent in the large body of work that uses adaptive learning to examine which conventions emerge in a variety of games, is unnecessarily strict.

Holdahl, Ethan & Wu, Jiabin. (2023). Conflicts, assortative matching, and the evolution of signaling norms. Journal of Economic Interaction and Coordination. 1-23.

> This paper proposes a model to explain the potential role of inter-group conflicts in determining the rise and fall of signaling norms. Individuals in a population are characterized by high and low productivity types and they are matched in pairs to form social relationships such as mating or foraging relationships. In each relationship, an individual's payoff is increasing in its own type and its partner's type. Hence, the payoff structure of a relationship does not resemble a dilemma situation. Assume that types are not observable. In one population, assortative matching according to types is sustained by signaling. In the other population, individuals do not signal and they are randomly matched. Types evolve within each population. At the same time, the two populations may engage in conflicts. Due to assortative matching, high types grow faster in the population with signaling, yet they bear the cost of signaling, which lowers their population's fitness in the long run. Through simulations, we show that the survival of the signaling population depends crucially on the timing and the efficiency of weapons used in inter-group conflicts.

Binder, S., Holdahl, E., Trinh, L., & Smith, J. H. (2020). Humanity's Fundamental Environmental Limits. *Human Ecology*, 48(2), 235-244.

> Models and estimates of Earth's human carrying capacity vary widely and assume, rather than solve for, binding environmental constraints (the process or resource in shortest supply relative to human biological needs). The binding constraint, and therefore the true upper bound on the number of humans that Earth could sustain indefinitely, remains unknown. We seek to resolve this uncertainty by considering a full range of technological possibilities and incorporating a potential stoichiometric constraint not previously explored. We find that limits to photosynthesis constrain population before micronutrients become limiting unless technological capabilities for utilizing nutrient resources lag far behind other technologies. With ideal technology, human carrying capacity runs into the tens of trillions, while with currently demonstrated technology Earth could support more than 200 billion humans. These numbers reflect neither a desirable nor a natural equilibrium population level, but represent a rough estimate of the maximum number of humans Earth could sustain.

Working Papers

Testing the Efficacy of Stepping Stone Equilibria in Coordination Games

> Games with multiple equilibria introduce the potential for populations to get stuck in inefficient outcomes. In theory, the introduction of additional equilibria, "stepping stones", could pave the way for a smoother and less risky transition. I run a lab experiment to test if the introduction of these "stepping stones", can facilitate transitions from an inefficient but safe equilibrium to a risky, payoff dominant equilibrium. I employ different payoffs for the transition strategy and examine the effects that different degrees of information about the game have on group's play. I find evidence that adding "stepping stones" does help populations transition to the efficient equilibria. I also find that when

groups have more information about each other's payoffs they are able to transition to the efficient equilibria faster and are less prone to cyclical behavior.

Institutional Screening and the Sustainability of Conditional Cooperation (with Jiabin Wu) *Submitted*

This paper studies a preference evolution model in which a population of agents are matched to play a sequential prisoner's dilemma in an incomplete information environment. An institution can design an incentive-compatible screening scheme, such as a special zone that requires an entry fee, or a costly label for purchase, to segregate the conditional cooperators from the non-cooperators. We show that institutional intervention of this sort can help the conditional cooperators to prevail when the psychological benefit of cooperating for them is sufficiently strong and the membership of the special zone or the label is inheritable with a sufficiently high probability.

The Role of AI in Trust: An Experimental Study (with Tanner Bivins, Connor Wiegand, and Jiabin Wu) *Submitted*

In this study, we experimentally explore the impact of AI as a supportive tool for players in a two-player trust game. The game begins with the trustee sending a message to the trustor. In certain scenarios, the trustee is aided by the large language model (LLM) ChatGPT in composing this message. In other scenarios, the trustor uses GPT to interpret the message from the trustee, or both players may have access to GPT assistance. Our findings indicate that when the trustee utilizes GPT as a helper, it enhances cooperation with the trustor. Interestingly, this improvement in cooperation is not attributed to GPT's superior messaging skills. Instead, it appears that when the trustee has GPT's assistance, it encourages the trustor to scrutinize the trustee's message more closely, understanding that it could be genuinely crafted, a mixture of personal input and GPT suggestions, or solely generated by GPT. The detailed scrutiny by the trustor, and potentially the trustee's awareness of this scrutiny, aligns the beliefs of the trustor with those trustees who send either genuine or mixed messages, thereby fostering an environment that encourages the development of trust.

Works in Progress

Selection Pressure in Oligopolies (with John Duffy, Francisco Klapp, Stephan Jagau, Alex Possajennikov)

Instantly Identifying all Nash Equilibria in 2x2 Games

Mistake Driven Cycles (with Jiabin Wu)

Teaching Experience

Primary Instructor

Principles of Microeconomics	Spring 2025
Introduction to Game Theory	Fall 2020, Winter 2022
Games and Information	Summer 2021, Summer 2022, Fall 2024
Intermediate Microeconomic Theory	Spring 2022, Fall 2024
Resource and Environmental Economic Issues	Fall 2022

Teaching Assistant

EC 101: Contemporary Economic Issues	Fall 2019
EC 201: Introduction to Economic Analysis: Microeconomics	Winter 2020
EC 202: Introduction to Economic Analysis: Macroeconomics	Winter 2020

Honors, Awards, Fellowships

Graduate Teaching Award, Department of Economics, University of Oregon 2022

First-Year Graduate Fellowship, Department of Economics, University of Oregon 2018 - 2019

Conference Presentations

2024 ESA North America, OSU Columbus. *Selection Pressure in Repeated Contests*.

2023 ESA North America, UNC Charlotte. *Selection Pressure in Contests*.

2022 ESA North America, UC Santa Barbara. *Stepping Stones*.

2021 Evolution, Virtual. *Group Selection of Handicap Signaling*.

Skills

R, Python, Matlab, JavaScript, HTML, LaTeX, Git, oTree, Shiny

Citizenship

USA

References

Jiabin Wu

Associate Professor of Economics

University of Oregon

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John Duffy

Professor of Economics

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Sarah Jacobson

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