Localization properties of non-normal networks

Malbor Asllani

Introduction

Complexity science delves into interconnections among constituent entities. Advances in data storage and analysis have spawned the interdisciplinary field of network science, where complex systems' building blocks are nodes linked together [1]. A new frontier has emerged: ***non-normal networks*** [2], characterized by a strong non-normality in their adjacency matrix $AA^T \neq A^T A$, and which are pervasive in real-world domains like biology, ecology (neuronal, genetic, protein networks), and human-made systems (social, economic, communication networks) [2]. ***The project explores the interplay between topology and spectral localization in non-normal systems.***

Research methods

We will describe the flow of mass through the graph Laplacian $\mathbf{L} = \mathbf{A} - \mathbf{K}$ where $\mathbf{A}$ which entry (i, j) equals 1 if there is an edge pointing from the node j to node i and zero otherwise and $\mathbf{K}$ is the diagonal matrix where entries are the number of the outgoing edges of the nodes [1]. The localization will be determined via the *Inverse Participation Ratio* (IPR)

$$IPR = \frac{\sum_i \left(\Phi_i^{(\alpha)}\right)^4}{\left[\sum_i \left(\Phi_i^{(\alpha)}\right)^2\right]^2}$$

where $\Phi_i^{(\alpha)}$ is the $i-$th entry of the Laplacian eigenvector, namely the vectors $\mathbf{\Phi}^{(\alpha)}$, s.t., $\mathbf{L}\mathbf{\Phi}^{(\alpha)} = \Lambda_\alpha \mathbf{\Phi}^{(\alpha)}$, where Λ_α is the eigenvalue. For a fully localized state $\mathbf{\Phi}^{(\alpha)} = [1, 0, \ldots, 0]^T$ $IPR = 1$ and a fully uniform state $\mathbf{\Phi}^{(\alpha)} = [1/\sqrt{N}, 1/\sqrt{N}, \ldots, 1/\sqrt{N}]^T$ $IPR = 1/N$.

Summary

Applying mathematical tools from data science and dynamical systems, we intend to analyze the localization properties of empirical networks, develop structural measures that relate the hierarchical level of nodes to such localization, and quantify the flow that nodes distribute among them.

Structural properties of non-normal networks

Non-normal networks abound with leader nodes, which are nodes characterized by having only incoming or outgoing edges [3]. Consider the food web illustrated in Figure 1A, where biomass, initially produced at lower levels by species such as algae or sawgrass, accumulates as it moves up the trophic levels. The position of each individual within this food web, determined through millions of years of evolution and competition, along with the associated biomass, reflects an individual's survival prospects. This metaphor of a food web naturally extends to all non-normal networks, where one can envision the flow of a certain quantity (referred to here as "mass" for simplicity) that quantifies benefits or costs related to interacting individuals or parts (nodes). We will use the term *localization phenomenon* to describe the accumulation of mass on nodes, hypothetically representing the success or failure of individuals in the game of life. ***The coexistence of multiple leader nodes, resulting in multiple localized states, necessitates the development of a novel Inverse Participation Ratio (IPR) measure.***

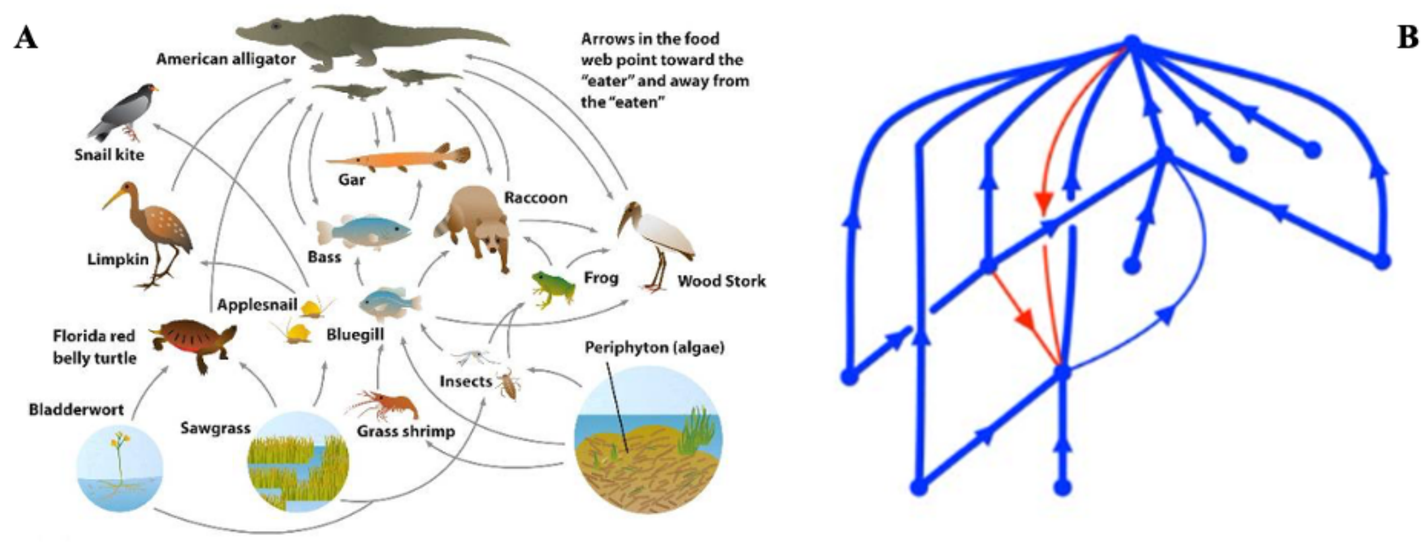

Figure 1: **A.** Florida Everglades food web. **B.** Schematic representation of the non-normal networks. A strong bottom-top hierarchical structure is evident.

Preliminary results: relation to dynamics

Localization has an immediate impact on the dynamical outcome of non-normal networked systems. In Figure 2, we demonstrate the effect by showcasing a set of coupled nonlinear oscillators of the Brusselator type: $\dot{x}_i = 1 - (b+1)x_i + cx_i^2 y_i + D_x \sum_i L_{ij} x_j$, $\dot{y}_i = bx_i - cx_i^2 y_i + D_y \sum_i L_{ij} y_j$, $\forall i$ where i denotes the oscillator index. This system yields an *amplitude chimera state*—a pattern in which groups of coherent oscillators coexist with groups of incoherent ones [4].

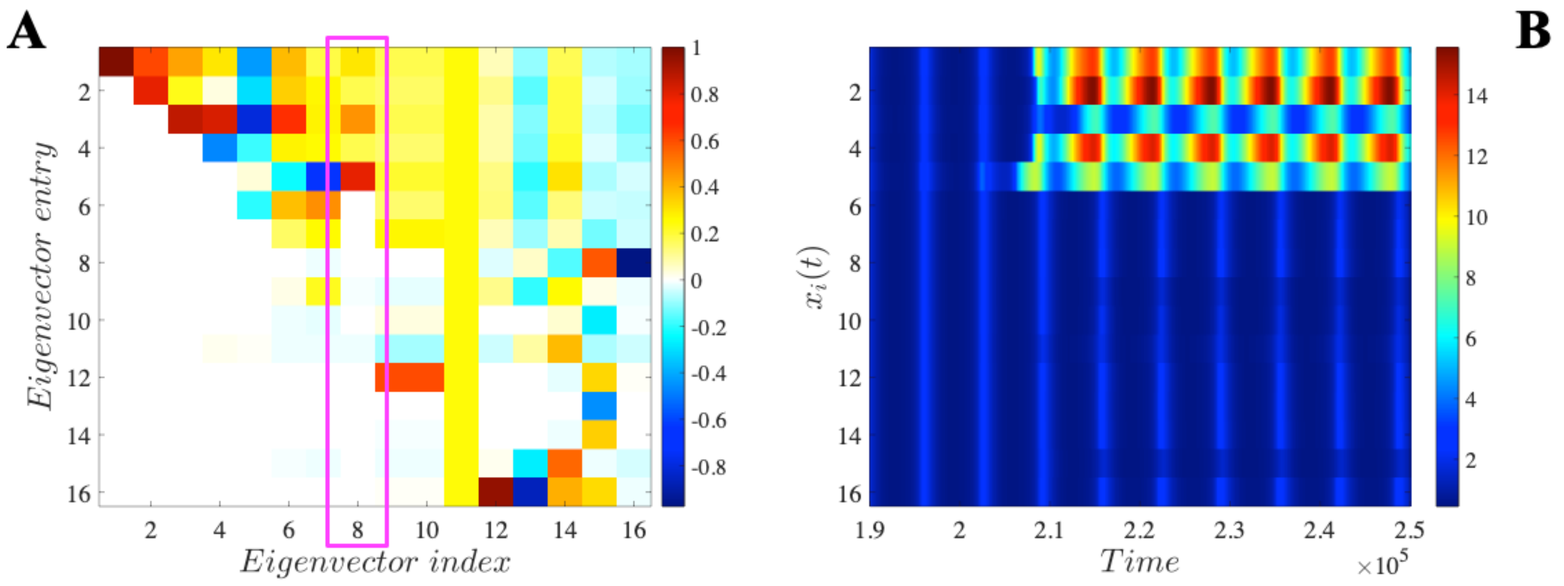

Figure 2: **A.** The matrix with columns the Laplacian eigenvectors and where the magenta rectangle shows the critical eigenvector. **B.** The colormap representation of the coupled oscillators dynamics evolution. Here $\mathbf{K}$ is the diagonal matrix of incoming edges.

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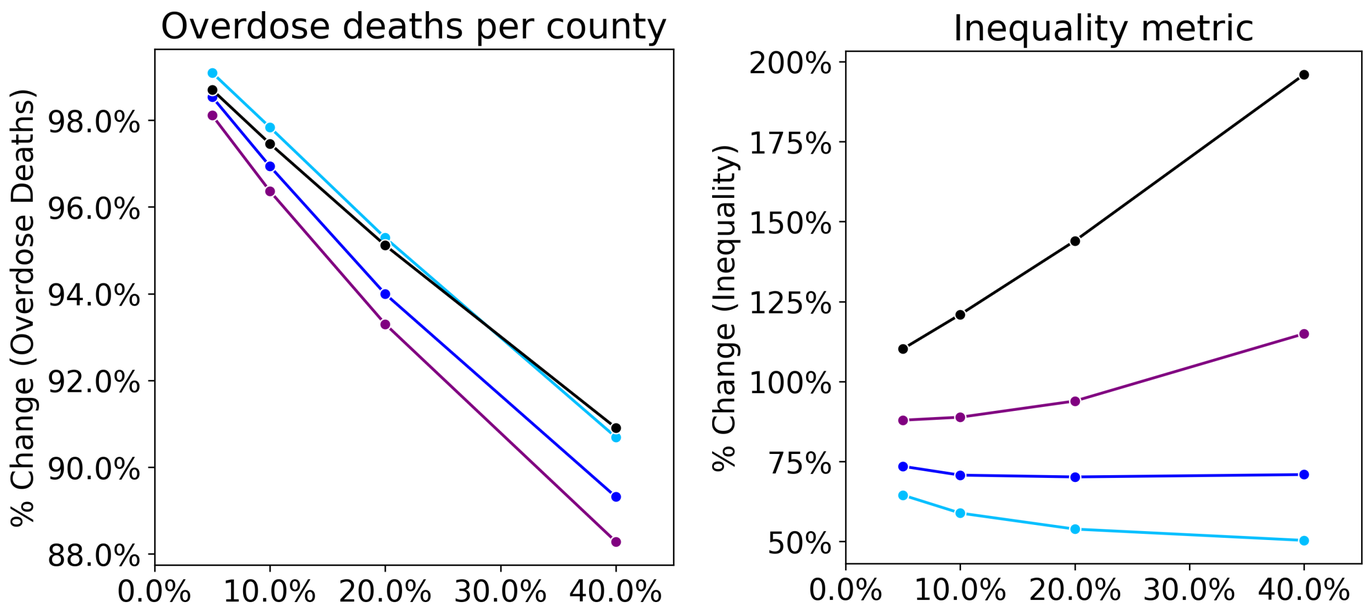
An optimization framework for combatting the U.S. substance use epidemic

- Additional treatment centers are needed to combat the substance use disorder (SUD) epidemic in the U.S., but unclear which communities should be prioritized
- Using mathematical optimization to guide treatment investment can both reduce overdose deaths *and* increase fairness in treatment access

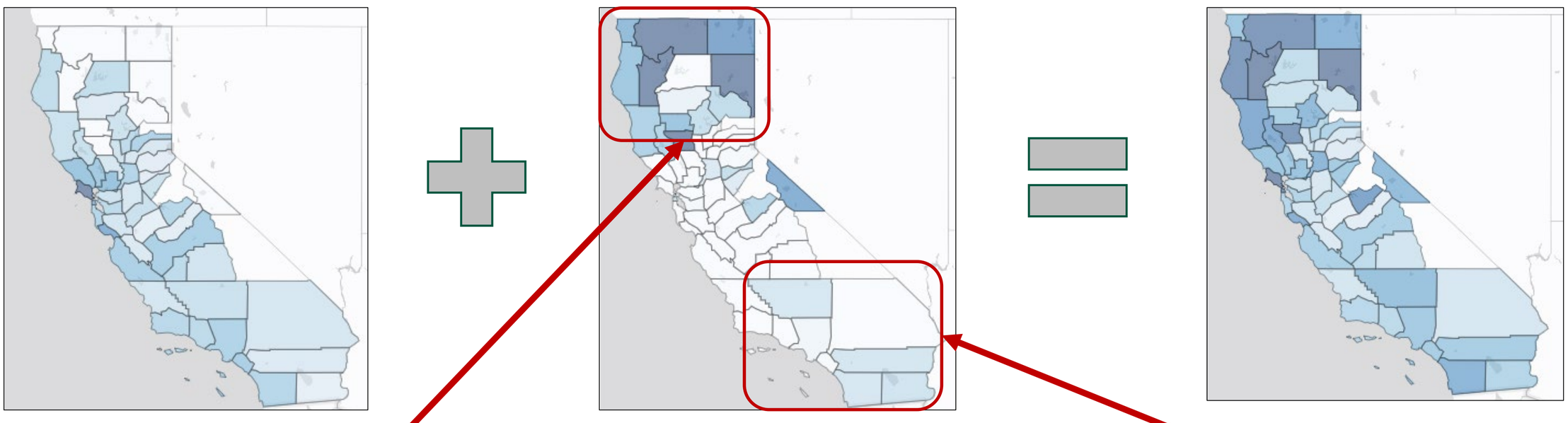
Predicted change in overdose deaths and treatment inequality under **status quo (---)** versus **optimization (---, ---, ---)**

- Distributing new centers evenly across counties *reduces SUD deaths* (left), but *worsens access inequality* (right)
- Optimization reduces deaths (left) *and* reduces inequality (right)



Optimization can place **high**, **medium**, or **low** emphasis on treatment inequality.

Example recommendation for California



Prioritizes rural counties with few centers (reduces inequality)…

…and high-population counties with above-average death rates (reduces death rates)

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Bayesian inference for quantile-optimal dynamic treatment regimes in clinical research

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Introduction

- A dynamic treatment regime (DTR) is a sequence of longitudinal treatment assignments specific to an individual patient based on their past treatment and clinical history.
- Most statistical methods for estimation of the optimal DTR aims to produce the highest mean health outcome; which can yield poor predictive performance if the outcome distribution is skewed, or contains outliers.
- Also, in many real-life examples, the tails of the outcome distribution are of direct interest.
- Hence, to identify the optimal treatment for individuals above/below certain quantile/percentile of interest, this research focuses on estimation and inference of quantile-optimal DTRs.

Bayesian Q-learning model

- Estimation of the optimal DTR at the desired quantile level begins at the last stage.
- Next, the optimal treatment at each interval is obtained by optimizing the "pseudo-outcome" at that interval; which is constructed under the assumption that all the subsequent treatments have been chosen optimally.
- The pseudo-outcome is the predicted counterfactual outcome under the quantile-optimal treatment in the future stages.
- At each stage, the conditional distribution of the pseudo-outcome given the treatment and covariate history up to that stage is modeled using a **Dirichlet process mixture** (DPM) model.
- This Bayesian modeling approach allows us to incorporate relevant prior information about the conditional distribution of the outcome, as well as to quantify the uncertainty in estimation through the posterior distribution.
- The estimated optimal DTR yields satisfactory predictive performance; as shown through extensive simulation studies.

Analysis of BMI dataset

- We apply the proposed method on a two-stage randomized clinical trial that studied the effect of meal replacement shakes on adolescent obesity.
- At each stage, each individual is assigned to one of the two randomized treatments.
- Four baseline covariates are available: gender, race, BMI of parent, and BMI at baseline. At the second stage, BMI at 4th month is collected.
- The outcome of interest is the BMI at the end of 12 months.
- **We study the optimal DTR at three quantile levels: 0.5, 0.25 and 0.75.**

Takeaways and Future Direction

- We developed a Bayesian Q-learning based approach for estimation and inference of quantile-optimal DTRs.
- Use of the DPM model allows us to model the conditional distribution of the outcome in a flexible, nonparametric manner.
- An interesting future direction is to try other covariate adjustment methods: Marginal structural models, G-computation, etc.
- We also need to compare the performance of the proposed Bayesian approach to its existing frequentist counterparts.
- The method should be explored in exciting real-life clinical data.

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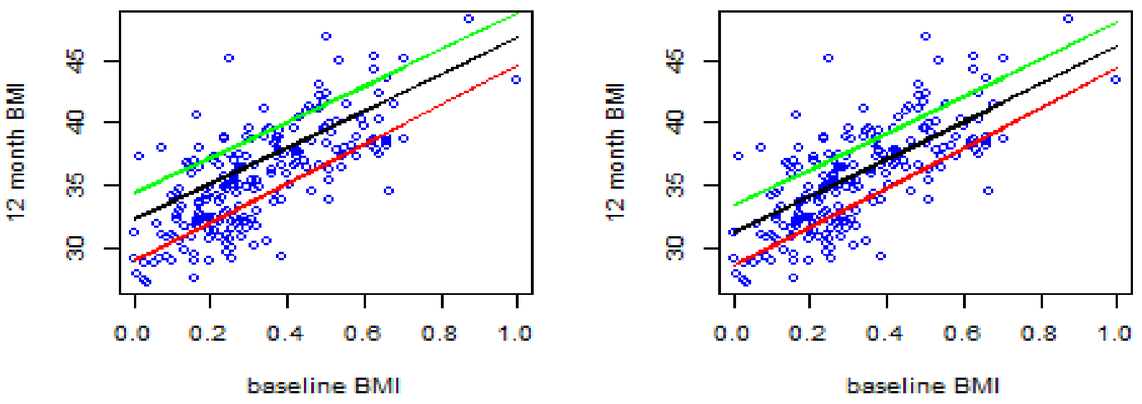
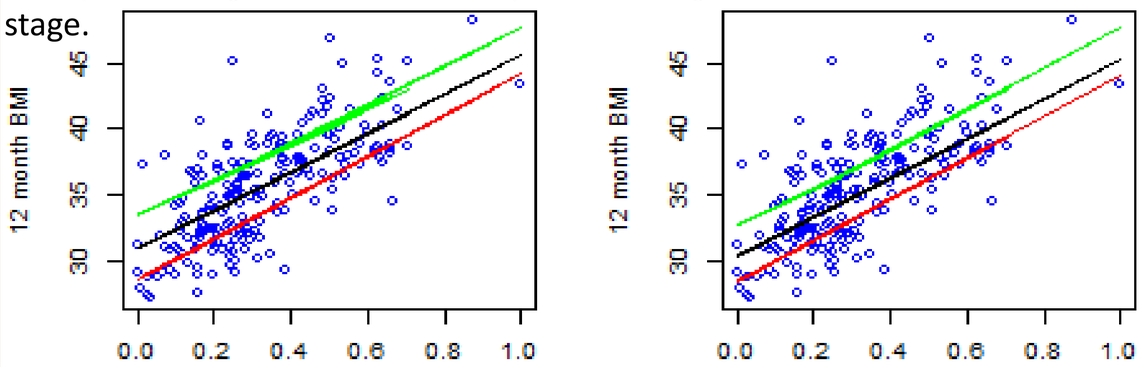
I would like to thank Professor Debajyoti Sinha for helping me with writing the proposal. I would like to thank the CRC for awarding me the FYAP for Summer 2023.

Results from BMI dataset

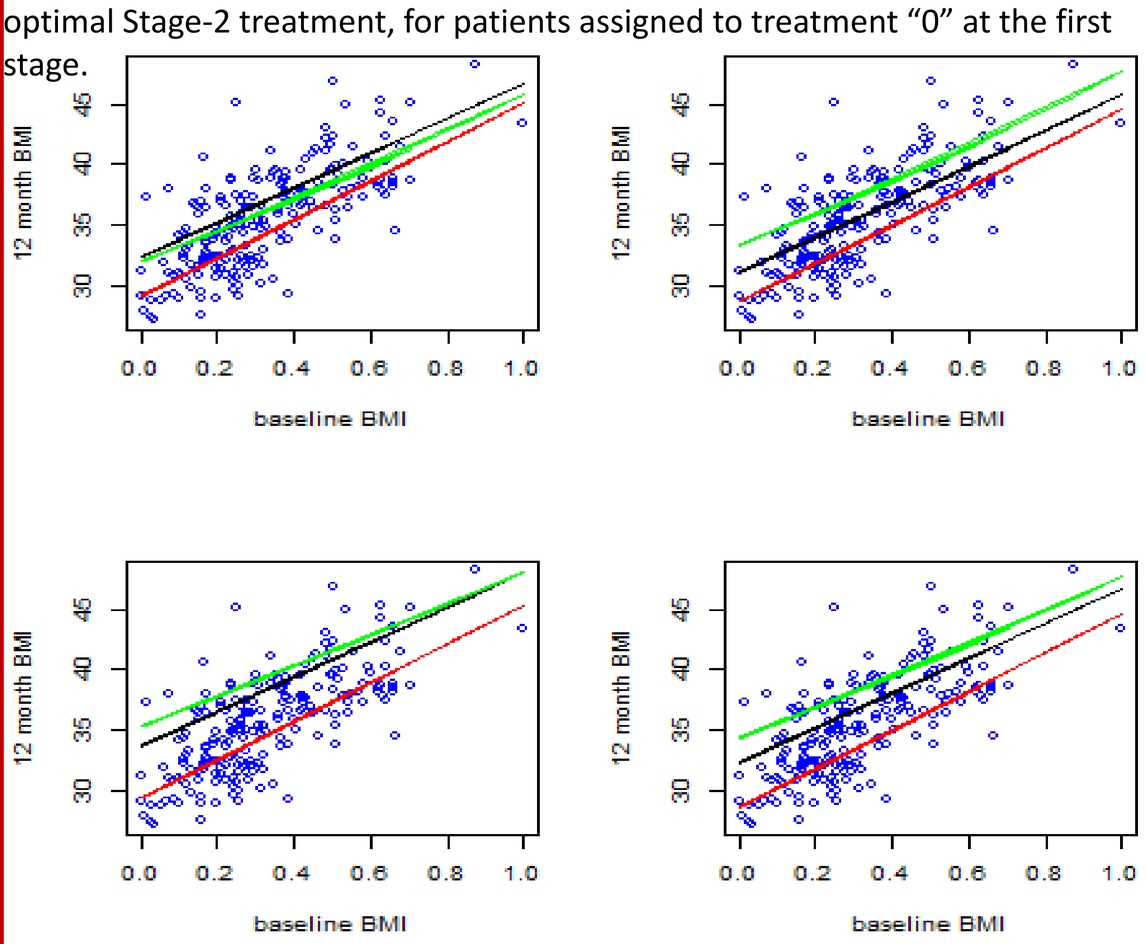
25th (red), 50th (black) and 75th (green) percentiles of the 12-month BMI under the optimal Stage-1 treatment.



25th (red), 50th (black) and 75th (green) percentiles of the 12-month BMI under the optimal Stage-2 treatment, for patients assigned to treatment "1" at the first stage.



25th (red), 50th (black) and 75th (green) percentiles of the 12-month BMI under the optimal Stage-2 treatment, for patients assigned to treatment "0" at the first stage.



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Shared Photographs as Agentic Data

Collaboration with Women Protesters in Iran

Mona Bozorgi | College of Fine Arts | Department of Art

Project Objectives

- Focus on the inclusive representation of Iranian women using photographs taken by themselves and shared on social media.
- Acknowledge the entanglements between humans and technology.
- Question the binary between artists and their subject of study, focusing on the collaboration and the shared agency between them.
- Exhibit and publish the work.

Background

In September 2022, Mahsa Amini, a young Iranian woman who was visiting Tehran with her family, was arrested by the morality police for the crime of not wearing her headscarf properly. Mahsa was separated from her family in the street and was taken to a detention center, where she went into a coma and later died in the hospital. After this incident, people, particularly women, have been coming to the streets, removing and brandishing their headscarves and burning them, or cutting their hair. These acts of protest do not end in the street; women continue practicing civil resistance in the virtual space by sharing photographs of themselves. These actions are their attempt to free their bodies from an oppressive system of representation. While women are aware of the danger inherent in sharing their images and the risk of being arrested, in the past few months, they have regularly shared photos as a political act, resulting in a proliferation of images of brave young Iranian women across social media. As I currently reside outside my home country, I find myself overwhelmed yet empowered by the shared images that connect us and weave our untold stories together. I feel responsible for spreading the messages of the protesters and showing various aspects of the violation of women's rights in Iran. By utilizing these images, my work highlights the significance of the information embedded in the shared photographs and investigates their cultural, social, and political production.

Unbidden,From *Threads of Freedom* series, 2023, Archival inkjet print on silk fabric, 20 x 20 in.

Methods

Utilizing research-creation methodology, I collected publicly shared images of Iranian women on Instagram (from the start of the "woman, life, freedom" movement to the present). I employed the software *Apify* to search publicly available data using relevant hashtags and automatically gathered the resulting images. The digital images of protesters were printed on silk, then mixed, layered, deconstructed, and reconstructed through hours of tedious work to pick apart and reweave them. This process is a form of protest, a way to resonate with the struggle, to participate by reweaving our stories, and in so doing, amplify the significance of Iranian women's actions and echo their message.

Amaranthine, From Threads of Freedom series, 2023, Archival inkjet print on silk fabric, 27 x 39 in

Broader Impacts

This body of work questions representation and emphasizes how Iranian women want to be represented by using their images, laden as they are with intent, story, and risk. Fabric in this project does not cover women's hair or body; instead, it becomes a surface that reveals women's bodies, and the threads of those fabrics reweave their shared stories. This project, by bringing different discursive and material elements together, sheds light on the entanglements between material, process, artist, subject, digital images, and technology, to reveal the significance of shared agency in the process of creating art.

Unwound, 2023, 19 x 38 in

FYAP Accomplishments

Published an article in *Art Journal Open*. Scan the QR code to read. Accepted to the Feminist Art History Conference at American University to present in September. Submitted applications for juried exhibitions.

Unreclining, 2023, 19.5 x 22.5 in.

Scan Me!

Next Steps

The future work will focus on creating large-scale and site-specific installations for gallery and museum exhibitions, aiming to provide an interactive experience for the audience. Additionally, I continue to seek publication in online and open-access platforms.

Contact: Mona Bozorgi | www.monabozorgi.com | mbozorgi@fsu.edu | Scan to visit my website! ▸▸

Experiences and Perspectives of College Student Veterans on a Cognitive Coaching Program

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Background / Issue:

Many veterans enter college after leaving military service. Veteran college drop-out rates are higher than rates for civilians—between 51% and 53% (Cate, 2017; National Center for Education statistics, 2013). In fact, veterans who were in the military between the Korean War and September 2001 had higher graduation rates than current veterans (Cate, 2017). Despite the complicating factors of pursuing higher education as a veteran, veteran students are an asset to higher education. It is imperative that we not only retain veteran students on college and university campuses but support and aid achievement of their academic goals. **Purpose:** The purpose of this project was to qualitatively explore the experiences and perspectives of military veteran college students who completed a cognitive coaching program called at Arizona State University. I plan to implement VAST at FSU.

What are you trying to do with your work?

- Evaluate a cognitive coaching program for student veterans and establish its use at FSU.

What are the limits of the current practice/how is it currently done?

- There is no one systematic way to do this. Researchers have demonstrated that strategy training for individuals with brain injury through cognitive coaching improves vocational and academic success (Kennedy 2013; Ylvisaker, 2006; Dawson & Guare, 2012).

What is new in your approach, and why do you think it will be successful?

- This approach is systematic, individually-tailored, and holistic. I evaluated the VAST program used at ASU. Data analysis revealed that student veterans experienced many gains after participating.

If you are successful, what difference will it make in your field?

- It will make a difference for veteran students—potentially leading to enhanced academic and occupational outcomes and goals.

What are the risks?

- The risks are that the intervention will be unsuccessful or that we will discourage student veterans from seeking academic support.

How much have you been able to accomplish with the FYAP award?

- I formed a team of research students and completed the qualitative analysis.

Where does your work go from here?

- Publication
- Development of the VAST Program at FSU

What are the next steps?

- Writing
- Present findings to FSU stakeholders
- Coordination of research, clinic, and veteran center efforts

ACKNOWLEDGMENTS:

I would like to thank the participants who completed interviews with me as well as Karen Gallagher, who created VAST. I would also to thank the following FSU students for their work on this project: Kyra Shepherd, Samantha Smith, and Regan Young. Thank you to the CRC at FSU for funding this work through the First Year Assistant Professor award.

Persistence in the Academy:

A Pilot Study of Pre-tenure Black Women Faculty in Computing

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BACKGROUND

The majority of United States Computing professors are White (56.9%), with only 2% being Black, according to the most recent CRA Taulbee Survey (Zweben, 2020). The CRA Taulbee Survey also purports that there are only 31 tenure-track Black Women Faculty (BWF) in Computing in the United States, including HBCUs, with 5 (or 2% of females), 8 (or 3% of females), and 18 (or 6% of females), respectively, at the Full, Associate, and Assistant Professor levels (Zweben, 2020). Black women in Computing are disproportionately represented at the lowest ranks of the professoriate, primarily in non-tenured positions, and advance at a slower rate than their male counterparts, but there is limited information about their career trajectory. Scholars have investigated the culture and atmosphere of STEM fields, and research results demonstrate that STEM fields can be hostile or unsupportive toward Black women (Allen & Butler, 2014; Ashford-Hanserd, 2020a, 2020b; Lloyd-Jones & Jean-Marie, 2020). Despite the rising body of research on BWF in Computing and STEM, it is important to emphasize that pre-tenure BWF in Computing education remains a demographic that has been grossly understudied. As a result, this study seeks to better understand the persistence of BWF in Computing in pre-tenure academic positions by examining their lived experiences, challenges, and career successes that contribute to their successful retention.

CURRENT STUDY

The study examines how BWF in Computing lived experiences contribute to their retention and persistence in Computing. Harper's (2010, 2012) A-DAF guides the design of the research questions to provide deeper insights into their persistence. This study addresses the following central research question: What are the experiences of pre-tenured Black Women Faculty in Computing, and how have these experiences contributed to their persistence in the Academy? To address this overarching question, two sub-questions will guide the inquiry:

1. What experiences influenced each participant's decision to pursue a tenure-track position in Computing?

2. Which factors contribute to Black women's ability to navigate the tenure process?

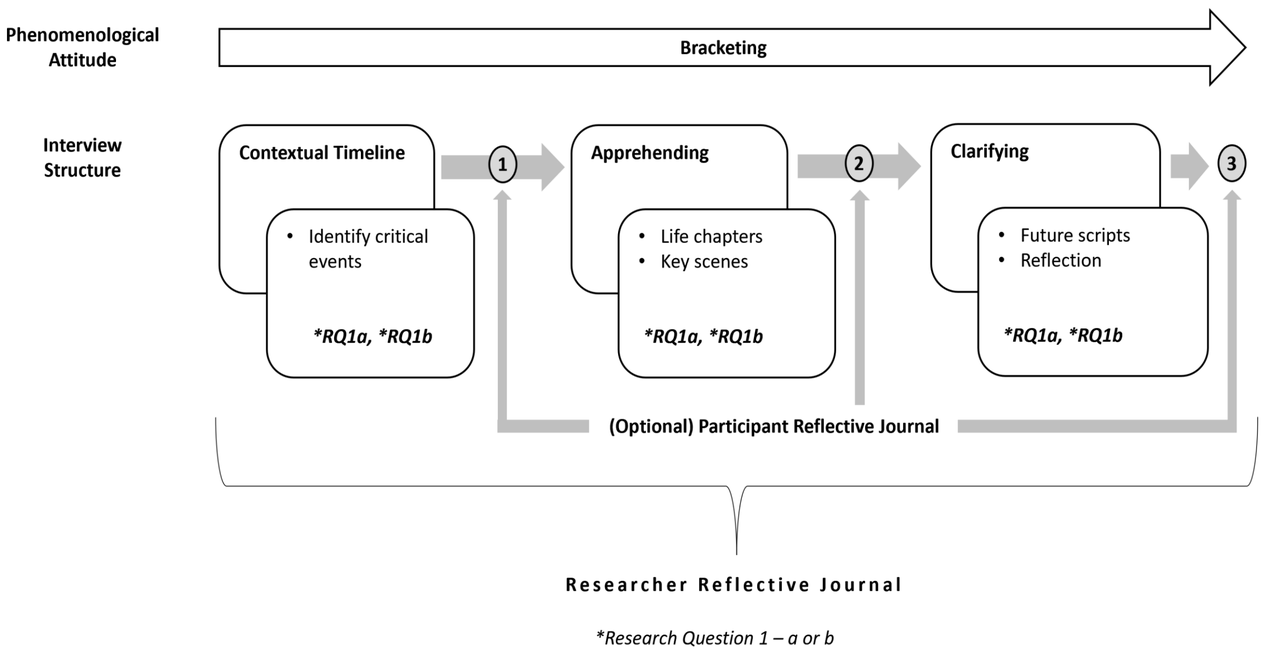
METHODS

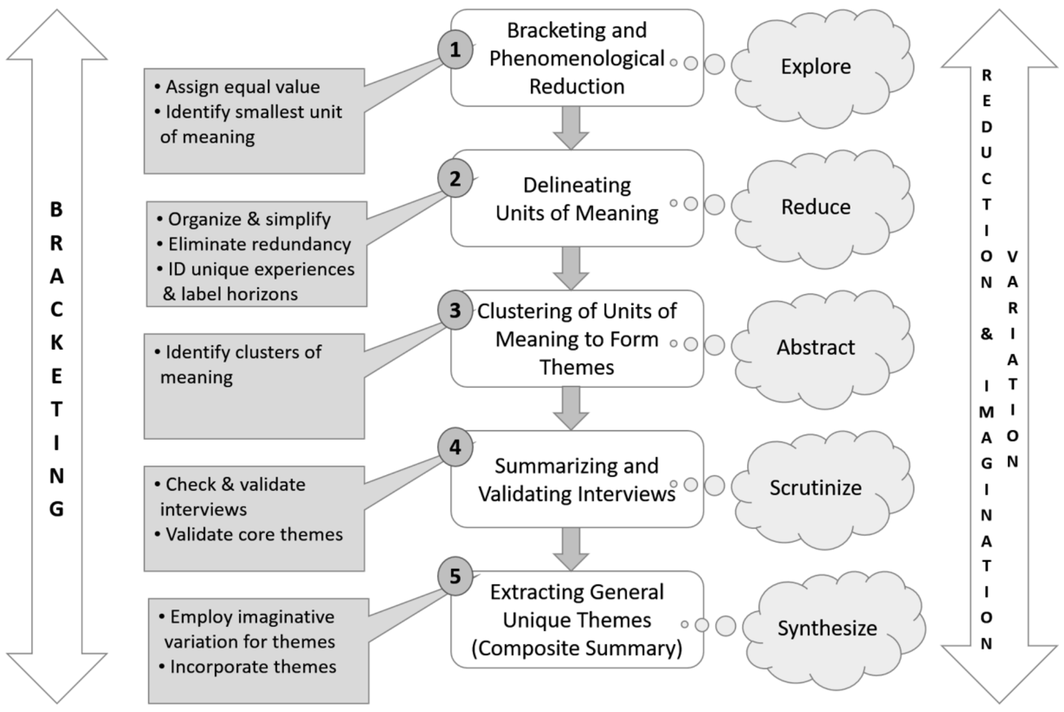
The pilot study used the qualitative data of 7 BWF in Computing to comprehend how events transpired and the significance of the associated experiences and attitudes for the participants. The recruitment strategies used in the study was purposeful criterion and snowball sampling approach.

The participant profile and recruitment criteria used for this study are as follows:

1. Identify as African American or Black and a woman;
2. Possess a Ph.D. degree in a Computing discipline (e.g., computer science, information systems, information technology, computer engineering);
3. Serve as a faculty member in a Computing department at a U.S. college or university;
4. Be early career faculty (i.e., assistant professor) at a four-year college or university and a
5. Be willing to participate in an in-depth interview and complete an optional reflective journal entry following the interview.

The construction of the participants' stories involved one-on-one, in-depth phenomenological interviews about their unique experiences in the Academy. The interviews were three-phased. Each participant received/offered a $50 Amazon gift card.





PRELIMINARY FINDINGS

The study used a modification of Hycner's explication process to interrupt the data. Using Hycner's data analysis approach, the following important themes and patterns were identified, which convey the essence of the 7 participant's shared experiences.

Core Themes	Description
Academic preparation & achievement	The theme is centered on BWF's academic experiences in Computing, which serve as a systematic preparation for academic & professional excellence.
Academic counterspaces	The theme represents a network of people, places, and circumstances that work cooperatively to give academic encouragement and support for BWF in the Computing field.
Navigating the Intersection of Race and Gender	The theme looks at how BWF in Computing's social realities form from their racial and gender orientation.
Contributions to Computing & the Academy	The theme highlights BWF in Computing's aim to support teaching, learning, and research opportunities that enable individuals and entities to contribute to society.
Embracing career advancement and professional development	The theme reflects how BWF in Computing leverage their skill sets and desire to pursue new career objectives and more challenging work possibilities.
Professional preparation	The theme focuses on BWF in Computing's experiential experiences, which serve as a systematic preparation for working in various roles within the University.
Professional counterspaces	The theme includes a system of individuals, organizations, and conditions collaborating to provide professional guidance and support for BWF in the Computing areas.

IMPLICATIONS & FUTURE DIRECTIONS

The goal of this qualitative phenomenological pilot study was to illuminate the voices of BWF in Computing and fill gaps in the body of knowledge regarding their unique experiences and career paths in the Academy. Shedding light on their lived experiences enables policymakers, administrators, and educators to expand their participation. The findings of this study contribute to the body of knowledge as it takes an asset-based approach to identify factors influencing the success of pre-tenure BWF in Computing, including counter spaces, mentoring, spirituality, family, colleague, and administrator support.

Future work will expand on the initial findings. The next steps will be to expand recruitment and to conduct a comparative analysis on the experiences of BWF in Computing at minority-serving institutions and predominantly white institutions.

SOURCES

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Electrical Conductivity of Electrical Insulation Materials at Cryogenic Temperatures

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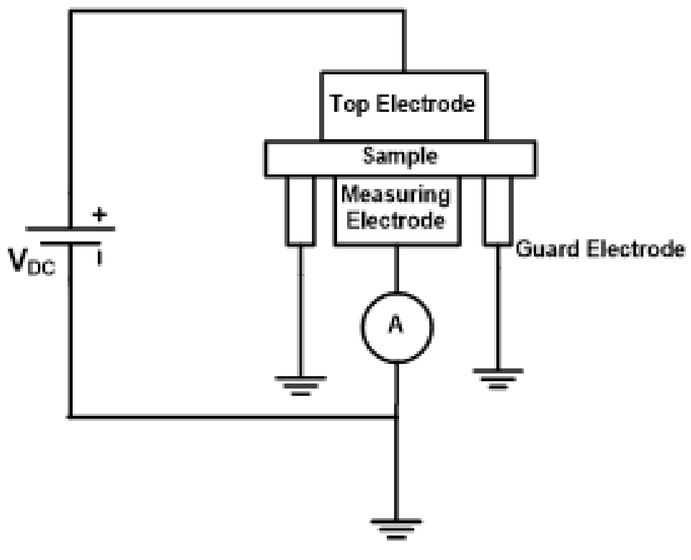
Experimental Setup

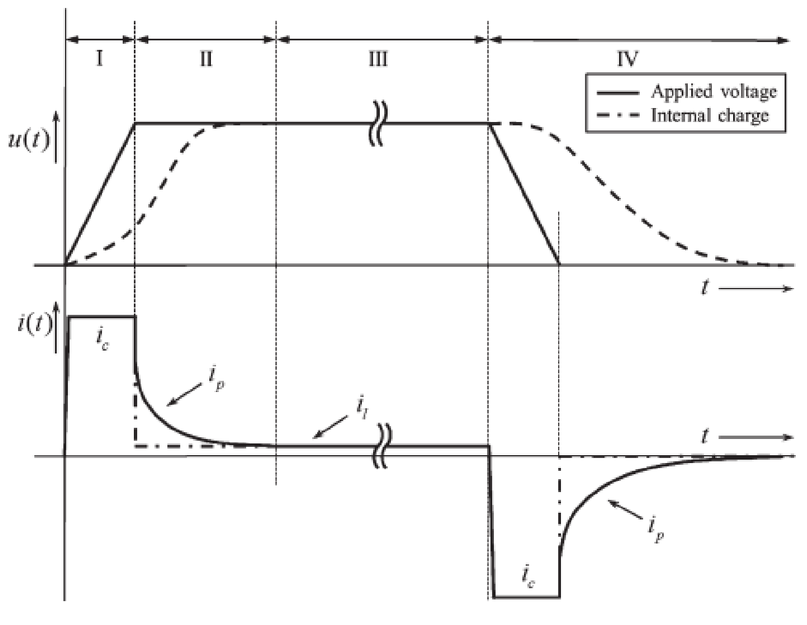
- Keysight electrical conductivity measurement cell was procured for room temperature measurement verification
- Customized electrical conductivity measurement cell was designed and fabricated to allow for measurements to be taken at cryogenic temperatures
- Cryogenic electrical conductivity measurement cell is anticipated to perform measurements in liquid nitrogen within the next two weeks
- Additional modifications required to perform measurement in pressurized helium gas at 77 K are underway and parts are to be machined on a waterjet shortly
- Design of experimental setup to perform measurement between 20-80 K are progressing as expected and lesson learnt from the experimental setups at 77 K will be incorporated as part of the final design
- Collection of experimental results should enable for publications to be prepared before the end of the year

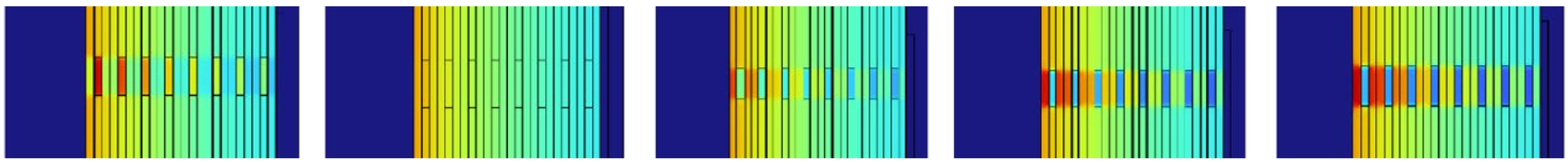
Keysight electrical conductivity measurement cell



Transient Electric Field Simulation

- Time taken for a steady state electric field to establish at cryogenic temperatures is ~ 50x longer than at room temperature
- DC transient electric field models at cryogenic temperature were developed utilizing conductivity values of Kapton and liquid nitrogen published in literature
- Modelling depicts that location of electric field enhancement within a lapped tape insulated superconducting cable changes from the butt gap to the lapped tape as electric field changes from permittivity based to conductivity based
- Models will be updated to include measurements completed in pressurized helium gas at cryogenic temperature





(A) (B) (C) (D) (E)

Time dependent DC electric field modelling of a LN2 cooled PPLP lapped tape cable. Electric field enhancement is seen in butt gap and changes to PPLP until steady state is achieved.
a) t = 0 sec, b) t = 400 sec, c) t= 1000 sec, d) 2000 sec, e) 5000 sec

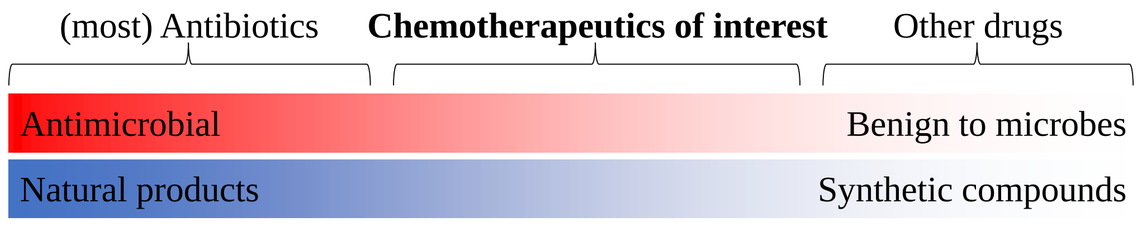
The author would like to thank the Council on Research & Creativity for awarding the First Year Assistant Professor Grant. The research conducted as part of this grant was incorporated as part of an Office of Naval Research – Young Investigator Program Proposal

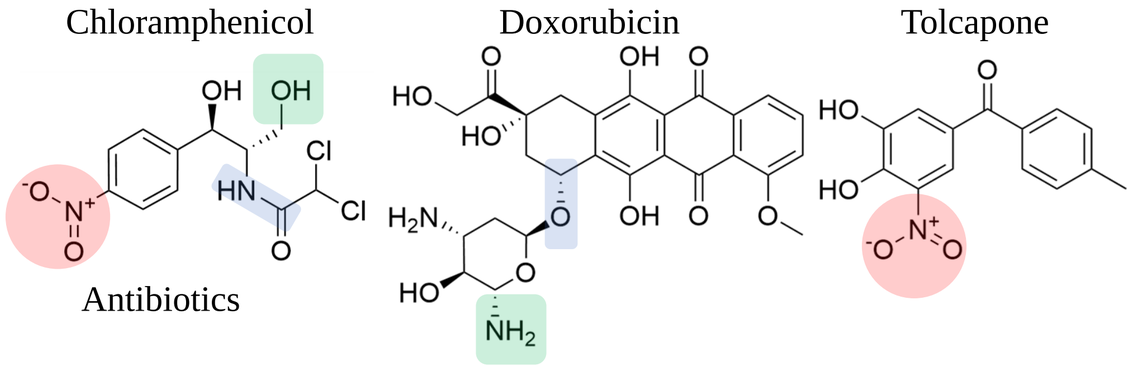
Microbiome resistance to chemotherapeutics

N. Zalenski, S. Bufford, T. Crofts (tcrofts@fsu.edu) – Dept Biomed Sci

Microbiome-pharmaceutical interactions

- Many antibiotics are natural products
- Antibiotic resistance is a **natural feature** of microbiomes
- Many **pharmaceuticals are also natural products** and can inhibit microbial growth
- Including many **chemotherapeutics**
- We **hypothesize** that bacterial resistance to natural product chemotherapeutics should mirror antibiotic resistance
- Bacterial modification of chemotherapeutics and other pharmaceuticals by the **gut microbiome** may affect drug safety and efficacy



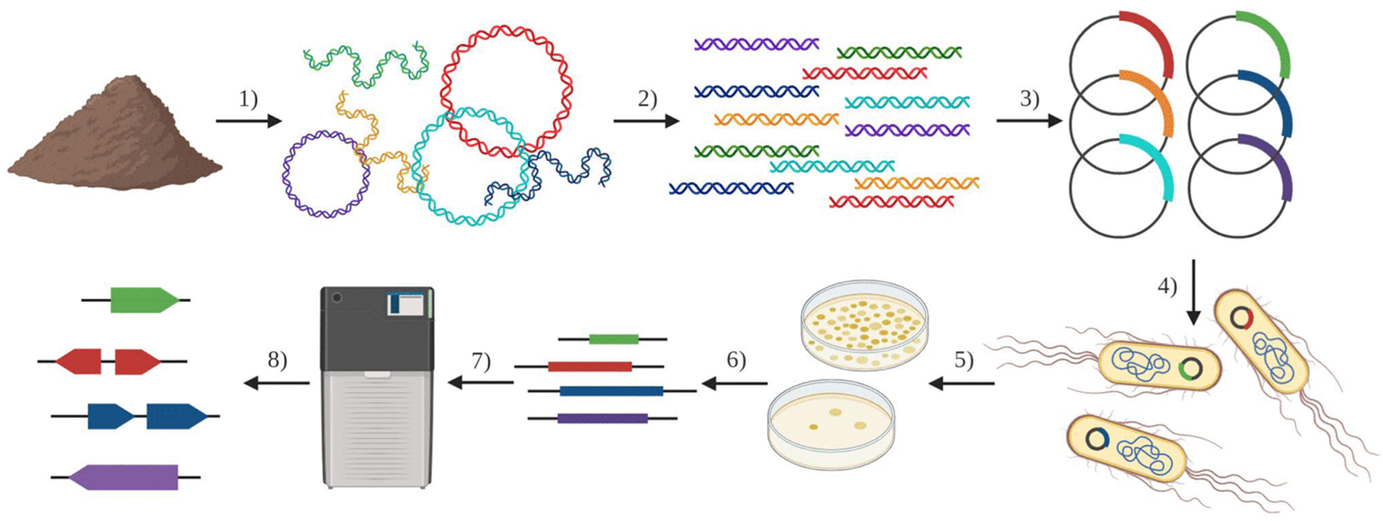


Potential resistance mechanisms:

Transferase | Hydrolase | Oxidoreductase

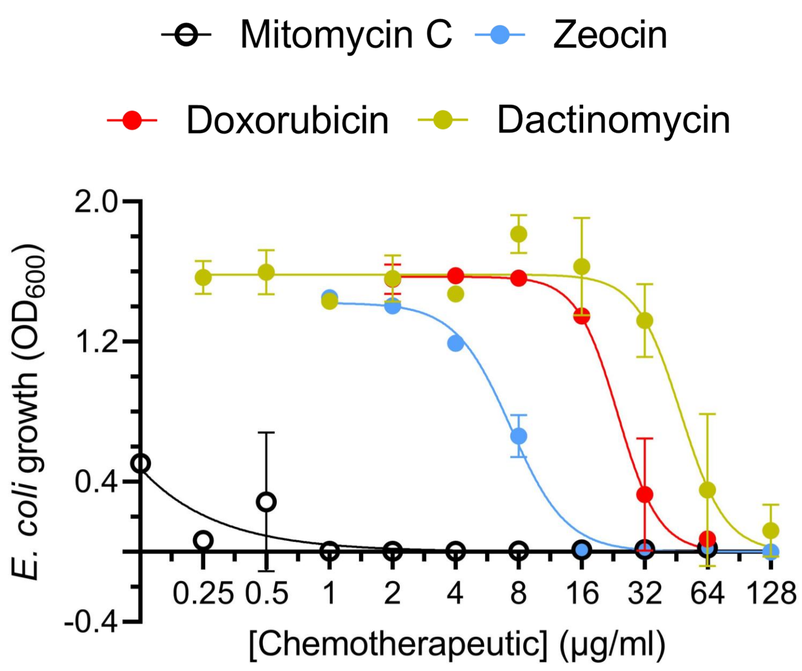
Functional metagenomic selections

- Functional metagenomic libraries encode the **genetic potential of a microbial community**
- High-throughput screening of microbiomes based on *E. coli* phenotype
- Can capture **novel genes independent of sequence**, especially if they confer resistance

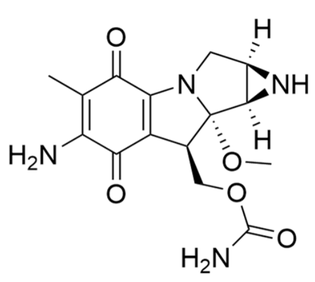


Genes for chemotherapeutic-resistance in the mammalian gut microbiome

E. coli sensitivity to chemotherapeutics

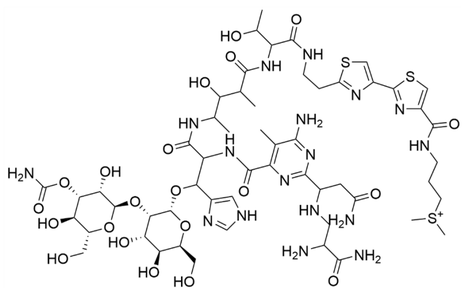


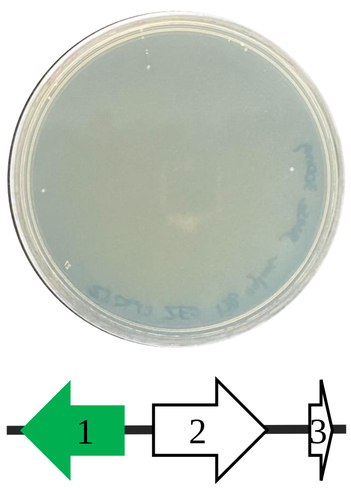
Mitomycin C
(Mitosol, Mutamycin)
DNA alkylation



2.7 kb fragment
Acutalibacter
(96% ID, 2.7 kb)
1. VOC family
2. Hypothetical
3. Yafy regulator
4. Amidohydrolase

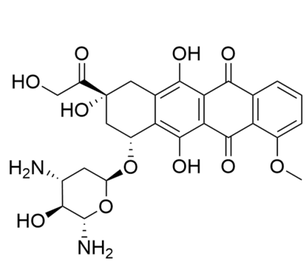
Zeocin
(Blenoxane analog)
DNA breaks





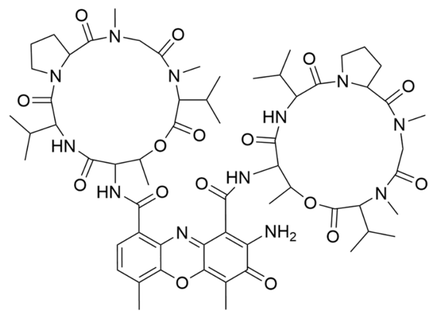
1.9 kb fragment
Clostridium
(68% ID, 376 bp)
1. Amidotransferase
2. Regulator
3. Hypothetical protein

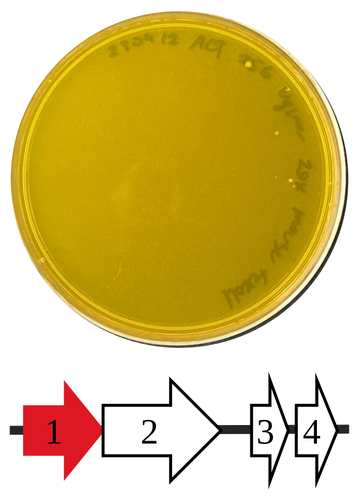
Doxorubicin
(Adriamycin, Caelyx)
DNA intercalation



2.1 kb fragment
Acetivibrio
(71% ID, 774 bp)
1. NAD^+ synthase
2. **RecA recombinase**
3. CinA (partial)

Dactinomycin
(Cosmegan)
DNA intercalation





2.0 kb fragment
Firmicutes
(85% ID, 664bp)
1. **Flavodoxin**
2. DUF3793
3. FeoA
4. FeoA

- Selections performed on functional metagenomic library prepared from mouse fecal samples
- Preliminary sequencing results show evidence for resistance *via* transferases, hydrolases, oxidoreductases, and **stress response**

Future steps

- Sequence and validate **100s of positive hits**
- Determine **mechanisms** and **health impacts**

Crofts Micro Lab

Targeted Sanctions and Redistribution

Jason Sanwalka Davis [1]

[1]Department of Political Science

Abstract

Can targeting economic sanctions at elites make sanctions more effective while reducing sanctions' collateral costs on the broader nonelite population? This paper presents a formal model that demonstrates that the ability to achieve either of these goals with targeting is conditional on a sanctioned state's capacity to redistribute. When sanctions target elites, elites have an incentive to increase redistribution from nonelites to compensate themselves for their losses. If sanctions targeting entails a trade-off between the aggregate costs of a sanction and the degree to which those costs are absorbed primarily by elites, then targeted sanctions will only be more effective when domestic redistribution is costly for the sanctioned state, constraining their ability to enact these compensatory measures. Furthermore, when comparing targeted and untargeted sanctions that produce the same aggregate costs, nonelites are always worse off when targeted sanctions are used; the redistributive responses to targeting imposed by elites ultimately harm nonelites more than broader-based sanctions would have. The implications of the model are explored through an examination of redistributive responses to sanctions used in Russia, Venezuela, Iran, and North Korea; redistributive responses to targeted sanctions are evident in all of these cases, but their extent and character varies depending on each state's capacity to redistribute.

Do Sanctions Work?

- Key conclusion from the literature is that it's hard to evaluate.
- Often only observe sanctions when the receiving state has decided to pursue some policy choice anyways → selection problems. (Nooruddin 2002)
- Some estimates arrived on approximately 35% success rate (Felbermayr et al. 2020), though this does not fully account for partial success or the effects of threats (Morgan et al. 2014).
- An additional concern is: what does success mean? Imposing costs can destabilize leaders (Marinov 2005), or weaken a country militarily. Not obvious that these are "failures".

If they work, what impacts when they work?

- Regime type (Peksen 2019).
- Expectations of future conflict (Drezner 1999).
- Uncertainty arising from limited leadership tenure (Spaniel and Smith 2005).
- Multilateral versus unilateral. (Bapat and Morgan 2009)
- Commitment to enforcing sanctions on domestic firms (Bapat and Kwon 2015).
- Combination with cyberoperations (Davis et al. WP)
- **Sanctions Targeting** (Morgan and Schwebach 1995, Brooks 2002, Lektzian and Souva 2007, Allen 2008)

The Argument in Brief

- If you want to impose costs on leaders to get them to change a policy, you need to consider what responses are available.
- If the state/leader possess significant capacity to redistribute, then the costs of sanctions will be easily fungible.
- It's like with tax incidence; it doesn't make sense to just look at "flypaper incidence".
- If the costs of sanctions are "passed on to consumers" (non-elites), then targeting doesn't really help.
- In fact, targeting may even **hurt** nonelites **more** if the leader is essentially willing to tank the broader economy to recoup their losses (see examples of Russia and Venezuela).

Model Overview

- Two states: G_1 and G_2
- G_1 chooses whether to impose targeted (T) or untargeted (U) sanctions on G_2
- G_1 then chooses an "amount" of sanctions to impose x, which imposes costs on G_2, but also incurs costs for G_1
- G_2's objective function is a distributive politics model with two groups: elites and non-elites.
- Elites are weighted more highly than nonelites ($\alpha > 1$)
- Both groups receive initial income y, before sanctions
- If targeted sanctions are used, this looks like:

$$U_{G_2}(x|T) = \alpha log([y - bx]) + log(y)$$

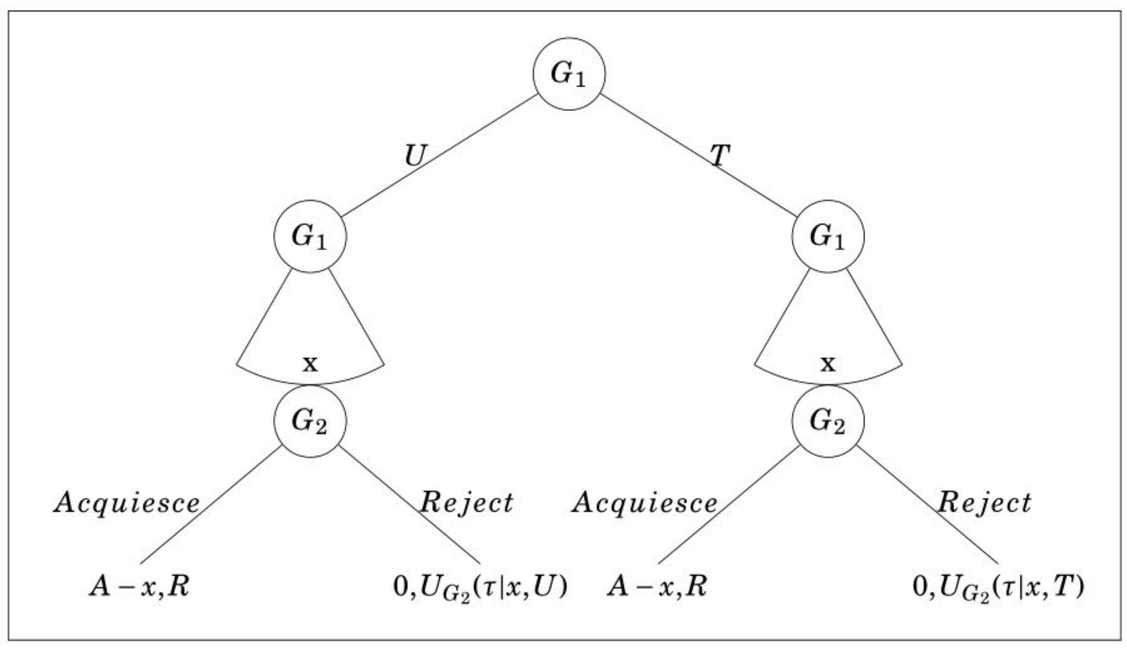
- After sanctions are imposed, G_2 can redistribute from nonelites
- However, some percentage of the amount transferred is lost, parameterized by $\theta_2 \in [0, 1]$
- Incorporating redistribution, the structure changes to the following with targeted sanctions:

$$U_{G_2}(\tau_2|x, T) = \alpha log([y - bx] + \tau_2\theta_2 y) + log(y(1 - \tau_2))$$

- Note that targeted sanctions only initially impact elites, but G_2 can redistribute afterwards from nonelites.
- Targeted sanctions impose costs with efficiency b, while untargeted sanctions impose costs with efficiency c, with $c > b$
- Untargeted sanctions impact both elites and nonelites equally, producing the following:

$$U_{G_2}(\tau_2|x, U) = \alpha\left(\left[y - \frac{cx}{2}\right] + \theta_2\tau_2\left[y - \frac{cx}{2}\right]\right) + log\left(\left[y - \frac{cx}{2}\right](1 - \tau_2)\right)$$

Game Form



Key Results

- The sanctions receiving state (G_2) redistributes more from non-elites when targeted sanctions are used relative to when untargeted sanctions are used **(Lemma 1)**
- When the sanctions recipient can redistribute value between domestic parties costlessly, untargeted sanctions become a more efficient tool for influencing that state **(Proposition 1)**
- As a sanction recipient's ability to redistribute declines, targeted sanctions become a more effective tool at coercing policy concessions **(Proposition 2)**
- For a given amount of aggregate costs imposed on the sanctioned state, nonelites are **always** worse off under **targeted** sanctions, unless redistribution is costless. **(Proposition 3)**

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Efficient, Reliable, and Interpretable Deep Learning for Science and Engineering

Abstract: We present a novel framework for active learning in regression, extending the conventional setup to handle diverse data types beyond pointwise samples. This extended framework accommodates *transform domain*, *vector-valued*, *continuous curve*, and *multimodal* data types, incorporating random sampling based on various measures and nonlinear approximations. The concept of the *generalized Christoffel function* is used to optimize sampling, yielding near-optimal sample complexity in important cases. This is highly relevant to scientific computing applications, where data generation is costly. Case studies include *gradient-augmented learning*, *Magnetic Resonance Imaging* (MRI) *with generative models*, and *adaptive sampling for solving Partial Differential Equations* (PDEs) using *Physics-Informed Neural Networks* (PINNs). The resulting approach, called *Christoffel Sampling* (CS) or *Christoffel Adaptive Sampling* (CAS) *in the adaptive case*, outperforms conventional methods, offering enhanced efficiency and accuracy for scientific computing tasks involving complex data types and limited data availability.

Introduction: The standard regression problem in machine learning involves learning an approximation to a function $f: D \subseteq \mathbb{R}^d \to \mathbb{R}$ from training data $\{(y_i, f(y_i))\}_{i=1}^m \subset D \times \mathbb{R}$. The approximation is sought in a set of functions $\mathbb{U}$, typically termed a *model class*, *hypothesis set* or *approximation space*, and is often computed by minimizing the empirical error (or risk) over the training set, i.e.,

$$\hat{f} \in \operatorname{argmin}_{u \in \mathbb{U}} \frac{1}{m} \sum_{i=1}^m |f(y_i) - u(y_i)|^2 . \qquad (1)$$

In this work, we develop a generalization of this problem, allowing for general types of data (i.e., not just discrete function samples), including multimodal data, and random sampling from arbitrary distributions. This framework facilitates active learning by allowing one to optimize the sampling distributions to obtain *near-best generalization from as few samples as possible*.

Definition: Let $\mathbb{X}$ be a separable Hilbert space, $\mathbb{Y}$ be a semi-inner product space, $(D, \mathcal{D}, \rho)$ be a measure space, $L: D \to \mathcal{L}(\mathbb{X}, \mathbb{Y})$ be such that the function $D \to \mathbb{C}$, $y \mapsto L(y)(x)$ is measurable for every $x \in \mathbb{X}$, and $\mathbb{V} \subseteq \mathbb{X}$ with $\mathbb{V} \neq \{0\}$. The *Generalized Christoffel function of* $\mathbb{V}$ with respect to L is

$$K(\mathbb{V})(y) = \sup\{\|L(y)(v)\|_{\mathbb{Y}}^2 / \|v\|_{\mathbb{X}}^2 : v \in \mathbb{V}, v \neq 0\}, \quad y \in D.$$

If $\mathbb{V} = \{0\}$, then we set $K(\mathbb{V})(y) = 0$.

Requirements for Christoffel sampling (CS):

- Finite-dimensional space $P = \operatorname{span}\{\psi_1, \dots, \psi_N\}$
- Normalized reciprocal Christoffel function $w(y) = \frac{1}{K(P)(y)}$

The CS procedure involves replacing problem (1) with a weighted ℓ^2-loss function, i.e.,

$$\hat{f} \in \operatorname{argmin}_{u \in \mathbb{U}} \frac{1}{m} \sum_{i=1}^m w(y_i) |f(y_i) - u(y_i)|^2 . \qquad (2)$$

Under certain conditions (*nondegeneracy of the sampling operators with constants* $0 < \alpha \leq \beta < \infty$, *and of* $\mathbb{U}$ *with respect to* L), we show sample complexity of

$$m \leq c_{\delta/2} \cdot (\beta/\alpha) \cdot n \cdot d \cdot \log(2nd/\epsilon),$$

when $\mathbb{U} - \mathbb{U} = \bigcup_{j=1}^d \mathbb{V}_j$, where $\mathbb{V}_j$ are subspaces of $\mathbb{X}$ with $\dim(\mathbb{V}_j) \leq n, \forall j = 1, \dots, d$. CS also allows for adaptive sampling with a sequence of subspaces $P^{(1)}, P^{(2)}, P^{(3)} \dots$.

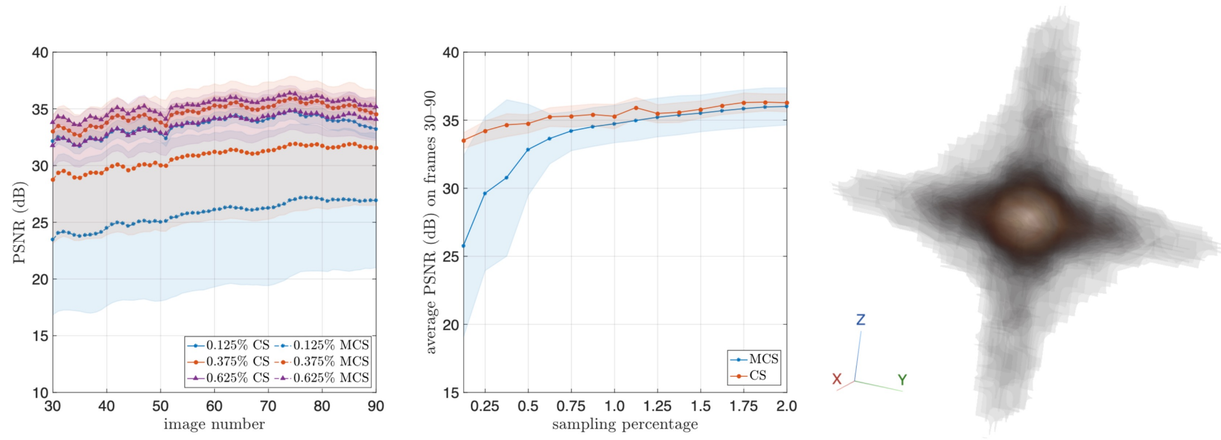
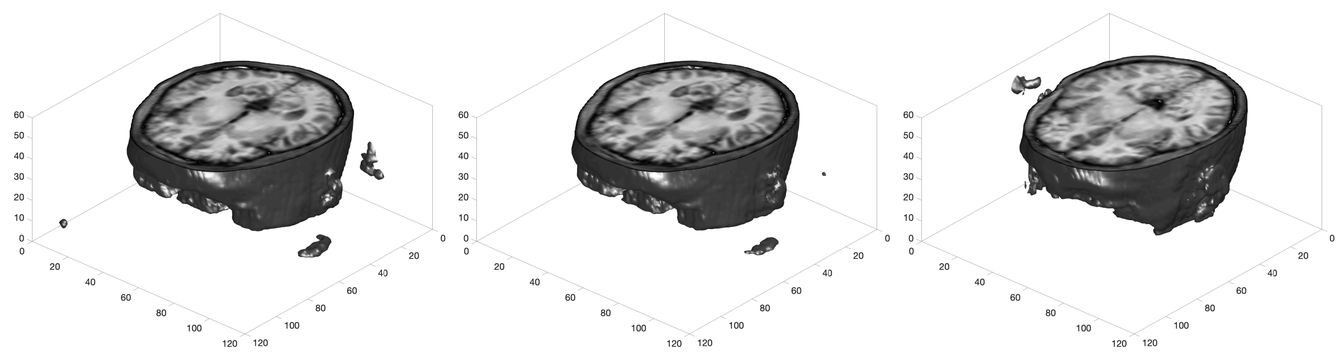


Figure 1: CS for MRI reconstruction using generative models. Plots of (left) the average PSNR vs. image number of the 3-dimensional brain MR image for both Christoffel sampling (CS) and Monte Carlo sampling (MCS) methods at 0.125%, 0.375%, and 0.625% sampling percentages, (middle) the average PSNR computed over the frames 30 to 90 of the image vs. sampling percentage for both CS and MCS methods, and (right) the empirical function $\widetilde{K}$ used for the CS procedure (allows added *interpretability* to the sampling procedure).



original MR image | CS | MCS

Consider Burger's equation with $D = (-1,1)$, $T = 1$,

$$\mathcal{L}u = \partial_t u + u \partial_x u - (0.01/\pi)\partial_{xx} u = 0,$$
$$u(x,0) = -\sin(\pi x), \quad x \in D,$$
$$u(-1,t) = u(1,t) = 0, \quad t \in (0,T].$$

We train a series of PINNs in an active learning setting in Fig. 2.

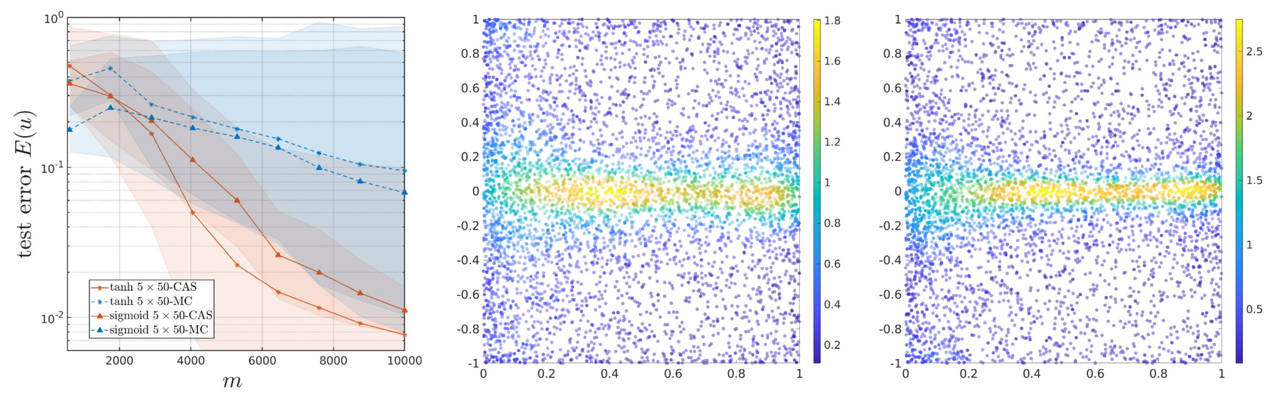


Figure 2: CAS for solving PDEs with PINNs. Plots of (left) the average test error $E(u)$ versus the number of samples used for training tanh and sigmoid 5×50 deep neural networks (DNNs) using CAS (solid line) and MCS (dashed line), (middle) the samples generated by the CAS method for tanh 5×50 DNN and (right) the samples generated by CAS for the sigmoid 5×50 DNN. The color indicates the density of the points and demonstrates the CAS procedure is sampling more near the shock.

Next steps:

- Apply for funding through NSF Computational and Data-Enabled Science and Engineering Program
- Continue development of CAS4ML framework, including improved sampling procedures for the empirical function $\widetilde{K}$
- Publish package for CS for Generative MRI reconstruction and adaptive sampling for PINNs

Outcomes:

- Paper submitted (currently under review) to 2023 Conference on Neural Information Processing Systems (**NeurIPS**), a high impact annual Machine Learning conference
  - Adcock, Ben, Juan M. Cardenas, and Nick Dexter. "CS4ML: A general framework for active learning with arbitrary data based on Christoffel functions." arXiv preprint arXiv:2306.00945 (2023).

Nick Dexter – Assistant Professor

Department of Scientific Computing – nick.dexter@fsu.edu

Streamlining the Double Edge Notched Tension (DENT) Test for Asphalt Binders

Michael D. Elwardany, Ph.D., P.E. [1]; **Patrick Laciuga** [2]; **Chukwunwike Okwuenu** [3]
[1] Assistant Professor; [2] Undergraduate Research Assistant; [3] Graduate Research Assistant, Florida State University

FAMU-FSU Engineering

FYAP

Introduction

The DENT (Double Edged Notch Tension) test is a fracture test method used to simulate ductile failure and compare the strain tolerance of different asphalt binders. The currently accepted standard involves fabricating two beams from binder specimens with a 5-, 10-, or 15-mm ligament between two notches initiating cracks in the beam, then the load in the binder is measured as the sample is subjected to a constant displacement rate.

The raw data of Load and displacement was used to calculate various Parameters indicative of the binder's ability to resist cracking, such as the Crack Tip Opening Displacement (CTOD). Although this approach has shown to be a direct indicator of a binder's strain tolerance, six tests are required to obtain CTOD following the current standard, which is time-consuming and expensive. Ideally, the industry would like to reliably evaluate binder strain tolerance by testing fewer specimens.

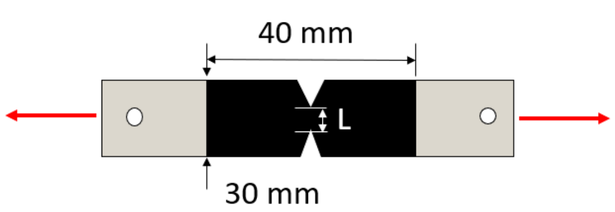


Fig. 1: DENT test specimen, where L is the ligament length

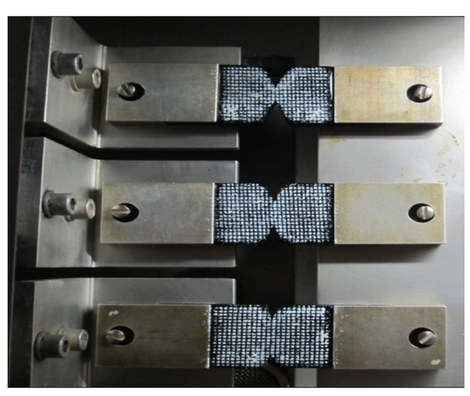


Fig. 2: DENT test with three ligament lengths

Motivation

The research team is investigating whether it is possible to reliably evaluate binder strain tolerance using fewer specimens, testing time, lower cost, and a smaller sample size. Effectively, we asked the question, "If less than three ligament lengths of an asphalt binder are tested using DENT, will the results be consistently reliable when compared with conclusions gathered from three ligament lengths?".

Data Structure & Source

All calculations were performed using previously gathered DENT data from the Federal Highway Administration (FHWA) stored in 30 Excel spreadsheets. Each spreadsheet corresponded to one of thirty binders.

Data Analysis

Python code was used to process files, calculate relevant parameters, generate plots, and compare strain tolerance methods evaluating one or two ligament lengths instead of three. Parameters include W_t (total work of fracture), peak load, and max displacement. W_t is computed as the area under the load-displacement curve, divided by the ligament's cross-sectional area.

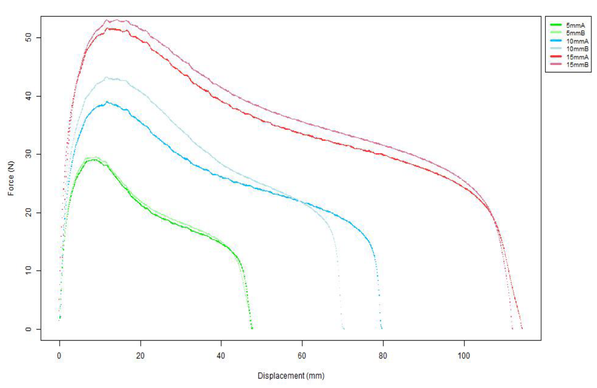


Fig. 3: Load-displacement curves.

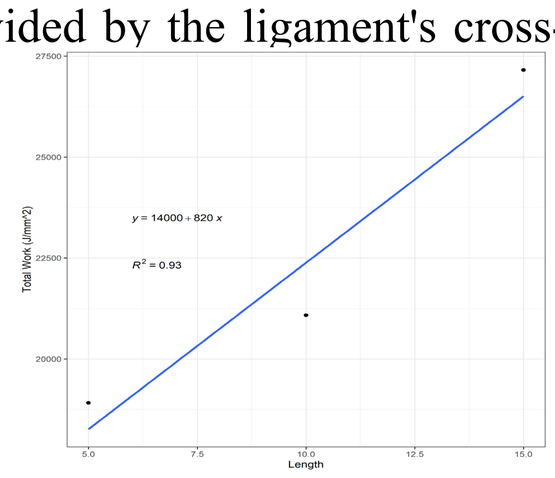


Fig. 4: Total work vs. ligament lengths regression.

Results

After obtaining conventional CTOD values using the standard method, averages for CTOD_2P and STI were calculated across all binders. For the validation stage, a subset of five binders was randomly selected for validation. All presented results are the average of two replicates for each binder.

The CTOD_2P values generated by the training model displayed a strong linear correlation (R^2=0.99) with calculated CTOD values. Similarly, the STI plot showed a correlation (R^2=0.90), albeit with a slightly skewed slope attributed to the use of single-length peak load and total work values. Error bars, derived from the standard deviation between two replicates, were added to each binder's plot.

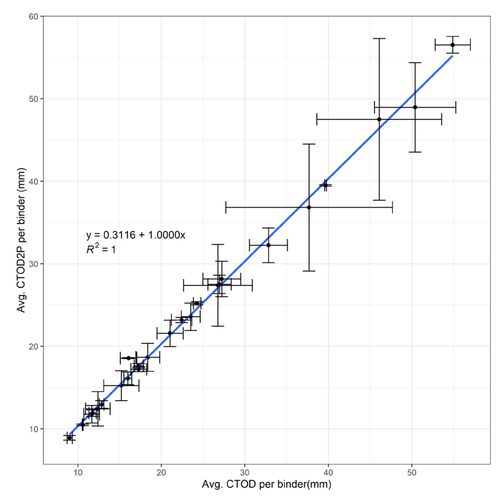


Fig. 5: Observed Avg. CTOD vs. Avg. CTOD_2P with regression, R^2 value, and standard deviation.

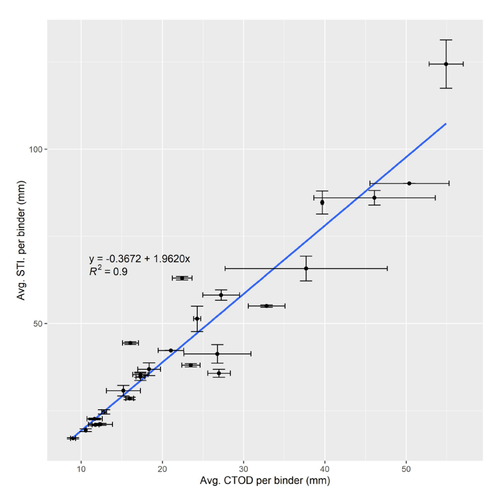


Fig. 6: Observed Avg. CTOD vs. Avg. STI with regression, R^2 value, and standard deviation.

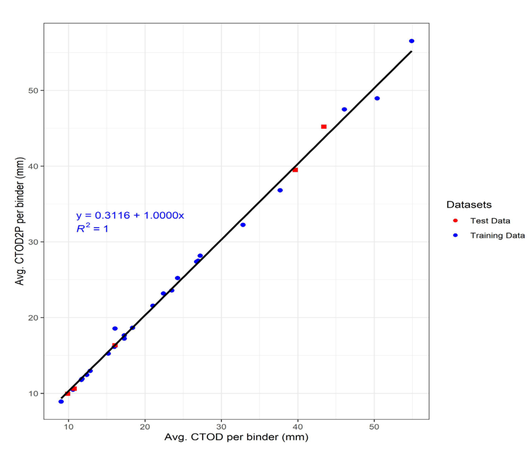


Fig. 7: Validation dataset overlaid on the training dataset for CTOD and CTOD_2P.

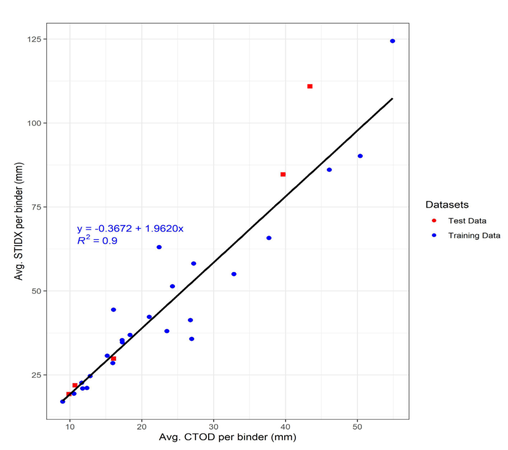


Fig. 6: Observed Avg. CTOD vs. Avg. STI with regression, R^2 value, and standard deviation.

Qualitative observation of the validation dataset overlaid with the developed model predictions affirmed the effectiveness of the studied approach across a diverse range of binders.

Conclusion

Given the strength of the correlation between CTOD_2P and STI when plotted against CTOD, there is very supportive evidence that we can test two lengths without compromising the test reliability. Additionally, the results of the methodology are likely to be easily transferrable across sets of data, as depicted by the consistency of the training set when compared to the validation set, which is supportive of the original hypothesis and promising for future simplification efforts.

Future Work

In addition to analyzing larger, diverse datasets, the team is considering the use of machine learning to explore further parameters for robust ranking of asphalt binder resistance to fatigue cracking.

Acknowledgment

The team appreciates the support provided by the First Year Assistant Professors (FYAP) program at FSU.

Music and Meaning in Video Games

Background

- The study of music in video games remains a relatively new but quickly developing field. While there have been a handful of articles, books, and edited collections of essays on various issues surrounding video game music, **there has yet to be a full monograph treatment that takes an analytical approach to the experience of music itself.**
- This lacuna in the video game music studies is likely due to two primary reasons 1) the difficulty of analyzing a dynamic, interactive form; and 2) assumptions within music analysis that assume an active, intent listener.
- In this project, **I reconsider music as immanent** in video games, and in turn the experiences and meanings we draw from them as players.

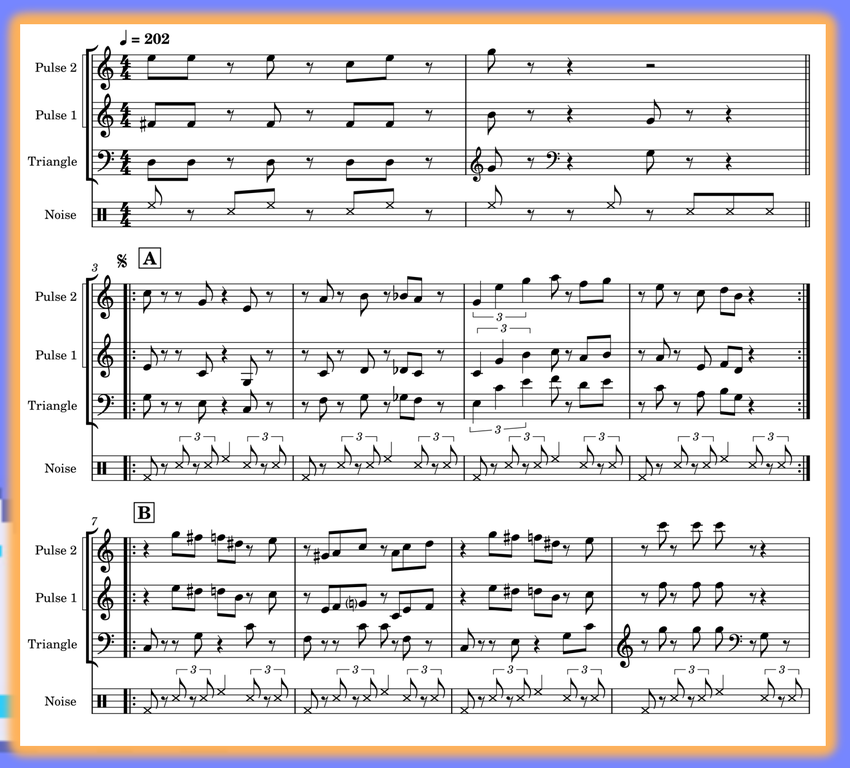


Figure 1: An abridged transcription of the overworld theme to Super Mario Bros. (1985) by Koji Kondo. Each musical line is organized by sound channel and corresponding wave shape. The theme features rhythmic syncopation (notes heard "off" of the main beat or groove) and chromaticism (notes heard "outside" of the main key area). Thanks to Dana Plank for help with this transcription.

Analytical Summary

- Players can enter a stage of perceptual mastery, or what I call **habituated play**, after consistent and repeated interaction with the game.
- At this stage, I argue that video games are perceived as **ecologies**, within which music plays an important role in player's understanding of the overall game environment.
- Following theories of conceptual blending in linguistics, I argue that at the stage of ecological perception, music can **music offer resources for novel concepts**. The formation of these novel concepts is not merely a result of constant associations between music and game, but rather facilitated by **play as an act of meaning construction.**

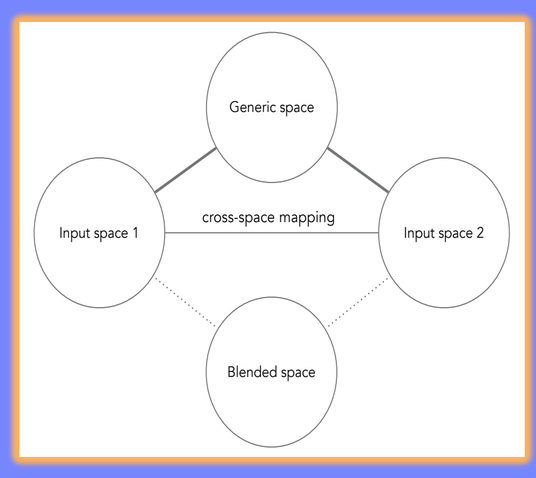


Figure 2: Adaptation of Gilles Fauconnier and Mark Turner's model of a Conceptual Integration Network, or CIN. The dotted lines represented the selective projection of attributes of the input space into the blended space. A typical CIN begins with correlated two input spaces. Concepts from these input spaces are then blended together in a third space (the conceptual blend), resulting in novel concepts. A fourth space—the generic space—captures the essential features of all the mental spaces in the CIN, and thus serves as a guide for the process of conceptual blending proper. See Gilles Fauconnier and Mark Turner, "Conceptual Blending, Form and Meaning," *Recherches en Communication* 19 (2003): 57–8.

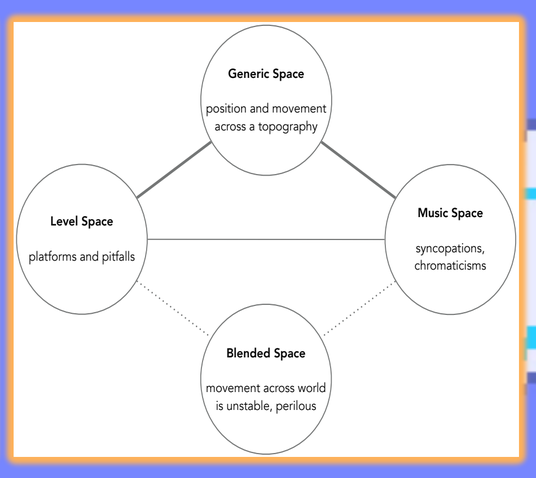


Figure 3: Conceptual integration network for the Overworld cue from *Super Mario Bros.* Mapping both music and matter through a general concept of topographical position and movement, we can analyze how off-beat syncopations and off-key chromaticisms project tonal instability that maps onto the unstable nature of movement in the level. Importantly, part of this blend encompasses the ludic nature of this concept—that platforms are perilous, and one wrong move could result in losing a life in the game.

Outcomes and Next Steps

- An **article** based on this work was submitted to the Journal of Sound and Music in Games.
- This work will also build into a **book proposal.**

Thanks for the coins, FYAP!

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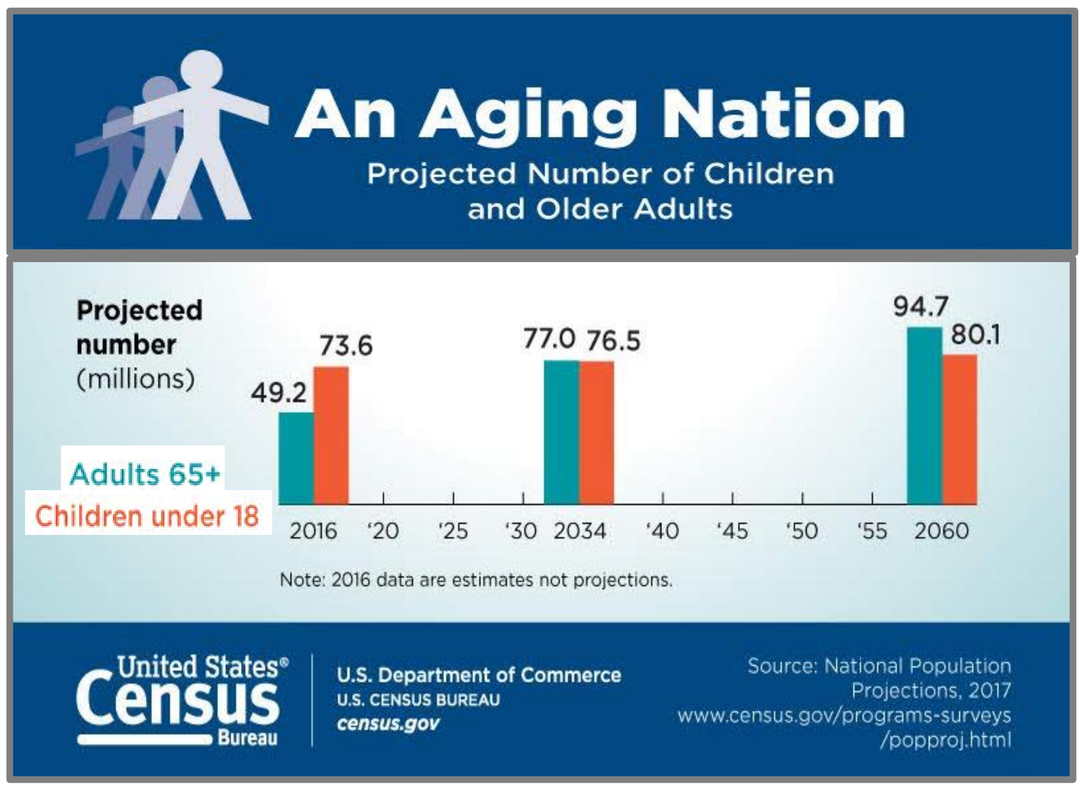
“That’s What It’s All About”: Influences of Desired Outcomes on Adult Learners’ Instrument Selections



Relevance & Research Questions

Quality of life benefits are associated with music making/learning in Older Adulthood - particularly in group/ensemble settings.

OAs approach music learning with desired outcomes that are relevant to persistence or attrition

Instrument choice profoundly shapes musical experiences and has been linked to desired outcomes

Research Questions: (1) What relationships might exist between OAs’ desired outcomes for ensemble participation and instrument selection? (2) What role might subjective values play?

Data Collection & Analysis

Quantitative Data	Qualitative Data	Interpretation
Survey Instrument: Factors Influencing Instrument Selection	45-Minute Interviews Protocol Informed by Quantitative Results	Explanatory potential of mixed quantitative and qualitative data
$N = 52$ Older Adults Means, *SD*, Frequencies	$n = 18$ In Vivo & Focus Coding	Discussion: Subjective Task Value Implications for Practice

Selected Qualitative Results

Desired Outcomes	Participant Quotes
Revitalizing Identity	‘Getting back to being a trombone player…That’s what it’s all about.’ **(STV: Attainment)**
Self-Perception: Capable, helpful,	‘And then we still couldn’t find anyone to do it, so now I play percussion...Drums, trumpet, euphonium – whatever the band needs. I can swap around.’ **(STV: Attainment)**
Connection to Fond Memories	‘It’s nostalgic. I’ve done a lot with this clarinet. So many good memories…When I think of band, I think of my clarinet. I’ve really enjoyed it.’ **(STV: Intrinsic/Interest)**
Challenge Via Novelty	‘Once you retire, you have to keep your brain active. So, I wanted something different. I knew piano. The keys are all orderly. When you plunk one, you get the same note every time. Not so with the trombone! The slide, your lips, air, everything is different.’ **(STV: Utility)**
Minimizing Physical Issues	‘I used to play the oboe, but the pressure in my eyes got to be a problem, and well, I need my eyes more than the oboe, so I switched to saxophone.’ **(STV: Cost)**

Discussion

Interview data added depth and nuance to understandings of the multifaceted nature of instrument selections by OAs. Consistent with STV use, the crux of each choice was a participant’s relative perceived value of each influence. Next steps include further use of STVs and Expectancy Value Theory to examine choices of OA music learners. Many participants anticipated the impact that their choices would have on their ensemble experience and chose instruments that aligned with their desired outcomes - with 33% switching to different instruments. Only one participant sought advice. Therefore, a director’s role may include facilitating progress towards desired outcomes rather than guiding selections. However, 1 participant disliked their chosen instrument and planned to quit. A director’s expertise may help similar individuals align desired outcomes with an improved instrument choice. Given the importance of desired outcomes in OA persistence, directors are also encouraged to provide continuing opportunities for beginning instruction as members’ desires evolve.

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The Implications of Charge Adjustments for Cumulative Disadvantage

When and Where Does Racial Disparity Accumulate in Criminal Court Processing?

Bryan Holmes
College of Criminology and Criminal Justice

Background

Racial differences in case outcomes have permeated criminal justice research for decades. Due to data limitations, much of this research relies on post-conviction data—therefore only examining differences that arise between adjudication and sentencing. Much less is known about the events that lead up to adjudication—namely charge adjustments. This oversight of the pre-trial process is pressing because of (a) the growing power of the prosecutor and (b) its implications for down-stream differences in case outcomes.

Current Study

Using data from the Florida Office of the State Court Administrator, this study explores where racial disparity in charge adjustments is more pronounced and its implication for down-stream racial differences in sentencing, for violations of Florida's criminal statutes for Robbery, Sexual Battery, Drug Possession, and Trespassing.

Research Aims

(1) Examine racial differences in charge adjustments.

(2) Examine racial differences in charge adjustments across multiple offense types.

(3) Examine how racial differences in charge adjustments impact racial differences in incarceration.

(4) Examine how racial differences in charge adjustments impact racial differences in incarceration across offense types.

Results

Robbery

- Black-White differences in charge severity were exacerbated at screening.
- Holding all other factors constant, racial gaps in incarceration odds were trivial.

Sexual Battery

- White charge severity was larger and both races experienced diminishing charge severity from arrest to conviction.
- From arrest to conviction (particularly screening to conviction) the Black-White incarceration gap converged.

Drug Possession

- White charge severity was higher across the process, with the smallest Black-White gap at conviction.
- Black defendants garnered higher incarceration odds, and that disadvantage decreased by about 0.6% in each successive stage.

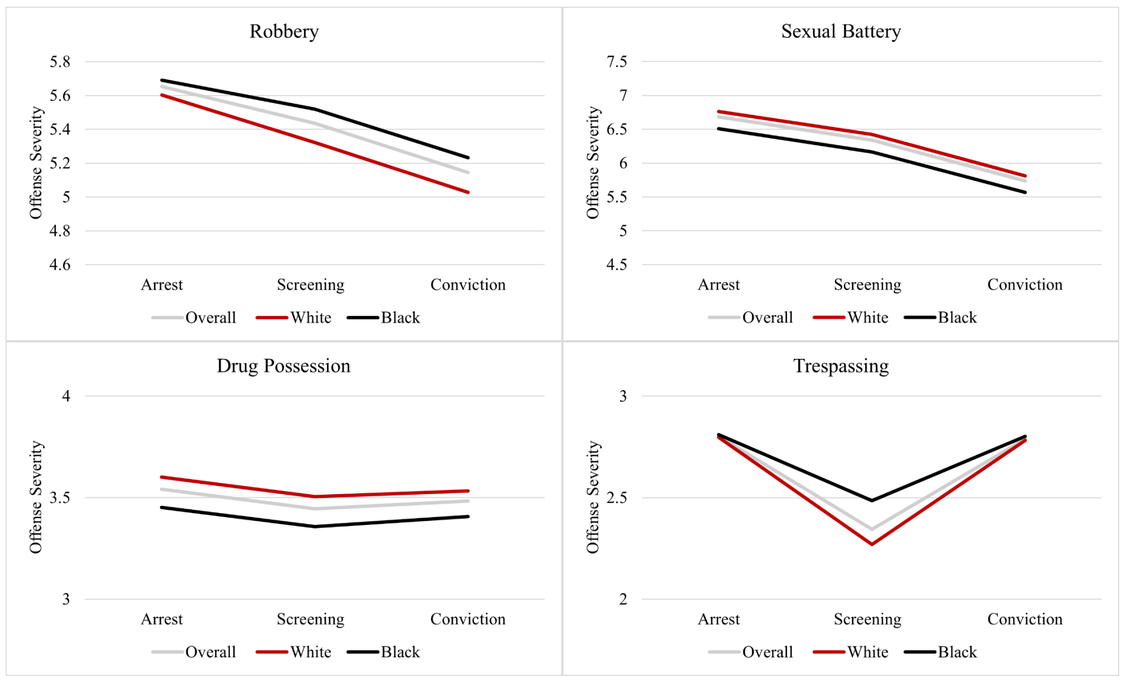
Trespassing

- Racial differences in charge severity were null at the beginning and end of the pre-trial process, but at screening Black charges were more severe.
- Black defendants had 6-to-7% lower odds of incarceration than Whites, no matter pre-trial stage.

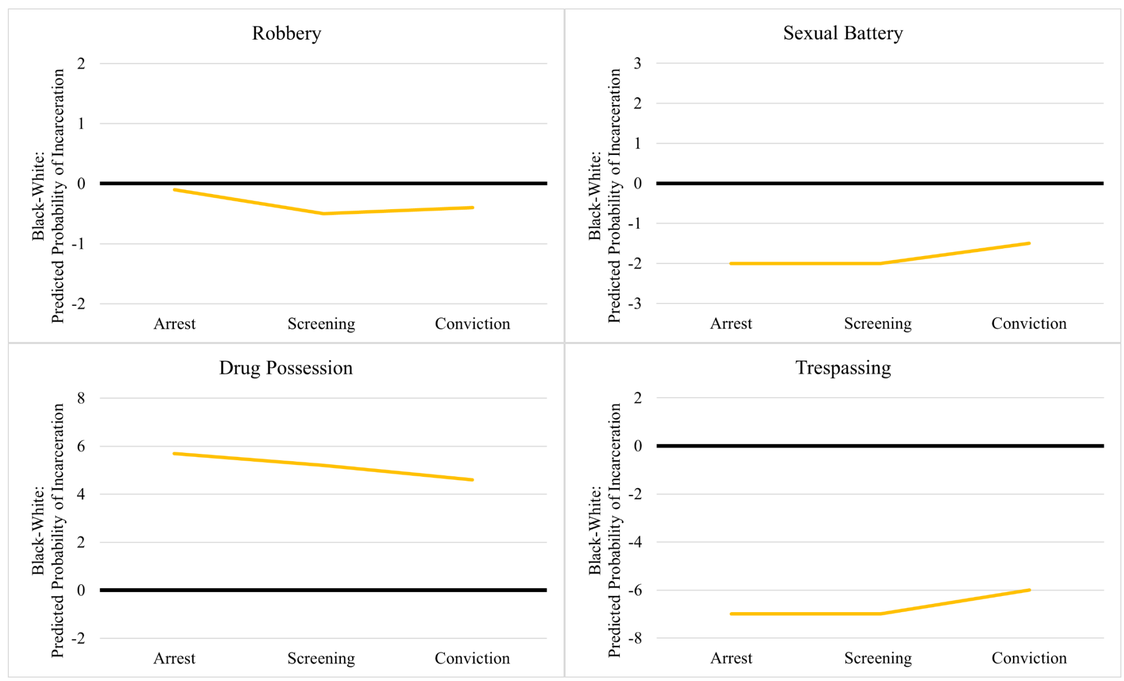
Descriptive Statistics of Criminal Cases in Florida, 2011-2021.

	Robbery	Sexual Battery	Drug Possession	Trespassing
	n = 24,017	*n = 9,588*	*n = 465,402*	*n = 98,448*
	%/Mean	%/Mean	%/Mean	%/Mean
Incarceration				
No	12.95%	16.77%	43.63%	44.18%
Yes	87.05%	83.23%	56.37%	55.82%
Race				
White	42.35%	67.51%	60.55%	64.68%
Black	57.47%	31.90%	39.07%	34.98%
Other	0.17%	0.59%	0.38%	0.34%
Sex (1 = Male)	89.73%	97.50%	78.51%	82.79%
Age at Filing	27.38	37.77	32.76	39.38
Arrest Charge Severity	5.65	6.68	3.54	2.80
Filing Charge Severity	5.44	6.34	3.45	2.34
Conviction Charge Severity	5.14	5.73	3.48	2.79
Counsel Type				
Self	10.64%	17.92%	23.58%	26.20%
Private	24.64%	27.30%	20.47%	10.29%
Appointed	51.69%	46.26%	42.47%	46.34%
Other	13.03%	8.53%	13.48%	17.17%
Mode of Disposition				
Plea	94.22%	79.58%	99.09%	98.54%
Jury Trial	5.36%	19.24%	0.37%	0.28%
Bench Trial	0.43%	1.19%	0.53%	1.18%

Descriptive Racial Differences in Charge Severity Across Arrest, Screening, and Conviction.



Multivariate Analysis: Racial Gaps in the Predicted Probability of Incarceration Using Arrest, Screening, or Conviction Charge as the Primary Legal Control.



Conclusion & Next Steps

These findings suggest that charge adjustments differ across (a) the stage in the criminal justice process, (b) offense type, and (c) race. This represents a first step in developing a nuanced understanding of how racial/ethnic effects accumulate throughout the criminal justice process, in order to target policy efforts in the crevices of justice administration that perpetuate unequal treatment.

Immediate next steps include: (1) gaining access to data on criminal history of defendants to better isolate the impact of race and (2) expanding this analysis to other racial/ethnic groups – such as Hispanic defendants. A longer-term project involves assessing place-based variation in these effects.

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SAD: A large-scale dataset for linguistics and machine learning

Tom Juzek *– Modern Languages and Linguistics – tjuzek@fsu.edu*

INTRO / AIM

INTR "Goodness" data are beneficial to linguistic theory, but difficult to obtain; only small datasets are available (N<400)

AIM Create infrastructure for data collection and create the largest dataset available: Syntactic Acceptability Dataset (*SAD*)

Use data for theory building / evaluation and training of machine learning models

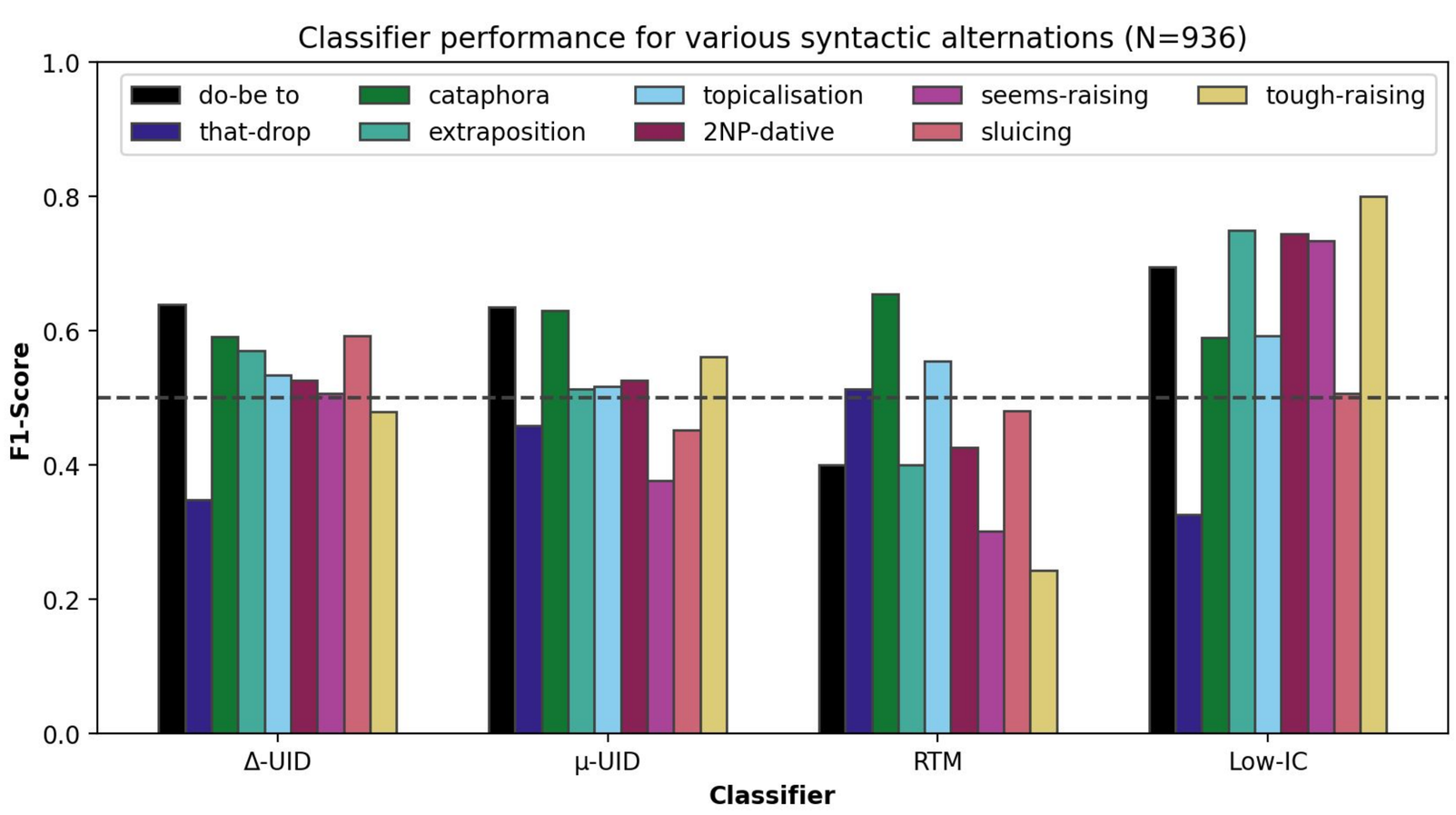
APPROACH

APPR Build scalable solution within common IT framework (LAMP)

Crowdsource human participants, collect linguistic goodness ratings

Calculate information theoretic measures with AI (Brown et al. 2020)

Use data to evaluate prominent theory (Jaeger 2006)



SUCCESSES / RISKS

SUCC New dataset established, currently 500 items, scalable to >15 000 items

First results are valuable!
Graph: common theory struggles with new data (dotted line = random coin)

RISK 500 items is too small for most ML models, >10 000 is needed

Procedure is still relatively expensive

FYAP / NEXT STEPS

NEXT One paper under review

One upcoming conference submission for publishing further analyses and preliminary dataset

FYAP Great opportunity to kickstart my research line at FSU 🚀 🚀 🚀

Great learning experience

References

Jaeger, T., & Levy, R. (2006). Speakers optimize information density through syntactic reduction. ***Advances in neural information processing systems*****, 19.**

Brown, T., et al. (2020). Language models are few-shot learners. ***Advances in neural information processing systems*****, 33, 1877-1901.**

Many thanks to

Dr Carolina González (mentoring)

Dr Irene Zanini-Cordi (help with proposal)

FSU-SC Machine Learning Seminar

The Effects of Time Preferences on Cooperation: Evidence from Infinitely Repeated Game Experiments

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FLORIDA STATE UNIVERSITY

Introduction

- Time preferences play an essential role in repeated games.
  1. *Discount factors*: Fudenberg and Maskin (1986), Abreu et al. (1990).
  2. *Present bias*: Chade et al. (2008).
- Lab repeated games using a random termination rule have limitations.
- This paper introduces a novel experimental design which allows us to test the effects of discount factors and present bias on cooperation in repeated PD experiments.
- The main results are:
  1. *Higher discount factors* promote cooperation.
  2. *Present bias* reduces cooperation.

Experimental design

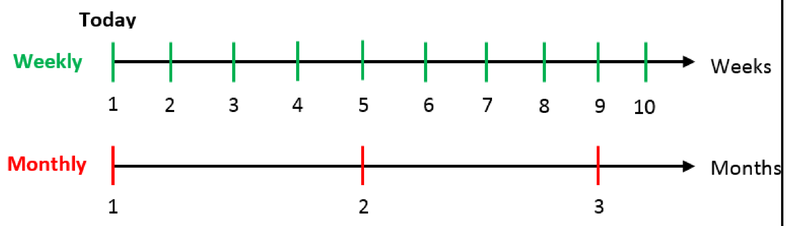
- 20 repeated PD games (matches).
- Continuation probability: 0.75.
- Only one match was randomly selected for actual payment.
- 3 treatments x 4 sessions: 226 subjects.

	The other's choice	
Your choice	1	2
1	\$4, \$4	\$1, \$5
2	\$5, \$1	\$2, \$2

Figure 1: Stage game payoffs

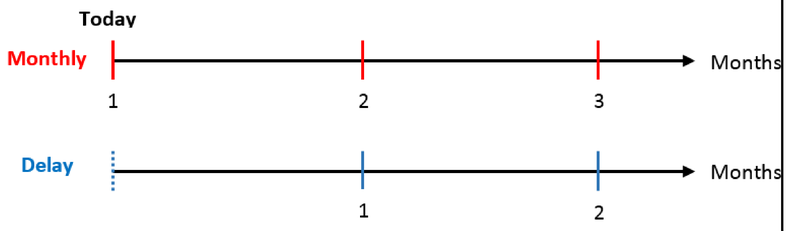
Key idea: subjects receive stage game payoffs over time.

(1) The effect of discount factors



Question 1: *Do subjects cooperate more in the Weekly treatment than in the Monthly treatment?*

(2) The effect of present bias



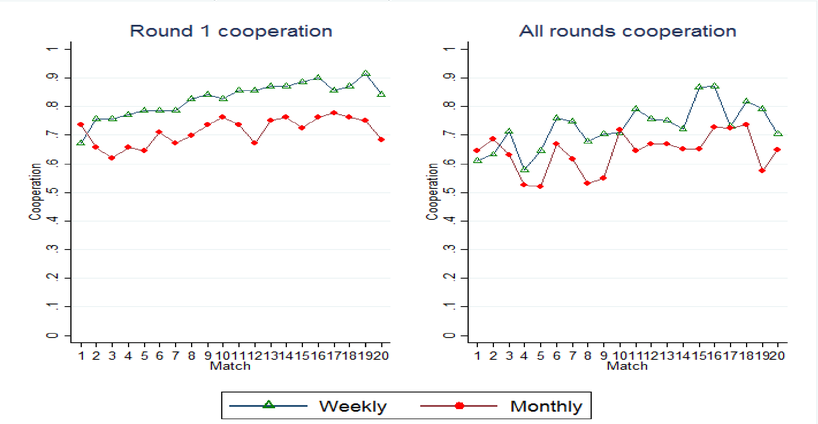
Question 2: *Do subjects cooperate more in the Delay treatment than in the Monthly treatment?*

Payment method

- **VENMO**: mobile app (money transfer).
- Widely used among U.S. students.
- No transfer fee $\rightarrow$ balancing immediate and future transaction costs.

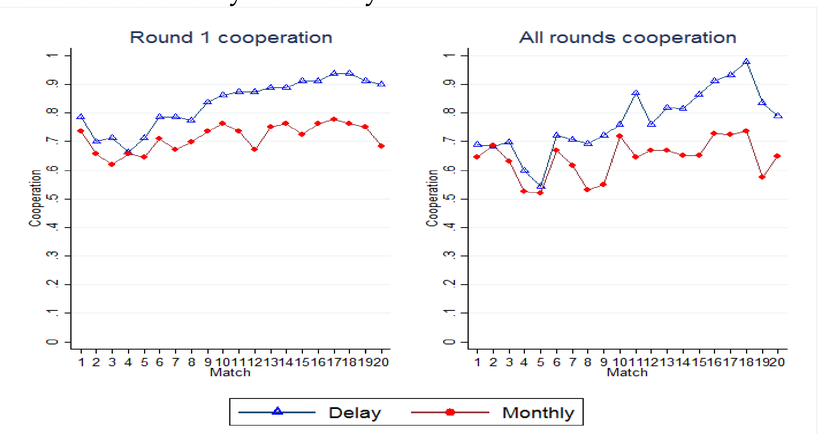
- In all treatments, we also elicit subjects' time preferences before playing repeated PD games.

Result 1. Weekly vs. Monthly



$\Rightarrow$ Higher discount factor promotes cooperation.

Result 2. Monthly vs. Delay



$\Rightarrow$ Present bias reduces cooperation.

Research in progress

1. Rubinstein bargaining (Kodritsch, ECMA, 2018).
2. Cournot duopoly (Obara and Park, JET, 2017).

FLORIDA STATE UNIVERSITY
DEPARTMENT OF PHYSICS

NATIONAL HIGH MAGNETIC FIELD LABORATORY

Plasmonic origami

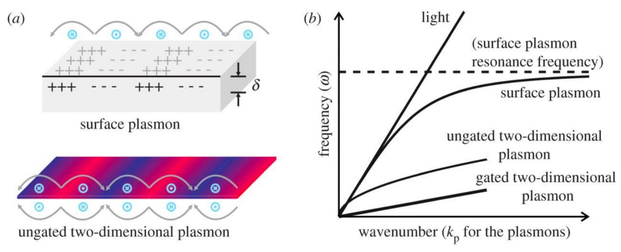
an investigation of plasmonic bands in moiré Wigner crystals

Cyprian Lewandowski

Research Question:
Can **surface plasmons** provide information about the nature of the **moiré Wigner crystals**?

Surface plasmons

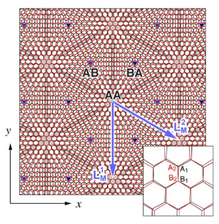
- Collective charge oscillations: electron movement in 2D synchronized by long-range Coulomb fields in 3D
- A unique probe of interactions in 2D electron systems
- Area of active research: strong light-matter coupling, deep sub-wavelength field confinement, wide tunability, and other wonders



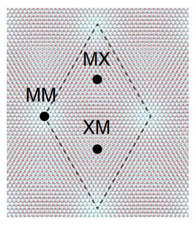
Source: *Plasmonics with 2D conductors*, H. Yoon, K. Yeung, P. Kim and D. Ham (2014)

Moiré materials

Twisted graphene layers



Transition metal dichalcogenides



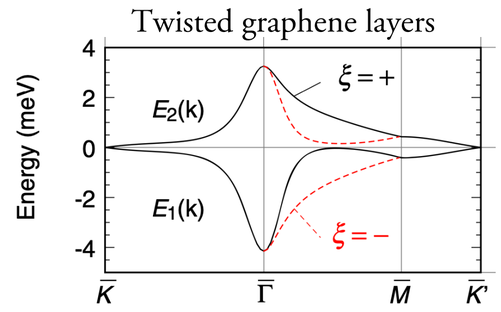
Flat bands in moiré Brillouin zone

Dominant role of interactions

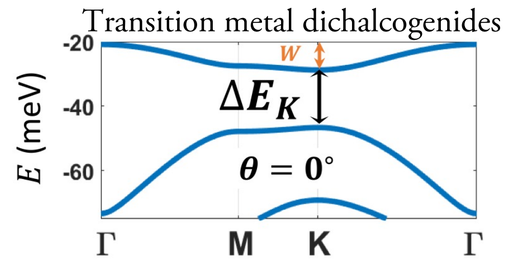
Huge effective fine structure constant

$$\alpha = \frac{e^2}{\kappa \hbar v_F} \gg 1$$

Twisted graphene layers



Transition metal dichalcogenides

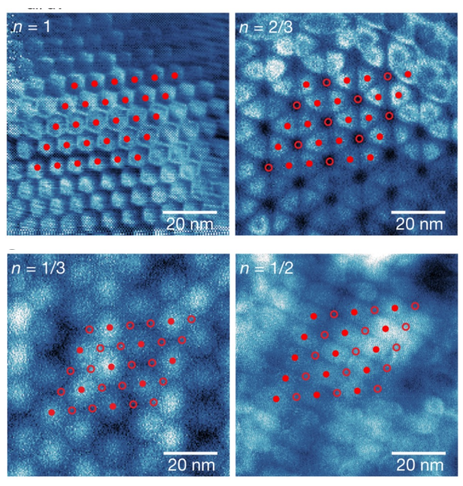


Y. Zhang, N. F. Q. Yuan, and L. Fu, Phys. Rev. B 102, 201115(R) (2020)

M. Koshino, et. al, Phys. Rev. X 8, 031087 (2018)

Wigner crystals

An electronic "crystal" formed by e-e strong interactions

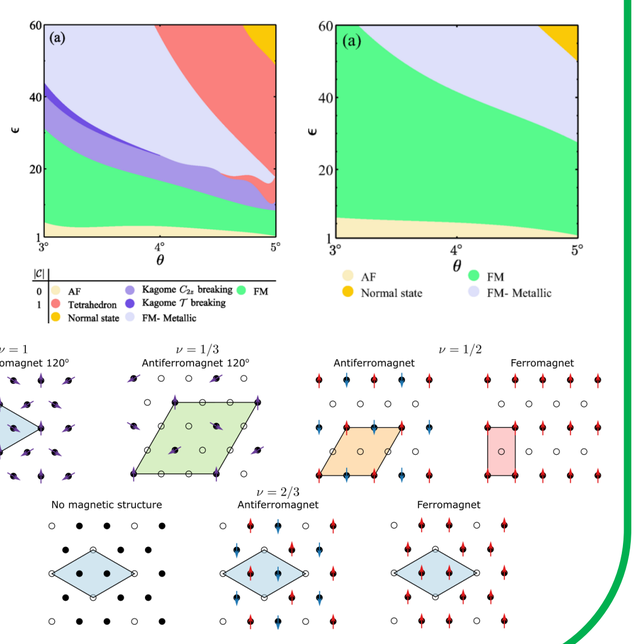


Imaging Mott and generalized Wigner crystal states

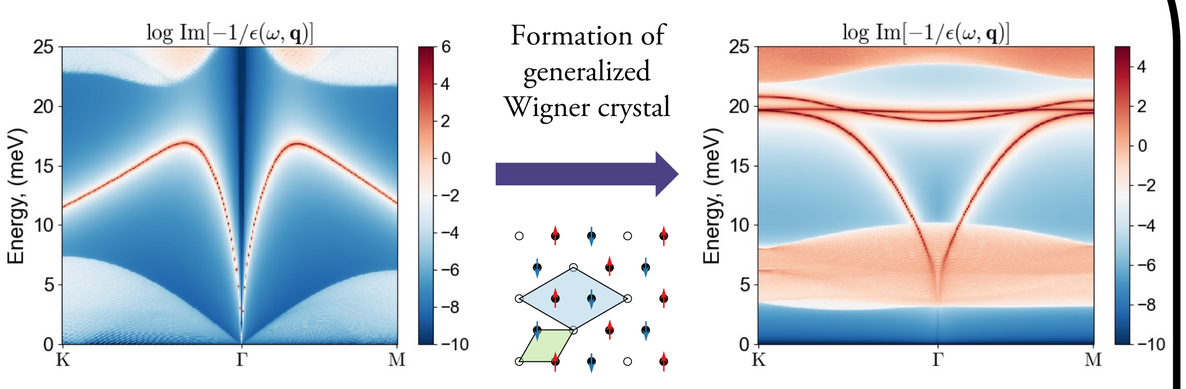
H. Li et al., Nature **597**, 650–654 (2021)

Many candidate ground-state orders!

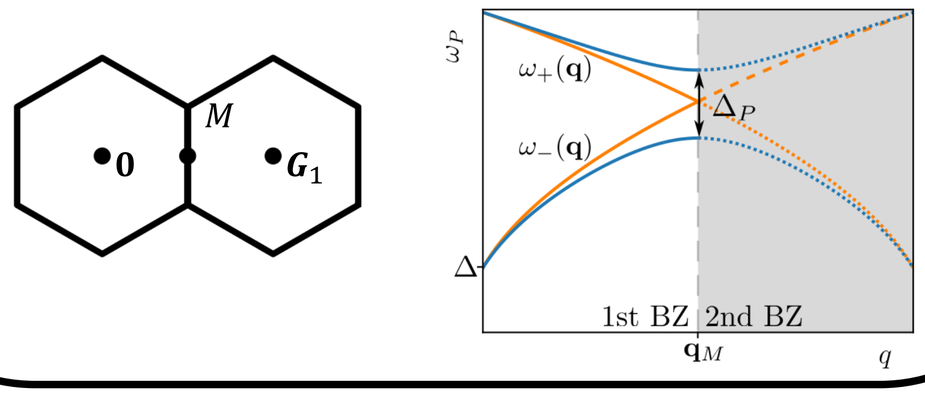
H. Pan, F. Wu, and S. Das Sarma, PRB **102**, 201104(R) (2020)



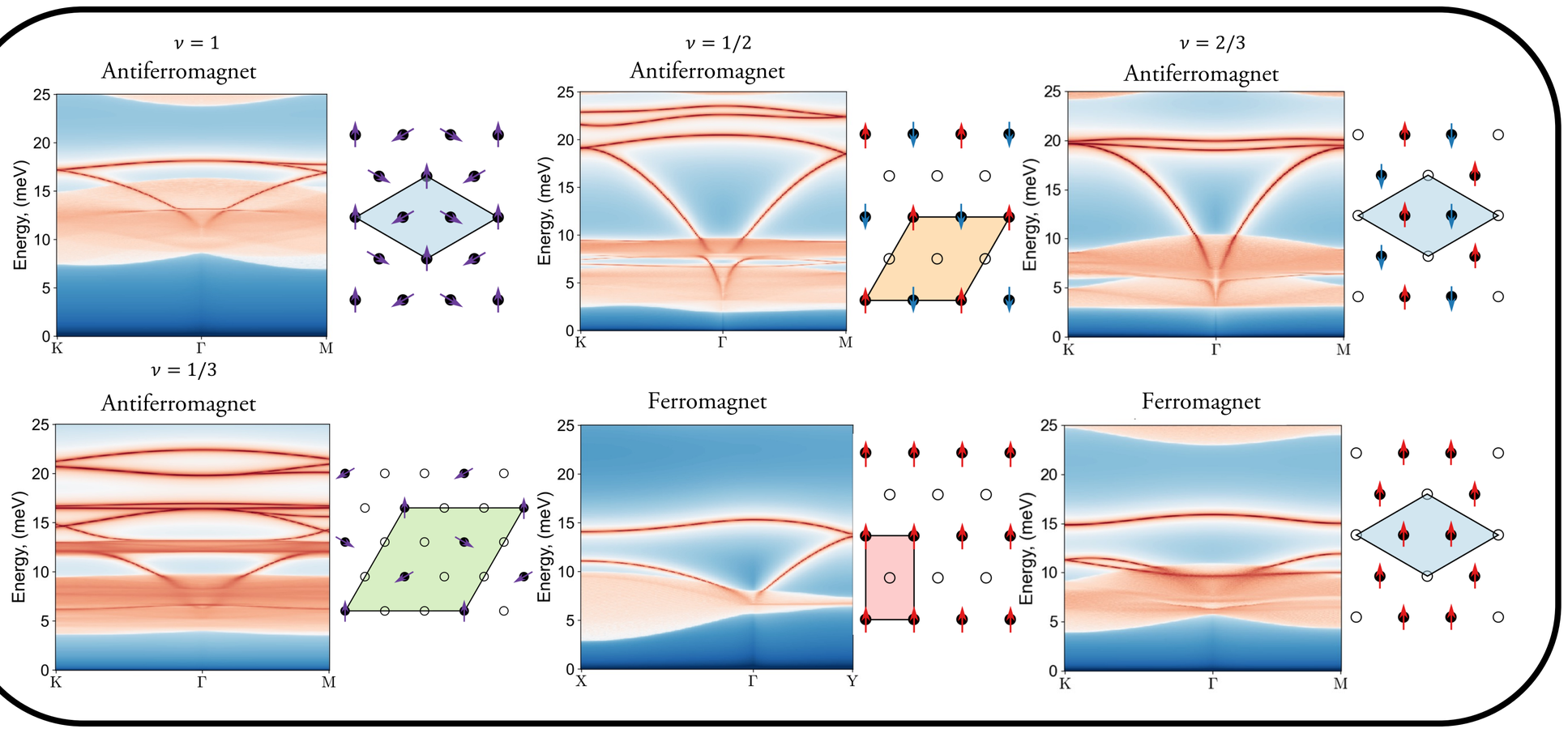
Results



Appearance of the correlated order gives rise to folding of the plasmon dispersion!



Key Qualitative Signature:
The number of new plasmon branches corresponds to the unit cell enlargement. This implies that plasmons, charge density response, encode information about spin structure!



Next steps:
real-space plasmon mode charge pattern distribution and topological properties of the dispersion

For more information: 10.1126/sciadv.adg3262 **Contact:** clewandowski@fsu.edu

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School of Dance

-Farai Malianga-
Assistant Professor
Videographer | Composer | Musician

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-Modern Day Djeli-

Modern Day DJELI

The 13th Century saw rise to one of the richest kingdoms the world has ever seen. The West African, Mali Empire would produce Mansa Musa. This monarch would eventually make a pilgrimage to the Holy Land so extravagant it would upset the World's economy. He was accompanied by a vast entourage that included his Djeli. Djeli's are Oral Historians.

In modern times Alex Haley, the great U.S. author would return to West Africa with only the name "Kunta Kinte" told to him by his African American Elders. He sat at the feet of a Djeli as the Griot sang the history that connected the African name "Kunta Kinte" to Dr. Haley's West African ancestry. The Djeli had memorized centuries of family lineage in the form of rhyme and song. Haley's research would become the 1977 TV mini-series "Roots: The Saga of an American Family" and winner of 9 Emmy awards.
I am a modern day Djeli.

The Exclusion

In 1409 in the Spanish City of Grenada King Ferdinand and Queen Isabella funded the Italian Sailor Christopher Columbus. They were determined to celebrate their emergence from the European Dark Ages. However, at the time Grenada it was already one of the most enlightened cities on Earth. The Moors had brought African, Arab, Roman, Greek philosophy and technology to the Spanish. In fact, during the Medieval period in Classical Music the Catholic church defined Romans and Greeks as heathens. The expulsion of the Moors allowed Europe to erase our shared global history to justify future conquest of "undiscovered" nations.

Robert Chanate

Chanate a member of the Kiowa Nation was born and raised in Carnegie Oklahoma. An activist and organizer who currently works with the Native Organizers Alliance. He has made it his life's work to support and uphold Native visions and traditions.

It was the early 1800's when Indian Removal Act displaced many Native Nations were forced to move to Oklahoma. The nomadic Nations that had used Oklahoma as a sight to convene were also suddenly confined to this one state. The Kiowa were one of those nations who were punished for practicing their ceremonies and customs. School became sights of U.S. colonizing indoctrination.

It wasn't until the 1950's a young Kiowa began singing at a camp when an elder overheard him. She began teaching him the songs that she remembered. This sparked the revival of an age-old Kiowa tradition. The Gourd Dance Festival is now celebrated every year during Independence Day weekend. It is a symbol of the recalamation of the Culture, Customs and Histories of the Native People of Oklahoma.

TimeLine	Music	America	Europe	Africa	Asia	Technology
Antiquity		Norte Chico	Stone Henge	Nubia/Egypt		Bone Flute
0			Greeks	Jesus	Indus Valley	Lute
		Hope Well	Roman	Carthage	Confucious	Kalimba
300		Mayan			Tang	
500	Medieval		Byzantine		Huns Gupta	
700			Vikings			
			Charlemagne			Oud/Rebab
			-Islamic Golden Age-			
1000		Pueblo		Great Zimbabwe		
			-Roman Catholic and Eastern Orthodox-			
				Mali Empire		Djembe
1300	Waltz				Mongol	Balaphone
1400		Aztec Inca		Kingdom of Congo		
1500		Human Trade				Trumpet
	Rennaissance					
1600	Baroque			Ottoman Empire		
1700	Field Holler	USA Independence				Piano
						Trombone
1800	Romantic Calypso Polka	Civil War	British Empire Napoleon Wars			Saxaphone
1900	Ragtime		Irish Patatoe Famine		Korea / Japan	Gramophone
	Samba		WORLD WAR 1			
1920	Gospel	Great Depression	Russian Revolution			Theremin E.Guitar
	Big Band			Ethiopia		
1940	Be-bop Electronic Soukous		WORLD WAR 2			Discoteque
					Chinese Revolution	Magnetic Tape
1950	Rock	Civil Rights		African Decolonization		JA Sound-System
1960	Funk Salsa Reggae					
1970	Afro-Beat					Technics Turntables
	Hip-Hop	Vietnam War				
1980	SKA					PC MTV
1990	Grunge	HIV Epidemic	Berlin Wall			Synthesizer
	EDM			Persian Gulf		
2000	Reggaeton					Napster iTunes Youtube Spotify
2010						Poke Man Go

Music History Profiles

The diagram is a timeline that compares dates and locations as they relate to world events, music and music technology.
Where does the History of your family intersect with the History of the World?
What music speaks to your life? What music identifies the experiences of those that came before you?
Are those songs, choices or creations of the places and spaces that make you who you are?

Aspiring Leaders' Conceptions of Professional Ethics and Ethical Leadership Identity Made Visible Through Simulated Practice

Daniel Moraguez, Assistant Professor, Educational Leadership & Policy Studies

Simulated learning experiences allow pre-service leaders opportunities to practice their leadership without the potential for stakeholder harm. Properly curated simulations, and wrap-around activities, can target specific skills and competences, **professional ethics** among them. In this study, aspiring leaders engaged with simulations addressing a multitude of problems of practice. As part of a reflective post-simulation activity, they were asked to consider the professional ethics necessary for addressing the disorienting dilemma they encountered. Responses reveal **how aspiring leaders conceptualize occupational ethics and how those conceptualizations align with ethical leadership paradigms.**

Why Ethical Leadership?

School level leaders must make **ethical decisions** on a daily basis, and often the circumstances of the **dilemma** create clashes between competing sets of beliefs or values. Ideally, educational leaders are able to apply diverse approaches when addressing **complex problems of practice** that present ethical dilemmas. The **ethical leadership paradigm(s)** leaders or aspiring leaders rely on in their decision-making will affect students and other members of the school community.

Ethical Leadership Paradigms

Often referred to as professional or occupational ethics, the multiple perspectives or paradigms supported in the educational leadership literature are the **ethic of justice** (Delgado, 1995; Kohlberg, 1981; Sergiovanni, 1992; Shapiro & Stefkovich, 2005), the **ethic of care** (Noddings, 1992), the **ethic of critique** (Purpel, 1989), the **ethic of profession** (Shapiro & Stefkovich, 2005), and the **ethic of community** (Furman, 2003).

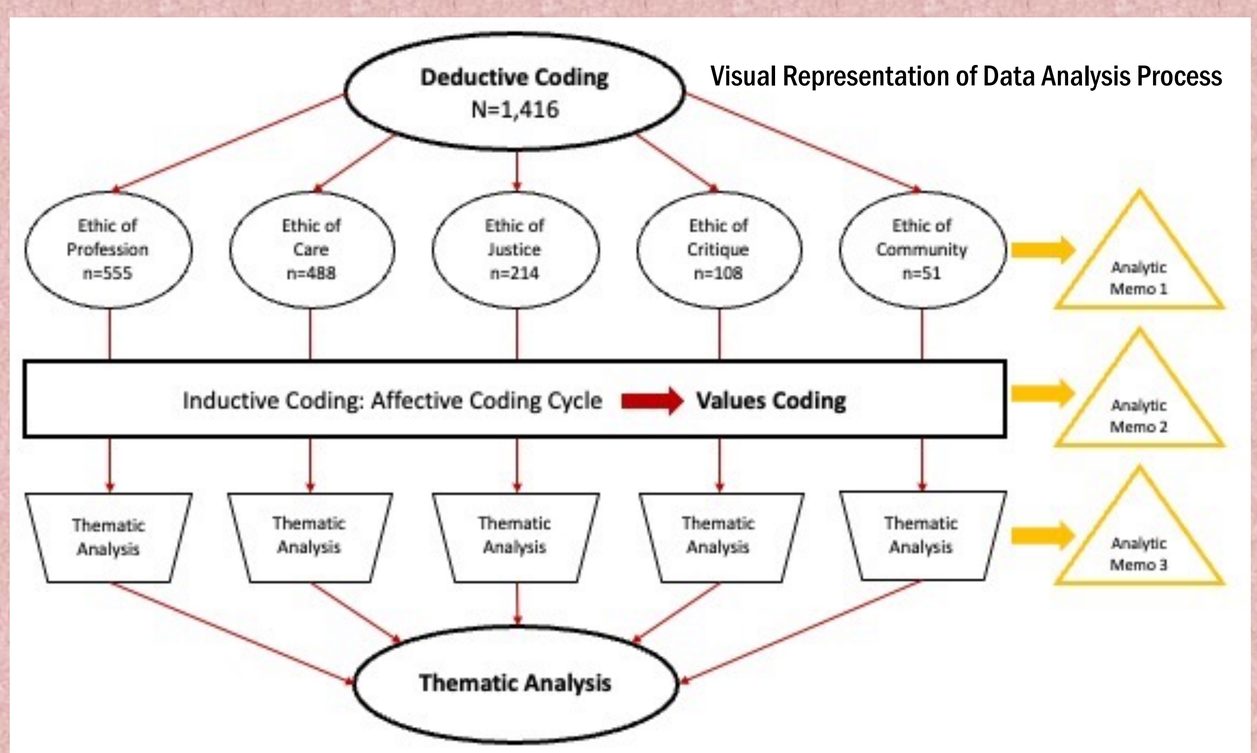
Definitions

Ethic of **Care**: Empathy and compassion; place great value in trust and relationships; empower stakeholders to be full, authentic selves
Ethic of **Community**: Inclusion, diversity, and democratic practices; in-depth knowledge of the community; distributed leadership
Ethic of **Critique**: Critical of laws/policies and process of making laws/policies; challenge power and privilege; endeavor to dismantle systems
Ethic of **Justice**: Reliant on laws and policies; centers individual rights, rights of the majority, and equity; treat all equally and with dignity
Ethic of **Profession**: Asks, "What would the profession ask me to do?"; students' best interest prioritized; integrates other paradigms

Data & Data Analysis

Data were collected from **over 200 aspiring leaders** over seven academic semesters. Students engaged with up to **three types of simulations** (digital, digital case study, and mixed reality) which were embedded in their courses. As part of a reflective post-simulation activity, students were asked in an open-response format to **consider the professional ethics necessary for addressing (with integrity) the disorienting dilemma** they encountered in their simulation. These students engaged with 19 different scenarios in total and produced 1,421 unique response cases (final **N of 1,416** after removing 5 responses coded as *other*). See figure for analysis process.

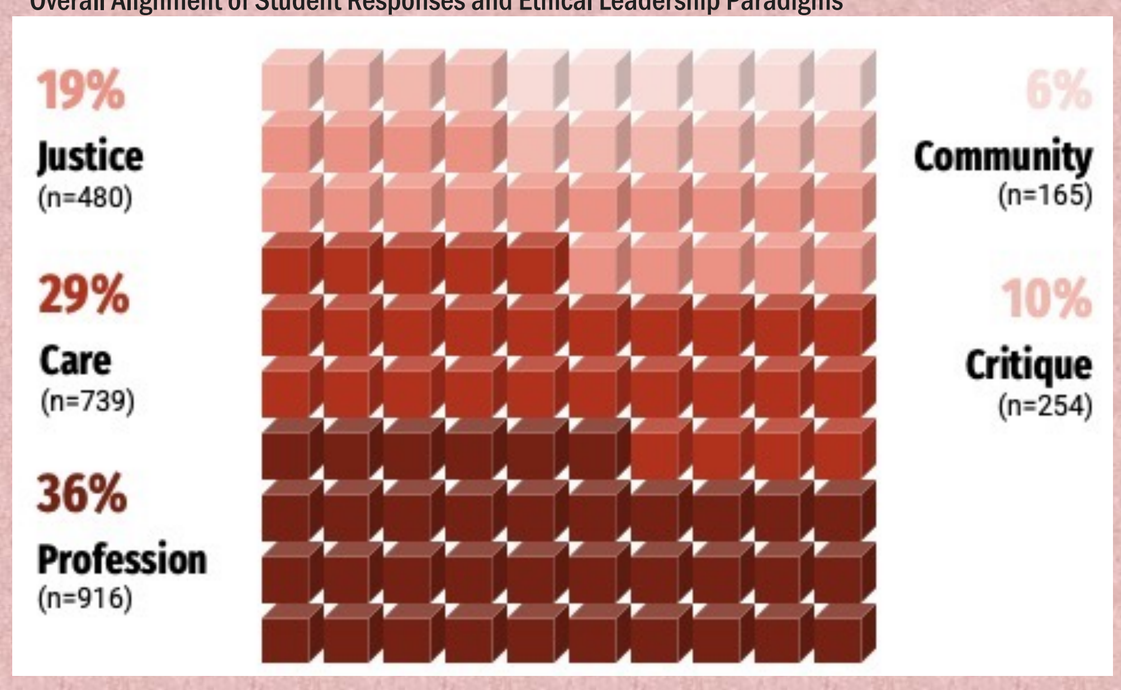
Visual Representation of Data Analysis Process



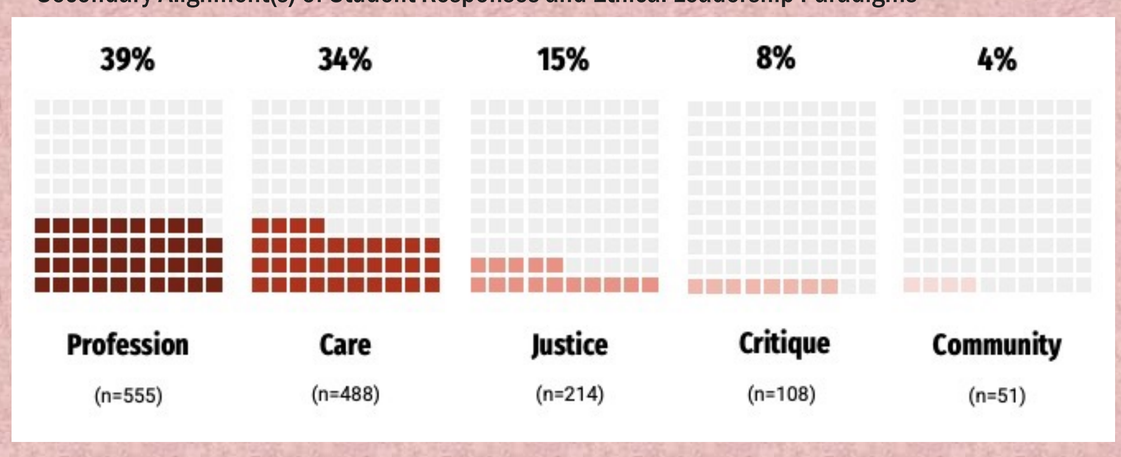
Findings

Student responses were **primarily aligned with the ethic of profession.** When considering both primary and secondary paradigms, students were still mostly aligned to the ethic of profession. Affective (values) coding revealed students' most prominent leadership values, beliefs, and attitudes. **V:** Candor, kindness, collaboration, diversity, transparency, communication, knowledge, obeying laws, and professionalism; **A:** Active leadership, teacher support, glows before grows, knowledge; **B:** Leaders are understanding, lead from the front, share their leadership, are empathetic and honest, work to develop teacher capacity, value parent involvement, and are student-centered.

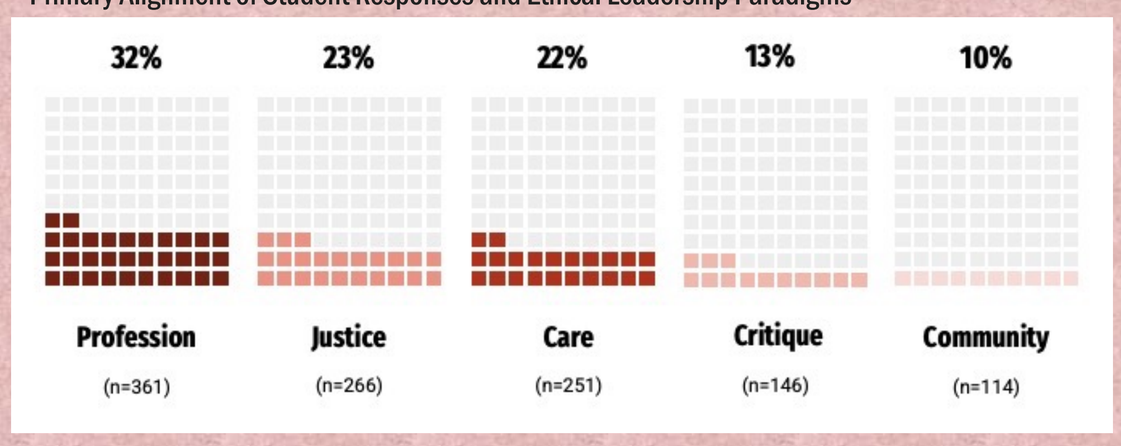
Overall Alignment of Student Responses and Ethical Leadership Paradigms



Secondary Alignment(s) of Student Responses and Ethical Leadership Paradigms



Primary Alignment of Student Responses and Ethical Leadership Paradigms



Example Student Responses

Profession: "Knowledge of available resources and knowledge that although it's uncomfortable, you're doing what's best for the student and keeping him safe."

Care: "Remaining sincere and honest with a genuine desire to help this educator grow."

Justice: "Holding students accountable equally."

Critique: "Transparency certainly helped me in this decision-making. Ensuring everyone knew what the process was and how we were making decisions made me feel good about the choices that were being made."

Community: "Include stakeholders to gather input. Allow for discussion. Remind everyone that the final decision will be based on the input and discussions held by the stakeholder reps."

Additional information:

Significance

Alignment with the ethic of profession and the ethic of care (65% overall) suggests they are basing actions on **students' best interest** and placing stakeholder **well-being** at the forefront of their decision-making. Aspiring leaders project a practice in alignment with the standards and expectations of their role, **leading for student success**, and creating **warm and caring school climates.** They are prioritizing **trust and building relationships** amongst the stakeholders, which seems ideal leadership practice, particularly now.

What's Next?

Simulated learning holds promise for providing students with **transformational learning opportunities** and instructors new **assessment and feedback mechanisms.** Additional research is needed to understand how their use as a pedagogical approach can contribute to the development of aspiring leaders' competences. In this study, students' responses revealed a broad range of conceptualizations of professional ethics and foreshadow inclinations to leadership that emphasizes **equity, anti-racism, and social justice.** The teaching of ethics can be a welcome addition to program courses and/or curricula. By teaching all paradigms and allowing students to explore the paradigms as they navigate personal and professional ethical codes, they will be better suited to address complex problems of practice with ethical implications once in service. **Future research will explore how specific competences change over time after prolonged engagement with course-embedded simulations.**

Contact: dm22w@fsu.edu; Follow @daniel_moraguez on X(Twitter)

Social and Information Dynamics in Financial Markets - A Social Finance Perspective

Project Outline

- Studied the roles of social and individual learning on outcomes of the Minority Game model of a financial market.
- Social learning occurs via agents adopting the strategies of their neighbours within a social network, while individual learning results in agents changing their strategies without input from other agents.

The Minority Game

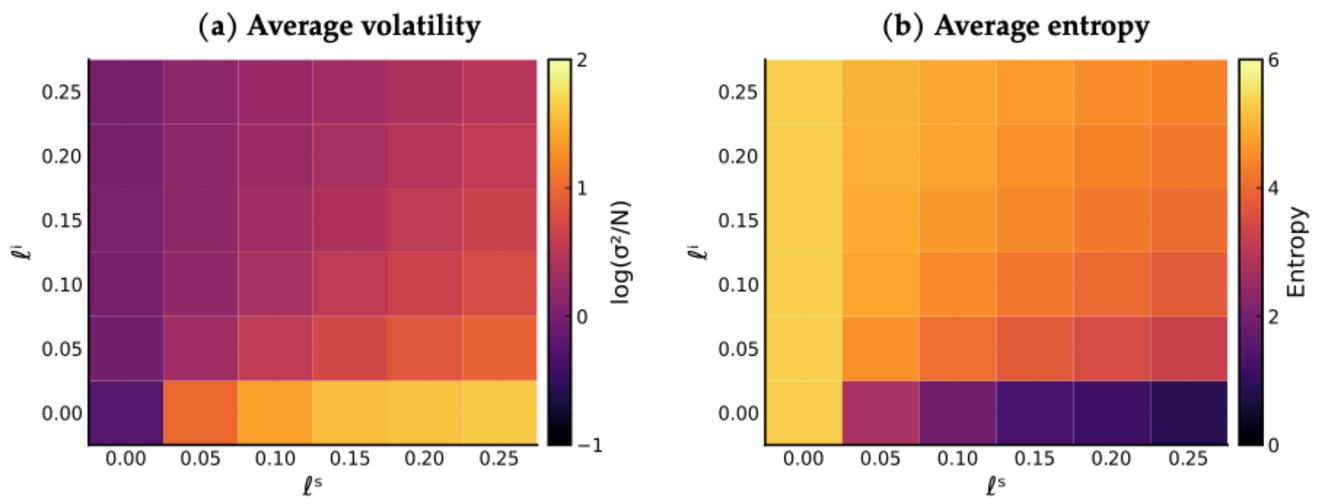
- N agents have S strategy tables, which are dictionaries with different combinations of memories of the last M winning actions as keys and recommended actions "buy" or "sell" as values.
- Whichever action is in the minority on a turn wins.
- Agents follow their strategy table that has won the most often playing over multiple turns.
- Though a simplified model, it can exhibit many qualitative behaviours of real markets.

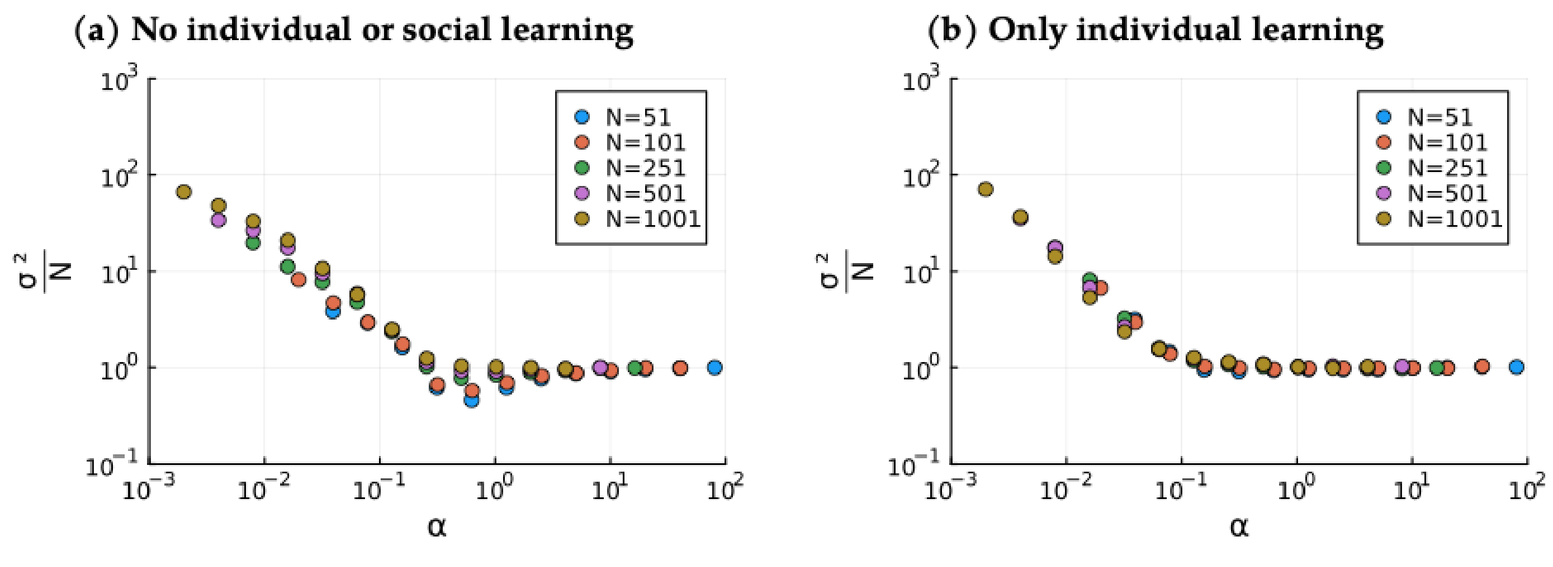
Efficiency in the Market

- The volatility is the time average variance of the attendance after each round of the game normalized by the population size, σ^2/N.
- It is an inverse measure of the efficiency of resource distribution in the game and a measure of the efficiency of the market. The lower it is, the more efficient the system.
- If it is greater than or less than one, the market is worse or better than a random toss of a fair coin.
- The population undergoes a phase transition as $\alpha = 2^M/N$ increases.

Results

- There is a correlation between high volatility, low entropy, and high social learning.
- Individual learning can mitigate the negative effects of social learning, since individual learning fosters strategy table diversity as measured by the entropy of strategy tables.





Results

- Without learning, there is a minimum volatility for intermediate α.
- There is no such minimum for individual learning. Volatility decreases as α increases and levels off at approximately 1. However, the decline is faster than when there is no such learning. Thus, for sufficiently low α, individual learning can result in a more efficient market.
- When there is only social learning, we observe a separation of the volatilities by population size N.

Summary

- Social learning can reduce market efficiency due to negative frequency dependent selection and loss of strategy diversity.
- Loss of strategy diversity can lock the population into a maximally inefficient state.
- Individual learning can rescue a population engaged in social learning or with low diversity from such inefficiencies.

Bryce Morsky, Dept of Mathematics, bmorsky@fsu.edu, preprint: https://arxiv.org/abs/2307.11846

Local rigidity of group actions on boundaries

Thang Nguyen

Florida State University

Introduction

The project studies how symmetric a geometric objects (*manifolds*) like circles and spheres are under perturbations.

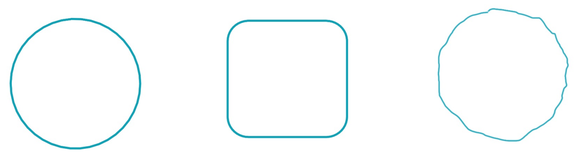


Figure 1. A circle with lots of symmetries and its deformations with less and less symmetries.

Generally, perturbations will make a nice manifold be less symmetric. The constraint to be imposed for the questions to consider are existence of a lattice action. This says, perturbed objects must have certain, not all but enough (from the word *lattice*), symmetry. If all perturbed manifolds are as symmetric as the original one, we call such a lattice action is locally rigid.

Objectives

We study how much symmetric a boundary manifold is under a perturbation. In particular, we have the following specific (long term) objectives:

1. **Objective 1.** Show that *actions of uniform lattices on Furstenberg boundaries* are *locally rigid* (or called stable) in continuous symmetry group (called homeomorphisms).
2. **Objective 2.** Show that *actions of non-uniform lattices on Furstenberg boundaries* are *locally rigid* in continuous symmetry group.
3. **Objective 3.** Show that *actions of uniform lattices on geodesic boundaries* are *not locally rigid* in continuous symmetry group.

Some more examples demonstrating objectives

Boundary manifolds consists of Furstenberg boundaries and geodesics boundaries. Furstenberg boundary is obtained by algebraic constructions while geodesic boundary is obtained from asymptotic geometry of another manifold. Some examples of boundary manifolds include:

- Circle S^1 as the infinity boundary, more precisely called geodesic boundary, of a plane. Suppose we are living on a flat plane. When we look at the horizon far away, the horizon looks like a round circle.
- Sphere S^2 as the geodesic boundary of a 3-space. Same situation as the example above, but now assuming that we are living in a universe of 3 dimensions. The horizon now is a round sphere. Each point on a sphere corresponds to a direction that our eyes looking to infinity.
- Generally boundary manifolds are arising as some structure *at infinity* of some other geometric objects.
- Boundary manifolds have lots of symmetry (compared to the manifold itself). For example, the circle has reflections and rotations as its symmetry. The set of rotations can be parametrized by the circle itself.

Examples of group actions:

- Each 2-by-2 invertible matrices maps directions in a 2-plane to directions, and thus maps the circle direction above into itself by smooth maps. We say the set of all 2-by-2 matrices acts on circle by smooth diffeomorphsisms.
- The subset of 2-by-2 invertible matrices with integer coefficients is a lattice subgroup of the set of 2-by-2 invertible matrices. We say, the lattice of integer matrices acts on the circles.
- We have similar examples for actions on sphere by considering the set of 3-by-3 matrices.

Results

Main Theorem [2]: *Actions of uniform lattices on projective spaces, and more generally on Furstenberg boundaries, are locally rigid in the space of homeomorphisms.*

An explicit, and new, example of our result is actions of groups of 3-by-3 matrices on the 2 dimension unit sphere in the 3 space is local rigid.

We also achieved partial results for Objective 3 for actions on spheres.

Comparison with existed results

Compared with results by Kanai [3], Katok and Spatzier [4], the actions above are locally rigid in the space of *smooth diffeomorphisms*. The space of smooth diffeomorphisms is much more restricted than the space of homeomorphisms. And the space of homeomorphisms is the optimal one for such a rigidity hold.

In an announced in progress work by Brown, Rodriguez Hertz, and Wang [1], the actions of all lattices, i.e. either uniform or non-uniform, are locally rigid in the space of smooth diffeomorphisms. Roughly speaking, a non-uniform lattice essentially has less elements than a uniform one. This announced result beats ours in term of covering non-uniform lattice cases, but ours beats theirs in term of the bigger perturbation space.

Methodology

General scheme: constructing *uniform hyperbolic* dynamical systems containing the information of the group actions. Perturbations of original action correspond to perturbations of a uniform hyperbolic dynamical system. Uniform hyperbolic systems are stable under perturbations by a Structural Stability Theory developed in the second half of last century.

Main difficulties to follow this general scheme:

- Since the perturbation space is larger, it is not possible to construct perturbed systems.
- Even the above difficulty is overcome, lack of smoothness will cause uniformly hyperbolicity and Structural Stability cannot be used, or even cannot be defined.

New ideas to overcome the difficulties:

- Constructing transverse foliations instead of dynamical systems.
- Using geometry on the large scale instead of analysis on the small scale to obtain a weak form of Structrual Stability.

Further research

Here is some further research in this project to pursue in the future.

- Complete Objective 2. That is to prove actions of non-uniform lattices are also locally rigid in the group of homeomorphisms.
- Investigate Objective 3 for larger classes of manifolds.
- Investigate Objective 1 and 2 for manifolds of the form product of boundary manifolds.

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"I want to be unbiased… but can I?"
Understanding the expectancies of bias reduction in interpersonal interactions

Irmak Olcaysoy Okten, Ph.D.
Department of Psychology

INTRODUCTION

- Most people possess biases that influence their interactions with others. Racial biases are among the most prevalent in the U.S. (Nosek et al., 2007). A substantial body of research in social psychology has aimed to reduce the impact of these biases on attitudes and behaviors in the past decade, yet many of these attempts were ineffective or weakly effective (e.g., Bezrukova et al., 2016).

- Past research has almost exclusively focused on increasing the *perceived value* of bias reduction to combat racial biases. Deriving from the Expectancy-Value models of motivation (e.g., Atkinson, 1957; Bandura, 1977), the current project systematically analyzes the role of another key factor in goal-directed actions: *positive expectancies* in bias reduction endeavors. Two forms of expectancies relevant to interracial interactions were examined here: self-efficacy expectancy (the expectancy that one can regulate their biases) and outcome expectancy (the expectancy that one's actions in an interracial interaction will be received positively by the targets of bias).

- **OBJECTIVES:**
  1. Creating a comprehensive, reliable, and valid measure of the three core motivational dimensions of bias regulation: egalitarian values, self-efficacy expectancy, outcome expectancy
  2. Showing that existing measures of bias regulation capture values more than expectancies
  3. Comparing the degrees of three motivational dimensions to identify the one(s) with the most room for improvement.

MEASURES

Bia Regulation Motives (BRM) Scale
- We constructed ten scientifically evidenced cases of bias in interracial interactions (e.g., student-teacher, patient-physician, suspect-police officer interactions). After reading each case, participants responded to three questions on the same 7-point scale (1: strongly disagree, 7: strongly agree):
  - It is important for me to be unbiased [in this scenario]
  - I would be biased [in this scenario] – *reversed coded*
  - [The person in this scenario] would perceive me as biased – *reversed coded*

Validation Scales
- Attitudes Towards Blacks (ATB) scale (Brigham, 1993)
- Internal and External Motivation to Respond without Prejudice (IMS and EMS) Scale (Plant & Devine, 1998)
- Should/Would bias discrepancy measure (Monteith & Voils, 1998)
- General Bias Expectancy Scale (Butz & Plant, 2006).
- Sociability Scale (Cheek & Buss, 1981) – for *discriminant validity*

Exploratory Measures
- Bias Awareness Scale (Perry et al., 2015)
- Social Desirability Scale (Stöber, 2001)

PROCEDURE

- Three hundred and four White participants from the U.S. (164 women, 133 men, seven non-binary; M_{age} = 43.61, SD_{age} = 14.34) finished the study on the Prolific survey platform.
- All participants completed the BRM scale, followed by all the validation and exploratory scales (individually randomized).

RESULTS

Construct Validity of the BRM Scale
- A factor analysis with varimax rotation confirmed the predicted three factors. Three motivational dimensions were clearly distinguishable.

	Factors (Motivational Dimensions)		
Example* Items	Egalitarian Values	Self-Efficacy Expectancy	Outcome Expectancy
It is important for me to be unbiased [in the given job activity]	**.728**	-.233	-.074
I would be biased [in the given job activity]	-.182	**.649**	.257
[The person in this job context] would perceive me as biased	-.070	.358	**.685**
It is important for me to be unbiased [in the given medical context]	**.623**	-.328	.082
I would be biased [in the given medical context]	-.245	**.768**	.160
[The person in this medical context] would perceive me as biased	-.076	.276	**.757**

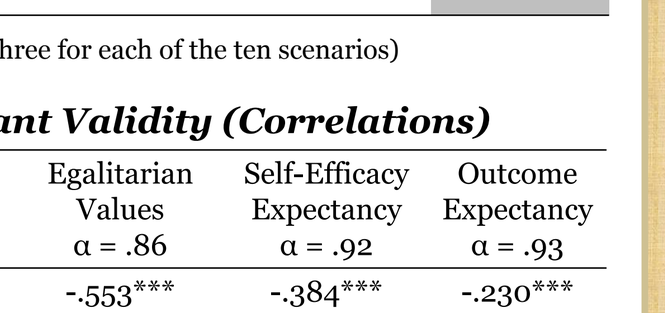
* The complete list included thirty items (three for each of the ten scenarios)

Convergent and Discriminant Validity (Correlations)

Validation Scales	Egalitarian Values α = .86	Self-Efficacy Expectancy α = .92	Outcome Expectancy α = .93
ATB (racist attitudes)	-.553***	-.384***	-.230***
IMS	.556***	.334***	.200***
EMS	-.153**	-.205***	-.081
Should	.620***	.427***	.172**
Would	.526***	.521***	.344***
General Self-Efficacy Expectancy	.433***	.362***	.208***
General Outcome Expectancy	.225***	.234***	.283***
Sociability	-.031	-.018	.084
Bias Awareness	-.019	-.324***	-.327***
Social Desirability	.117*	.199***	.272***

***p < .001, ** p < .01, * p < .05

Egalitarian values were significantly higher than both types of expectancies. Outcome expectancies were the lowest among the three dimensions (all ps < .001)



Note. Error bars indicate standard deviations

CONCLUSIONS & FUTURE DIRECTIONS

- Our new and validated measure of bias regulation motives revealed that White participants generally wanted to be unbiased toward Black people (high value). However, they still reported they might be biased (lower self-efficacy expectancy). And, even when they reported they would be unbiased, they considered that Black people might perceive them as biased (even lower outcome expectancy).
- Other (existing) measures of bias regulation captured values more than expectancies. Importantly, our results showed that there was more room for improvement of bias regulation expectancies than values. Thus, we aim to bring more attention to the understudied construct of expectancies.
- This study provided preliminary results that informed our recently submitted NSF grant proposal. The next steps include understanding the causes of low expectancies for bias regulation and helping perceivers effectively regulate their biases by addressing low expectancies.

Motivated Social Cognition Lab

Acknowledgements: FSU FYAP program, Ashby Plant, Martha Cooper

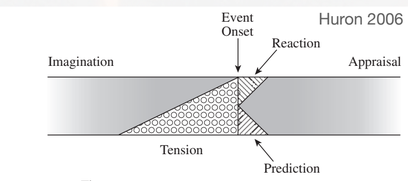
Contact our lab:
wwww.motivatedsocialcognition.com
@MotivatedLab

For materials use the QR code:

Where Words Belong:
Meter and Meaning in Greek Epic

- How can we use **computation** to explore **patterns of expectancy** in Greek epic? In what ways can **breaks** in normative patterns inform our **close reading** of poetry?
- Epic poets **disrupt** audience expectations by varying **metrical position** of words.
- Breaks in patterns can overlap and **mimic** the internal experience of characters, such as in the abduction of Persephone in the *Homeric Hymn to Demeter*.

***Hom. Hymn Demeter* 17–40**
Hades, Korê, and Demeter



	Tension	Reaction	Appraisal
…χάνε δὲ χθὼν εὐρυάγυια Νύσιον ἂμ πεδίον, τῇ ὄρουσεν ἄναξ Πολυδέγμων ἵπποις ἀθανάτοισι, Κρόνου πολυώνυμος υἱός.	—	X	mimetic
…ἴαχησε δ’ ἄρ’ ὄρθια φωνῇ, κεκλομένη πατέρα Κρονίδην ὕπατον καὶ ἄριστον.	^	XX	exceptionally mimetic
οὐδέ τις ἀθανάτων οὐδὲ θνητῶν ἀνθρώπων ἤκουσεν φωνῆς,	^	X	“not hearing voice”
…ἔτι δ’ ἥλπετο μητέρα κεδνὴν ὄψεσθαι καὶ φῦλα θεῶν αἰειγενετάων, τόφρα οἱ ἐλπὶς ἔθελγε μέγαν νόον ἀχνυμένης περ·	—	—	“expectation of mother”
ἤχησαν δ’ ὀρέων κορυφαὶ καὶ βένθεα πόντου φωνῇ ὑπ’ ἀθανάτῃ· τῆς δ’ ἔκλυε πότνια μήτηρ. ὀξὺ δέ μιν κραδίην ἄχος ἔλλαβεν,	≈	√…	thematic mimesis emotio-material affect audience-diegetic consonance

Next, **generalize** expectancy to word form, type, and pause; and explore **aesthetics of attention** in form and narrative.


Krater
Persephone Painter
c. 440 BCE
Attic
Metropolitan Museum
28.57.23

Stephen Sansom | FSU Classics | sasansom@fsu.edu

COLLAB PIANO podcast

Apple Podcasts Spotify

DR. NATALIE SHERER
Assistant Professor of Vocal Coaching & Collaborative Artist
Voice & Opera Area
FSU College of Music
collabpianist.com | nsherer@fsu.edu

Celebrating Musical Partnerships & Art Song in a Streaming-Centered World

CONTEXT

As a pianist, I proposed making recordings with singers of select *art songs*, defined broadly as musical settings of poetry composed for piano and voice, after detailed study and preparation. The FSU First Year Assistant Professor (FYAP) Award supported this work which culminated in the continuation of the *CollabPiano Podcast*—my chosen medium for sharing my analyses and recorded performances, along with curated interviews with fellow performers. This podcast celebrates collaborative pianists who specialize in making music with singers and instrumentalists.

PRIMARY GOALS

- Identify **relationships** between poetic and musical elements of select songs
- Discern how text-music relationships manifest in specific **artistic choices** within the musical partnership
- Create recorded **performances** of the songs with colleagues that tangibly apply/reflect those observations
- Release recordings via curated **podcast episodes**

TEXT PAINTING

Text painting refers to the specific ways a composer depicts/reflects the meaning of the text they are setting. Composers create a musical interpretation of the words, thoughts, atmospheres, emotions, and storytelling found in the text by their deliberate use of melody, harmony, rhythm, piano and voice interaction, texture, dynamics, articulations, and expressive directions. Observations of text-music relationships tangibly influence how pianists and singers collaborate in performance - this fueled my discussions with podcast guests. Musical excerpts are woven through the episodes to highlight details before the full performance is heard. This guides listeners to better understand the song and the specific performance insights shared by the musicians.

2. "'TIGER, TIGER' BY REBECCA CLARKE"

Dr. Marcía Porter (FSU Voice & Opera Area Coordinator) joins me as we share our recording of "Tiger, Tiger," composed by Rebecca Clark with text by William Blake. The text painting is palpable; the piano *is* the tiger in this song. We describe the musical building blocks that Clarke uses to create feline sounds as well as her departures into other textures to reflect the descriptions of the stars and the lamb that Blake mentions in this famous poem. Clarke was a prolific composer, but many of her pieces remain unpublished, so I wanted to highlight her work.

RESULTS

In addition to the research, analysis, preparation, rehearsal, and recording stages of the project, subsequent objectives included writing, producing, publishing, and promoting **three new episodes** for the CollabPiano Podcast:

Listen to SEASON 2 on SPOTIFY APPLE PODCASTS NATSCAST

NATSCast is the official podcast network of the National Association of Teachers of Singing, which provides quality resources for voice teachers and singers and has a growing membership of collaborative pianists.

1. "MEMORY AND PSYCHOLOGY IN HUGO WOLF'S MIGNON LIEDER"

Memory, psychology, and text painting intersect in Hugo Wolf's moving Mignon Lieder. This episode highlights four songs that tell the story of Mignon, a young girl in Goethe's novel *Wilhelm Meister's Apprenticeship*. It features a new recording of "Kennst du das Land?" by Dr. Sahoko Timpone (FSU Voice Faculty) and myself. How do you portray a character's inner world of turmoil and recollection? That's what I discuss with renowned pianist Martin Katz (Chair of Collaborative Piano at University of Michigan). Our detailed discussion of Mignon and analysis of how she is portrayed musically shows Wolf's mastery in many ways. Wolf captures the natural inflection of the German text with the rhythms in the vocal line. He uses modified strophic form which repeats musical material—ideal for depicting text with a refrain and constant switches from memories to the present moment. His piano textures, dynamics, and use of range help create the places and dramatic emotions described in each section as Mignon longs for home.

3. "SORROW AND ECSTASY: THE SONGS OF HENRI DUPARC"

This episode immerses listeners in the world of French composer Henri Duparc and includes recordings by singers Aria Minasian (mezzo-soprano), Megan Warburton (soprano), Taewon Sohn (baritone), Nicholas Music (tenor), and myself. In addition to sharing analyses of text-music relationships in select songs, the singers and I discuss the novel features of the recital we performed together of Duparc's complete songs. Duparc was a master at creating sensuous, lush soundscapes, but tragically stopped composing at the age of 37 and destroyed much of his work. We delve into Duparc's ability to musically portray the span of human emotions, from grief and rage to pure bliss, and how the piano embodies these as much as the voice.

BROADER IMPACTS/NEXT STEPS

There are currently very few podcasts centered on art song or collaborative piano. The intended audience includes pianists, singers, prospective FSU music students, and music appreciators. This podcast will foster better understanding of the collaborative piano field/repertoire, and this free, easily accessible medium can be listened to by a wide, international audience. Listeners can be reached outside of traditional performance venues, expanding the impact. Through performing, recording, and researching relevant repertoire, interviewing musicians, and crafting/sharing the *CollabPiano Podcast*, this project furthers my long-term goals to advocate for excellence in the collaborative piano field as a performer, promote art song (including historically under-performed composers), foster respect and equality between musicians, provide entertainment and enrichment to audiences, and increase audience satisfaction through creative performance approaches.

I anticipate that my work will garner interest from organizations like the International Keyboard Collaborative Arts Society, National Association of Teachers of Singing, Sparks & Wiry Cries (art song organization), and the Collaborative Arts Institute of Chicago, and I will pursue performance opportunities at their festivals and conferences. Developing these relationships will lead to enhanced prospects for future performances, external funding, collaborations, and recruitment of singers and pianists as an FSU ambassador.

"The Picture of Dorian Gray"
Composing and Publishing a New Work for Orchestra, Voice, and Dance

Daniel Smith, Assistant Professor
College of Fine Arts, Florida State University

Introduction

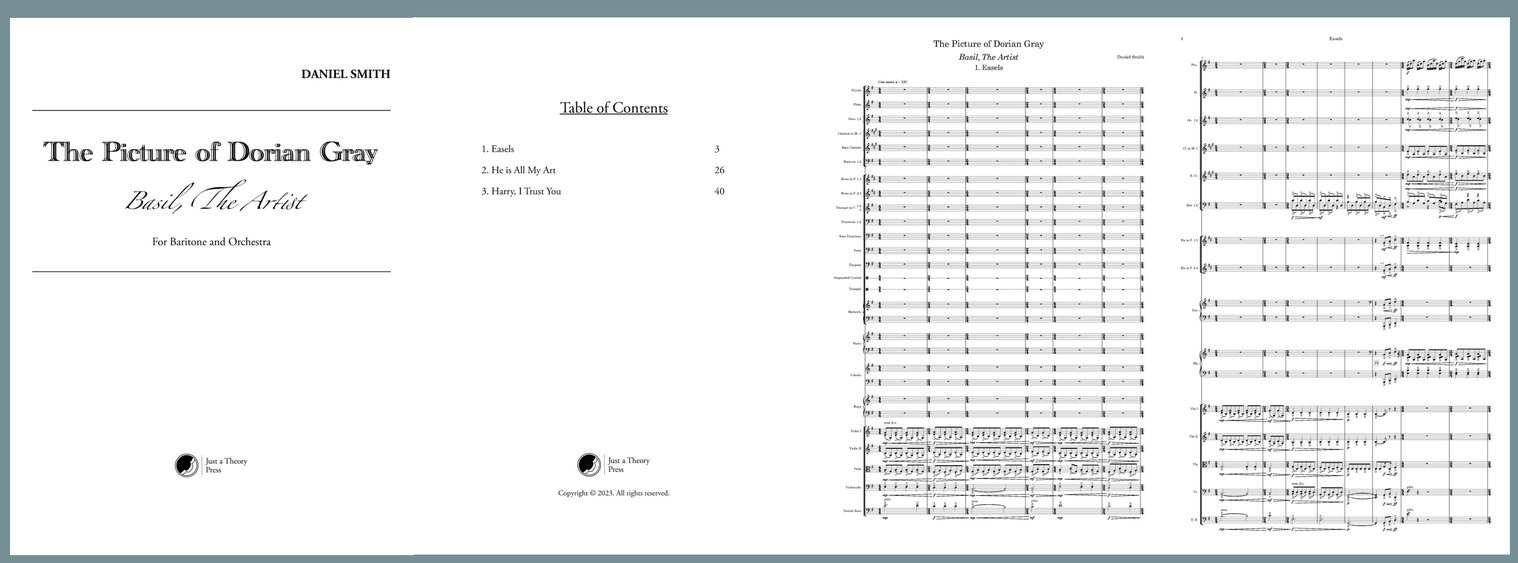
This project is the first stage in the development of a large-scale operatic and choreographic work based on Oscar Wilde's *The Picture of Dorian Gray.* The work eschews typical narrative structures. Instead, musico-choreographic "chapters" are designed to portray significant characters and themes from the novel, attempting to distill their essences into tableaux of music and abstract dance. Two versions of the work are being generated. One is for orchestra, voice, and dance. The other is for piano, voice, and dance. This allows for performance possibilities from entities with large or medium production budgets.

During this project period, two versions of the first "chapter," titled *Basil, The Artist,* were created. In them, Basil Hallward, the character who paints the fateful portrait of Dorian, is depicted in three movements. The first movement, "Easels," begins instrumentally and gradually introduces a choreographic element. It seeks to convey a sense of purity and passion that is foundational to Basil's character. The second movement, "He is All My Art," adds voice and focuses on the deep adoration and connection Basil feels toward Dorian. The third movement, "Harry, I Trust You," is brief and portends darker thematic ideas related to mistrust and loss of innocence.

Musical scores for both the fully orchestrated version and the piano version were composed. The materials were edited and published. A soft premiere of the piano version was performed at Texas A&M University. Subsequently, the music to this version was recorded at Baylor University.

Results

Excerpts from musical score of orchestral version


DANIEL SMITH

The Picture of Dorian Gray

Basil, The Artist

For Baritone and Orchestra

Just a Theory Press

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3. Harry, I Trust You 40

Just a Theory Press

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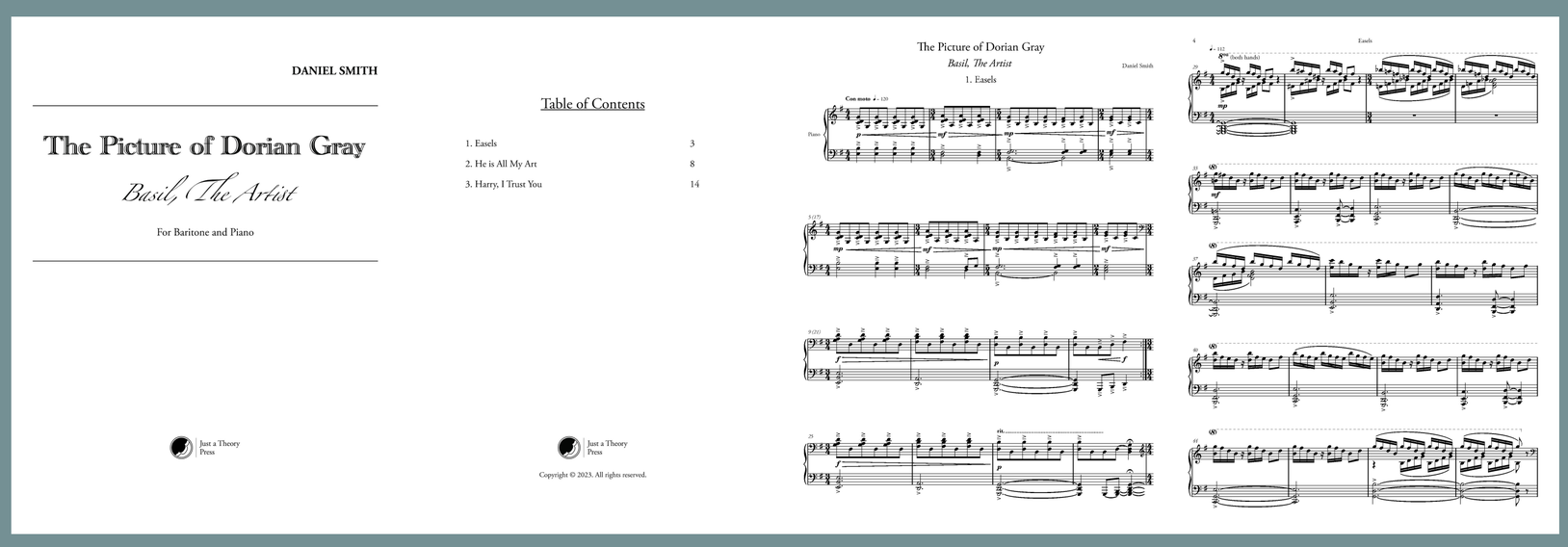
The Picture of Dorian Gray
Basil, The Artist
1. Easels
Daniel Smith

4 Easels

Excerpts from musical score of piano reduction


DANIEL SMITH

The Picture of Dorian Gray

Basil, The Artist

For Baritone and Piano

Just a Theory Press

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Just a Theory Press

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The Picture of Dorian Gray
Basil, The Artist
1. Easels
Daniel Smith

4 Easels

Link to video of performance at Rudder Auditorium, Texas A&M University

Link to video of recording session at Roxy Grove Hall, Baylor University

Future Direction

Presently, Just a Theory press, the publisher of the work, is in discussion with select opera companies, dance companies, and choreographers about future performance opportunities of this "chapter" as well as potential commissions for the remaining "chapters." In all, the work is intended to consist of eight to ten "chapters" and have a running time of approximately two hours. It is anticipated that the remainder of the work will be created over the next two to three years.

Project Team Members

Composer/pianist – Daniel Smith, Florida State University
Baritone – Mark Diamond, Baylor University
Choreographer/Dancer/Painter – Ben Howard, Florida State University
Recording Engineer – Carlos Monzón, Baylor University
Videographer – Jennifer A. Petuch, Texas A&M University
Engraver – Nathan Thatcher, Independent Contractor
Publisher – Joshua Devries, Just a Theory Press

COCOA IN THE DARK:
FILM AS A SITE TO MOBILIZE CHANGE

"Our 2023 world looks drastically different than our 2018 reality."

ISSUE

Aware the film lacked surprise and crystalized originality, *Cocoa in the Dark* sat on a hard drive as the world around it shifted. Though **written and shot in 2018**, it was never completed nor released. Unfortunately, as is the case with systemic injustice, the film's message grew more relevant as time passed. Our **2023** world looks drastically different than our 2018 reality.

How we perceive safety, what we prioritize, even mundane things like how we greet each other have completely changed. In a "post-covid," #MeToo, BlackLivesMatter, Anti-Racism era, a film about a false rape accusation (though based on actual events) needed to be re-imagined if it were to respond to our current moment with care.

LOGLINE

The captain of the debate team makes high school and fatherhood look easy until his life is forever changed after pleading guilty to a crime he didn't commit.

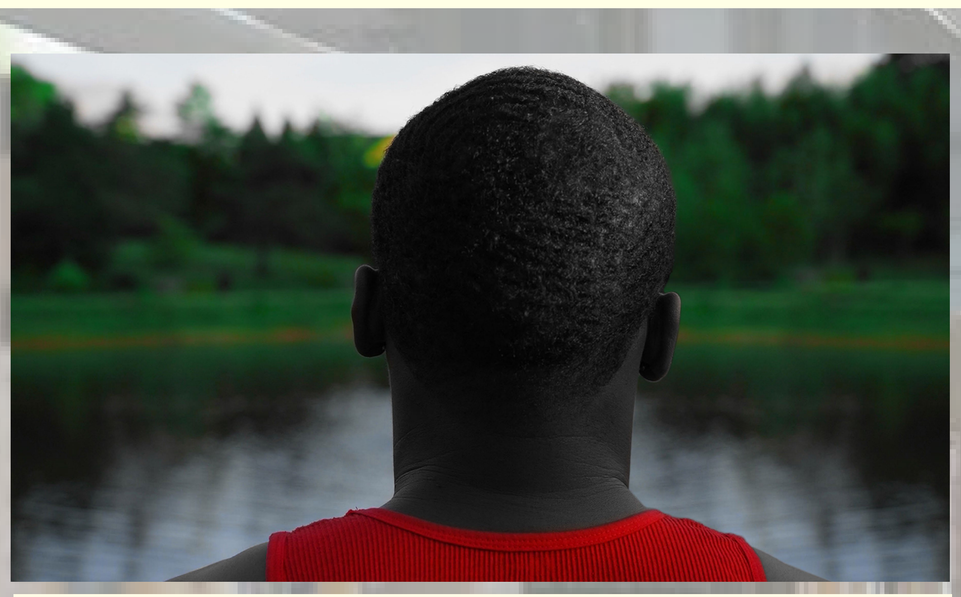


Image 1. Originally photographed by P.I., this key art required 3 additional artists to complete.

GOALS

Editing was the primary creative activity undertaken during the project period. Though raw in its appearance, the film was ready for the final stage of post-production. The FYAP grant gave me concentrated time to usher the film to its final iteration as well as recruit specialized talent to finalize various aspects of the film. FYAP also assisted with licensing fees for publication of copyrighted material and made two working sessions in Rochester, NY possible.

Outside of **music composition**, additional elements crafted and subsequently tested were **sound design**, **color correction** and **rendering**, foley (**sound effects**) creation, and final **picture editing**.

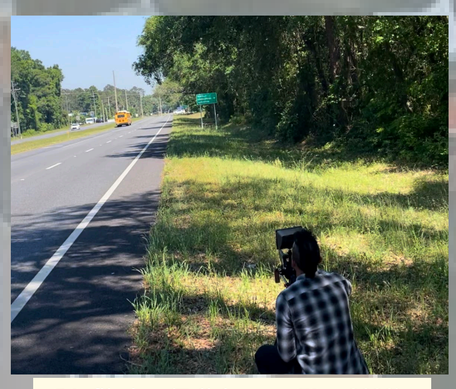
DISCUSSION

Film editing demands hundreds of hours, in general. The summer and fall of **2022** was dedicated to gathering additional footage, identifying creative solutions for plot inconsistencies, and re-editing. Arriving to the pre-summer **2023** edit took considerable time. Yet, much more work was required. While the most critical benchmarks were met, May, June, and July were devoted to sharpening the work and bringing the film to completion.

Large studio projects devote full teams to just one area (e.g. sound design). **Independent films**, such as *Cocoa in the Dark*, require considerably more labor from just a few artists. Through FYAP, I devoted the necessary 8+hrs a day to editing and guiding specialized talent.

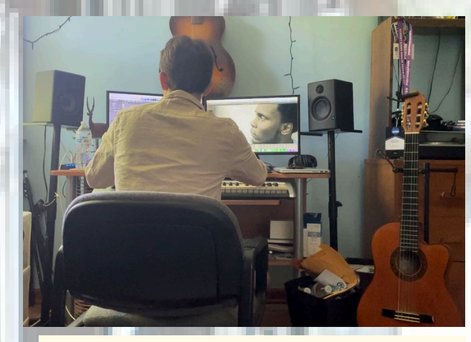
P.I. filming (Atlanta, GA – 2018).

P.I. filming (Gainesville, FL – 2022).



P.I. filming (Tallahassee, FL – 2023).

P.I. filming (Tallahassee, FL – 2023).



Composer Andrew Ragan reworks score.

CREATIVE ACTIVITIES

Colorist Wen Tong samples a look for Act I.

"…reveals my supreme goal as a storyteller – to use art as a site to mobilize change."

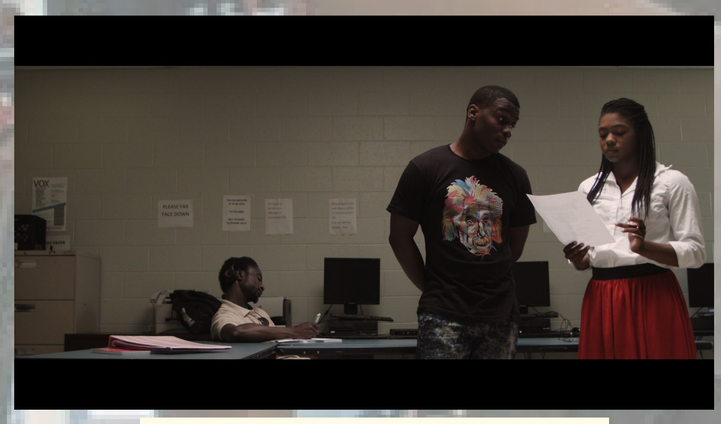


Image 2. Final rendered look.

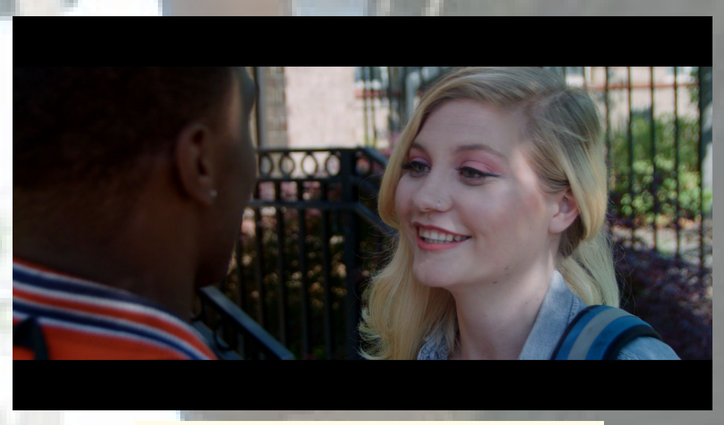


Image 3. Final rendered look.

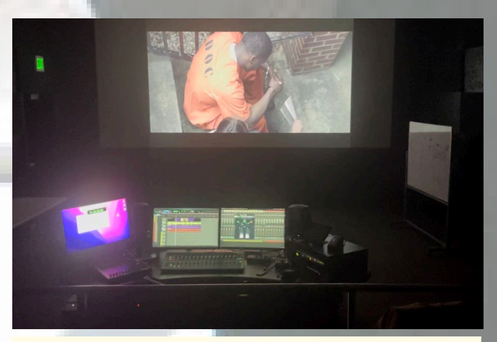


Image 4. Quality check (QC) in sound stage.

"u guys were amazing to watch to only have 3 crew members! an has incredible talent, and the way he works with the cast and crew inspiring to watch!"

- Paul "C.O. Lassiter" Rossi

BROADER IMPACTS

Inspired by actual events, the film follows an 18 year old kid who navigates fatherhood, high school, then eventually a 7-year prison sentence for a crime he didn't commit. The film shines a light on the **U.S. criminal justice system** and how it grossly fails the working poor and most egregiously, people of color.

In addition to the criminal justice theme that binds the film, other threads emerge. *Cocoa in the Dark* is also about a strained relationship between a father and a son. It is about a teenager who attempts to navigate fatherhood and youth. It is about the social systems that affect our lives. Anti-Racism now puts into focus how systemic racism affects the working poor. The film presents the reality of this sometimes opaque topic.

CONCLUSION

Creative research is demonstrated through my work as a filmmaker, theater-maker, actor, writer, and director. *Cocoa in the Dark* embodies nearly every aspect of my research agenda. More urgently, however, this film speaks to **an issue devastating Black spaces**.

The sharing of this work supports my long-term research goals as an artist-scholar and simultaneously reveals my supreme goal as a storyteller – to use art as a site to mobilize change.

SCAN TO LEARN MORE

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Competencies for Assistive Technology Instruction and Skills

Background

Assistive technology

- Powerful tool for providing students with visual impairments access classrooms.
- Only 40% of students with visual impairment have access to assistive technology (Tuttle & Carter, 2022a).
- Teachers express a lack of confidence and resources for instruction (e.g., Griffin-Shirley et al., 2004).
- Current literature primarily focuses on technology used within interventions not how students are being prepared to use technology (Tuttle & Carter, 2022b).

Aims

The goal of the project was to develop identify a comprehensive list of technology skills within a developmental framework for students with visual impairments. The project was guided by two research questions:

- How should teachers of visual impairment approach teaching assistive technology to students with visual impairments?
- What digital competencies do students with visual impairments need to be prepared to participate in general education classrooms and future careers?

Methods

- I recruited 39 professional experts
- Utilized a Delphi method (Imig & Imig, 2007), which leverages professional consensus
- Experts engaged in 3 rounds of feedback
  - guided the development of the framework regarding the way skills are covered (e.g., teach technology within a specific task or a developmental sequence)
  - Compiled list of competencies
- I evaluated the list with a criterion of 80% for inclusion in the results of the study.

Results

- Experts identified 295 technology skills students with visual impairments know.
- Skills had a unique consideration for visual impairments, with a general recommendation for mastery of the same technology skills as their sighted peers
- Experts emphasized covering skills by related task and had a high level of agreement on the structure of presenting skills.
- There was strong consensus for the content covered in skills, but diverting opinions on when and what order to cover them

Structure of of Competency Framework

Task –The purpose in which students were using the devices. For example, sending an email, creating a presentation, engaging in recreation.

Developmental sequence – Ordering of skills so that prerequisite skills come before more advanced skills.

Modality –Grouping skills by the learning media they rely upon. For example, grouping skills related magnification features together vs. skills that rely on refreshable braille.

Next Steps

- Results will guide the development of a technology curriculum focused on developing a subsection of the skills identified.
- Resulting work will serve as a basis for applying for an Early Career Development and Mentoring Grant from IES (84.324B).

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Griffin-Shirley, N., Koenig, A. K., Layton, C. A., Davidson, R. C., Keun Siew, L., Edmonds, A. R., & Robinson, M. C. (2004). A survey of teachers of students with visual impairments: Responsibilities, satisfactions, and needs. *RE:view, 36*(1), 7–20. https://doi.org/10.3200/REVU.36.1.7-20

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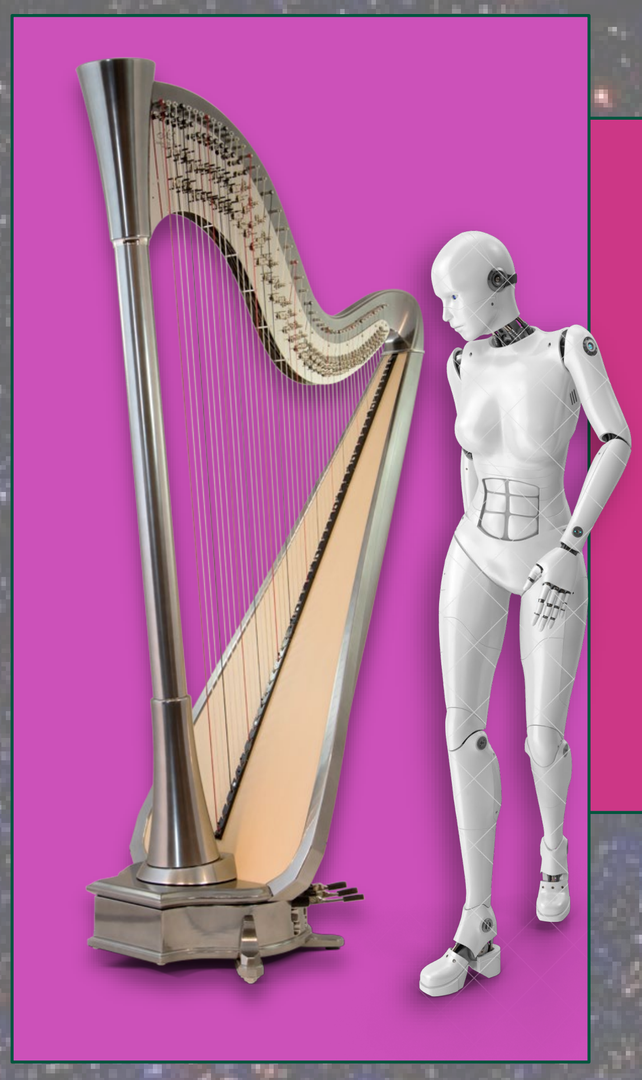

Cyborg Aesthetics: Feminism, Technology, and the Electroacoustic Harp

introduction

- The Western acoustic pedal harp has been historically stigmatized as a woman's instrument due to its prominent role in middle/upper-class domestic spaces and the "frivolous" nature of its repertoire from the 18th and 19th centuries. However, the pedal harp's fundamental methodologies, aesthetic codes, and performance practices have been, in fact, established by an elite group of professional male harpists.
- Existing scholarship on gender and the harp (Gross 1994, Yeung 1998, Lane 2022) advocates a post-gender framework to legitimize the harp in the classical music industry, overlooking gender as a critical factor in the instrument's aesthetic formation.
- This research-creation project turns to the electroacoustic harp as a potential site for a new (techno)-feminist aesthetic, or a **cyborg aesthetic**. The inclusion of technology is vital as it facilitates crucial philosophical departures in conceptualizing gendered embodiment, creative autonomy, and identity.

methods

- Donna Haraway's cyborg (1983) as theoretical basis for the electroacoustic harp as a hybrid human-machine sounding body.
- Qualitative analyses of music by electroacoustic harpists Zeena Parkins, Mary Lattimore, and Lara Somogyi.
- Application of feminist and queer phenomenologies to certain sonic phenomena, e.g., electronic feedback, noise, repetition, and organic form.
- Hands-on work with an electroacoustic harp to study the impact of amplification and electronic effects on the PI/performer's aural/gestural embodiment.

Equipment used:
Schatten CH-3 Harp Pickup with Integrated Preamp

outcomes

- Published one peer-reviewed article on the aesthetic philosophy of the electroacoustic pedal harp in *The American Harp Journal* (Summer 2023).
- Published one public interest article on post-structural philosophy and digital technology in artistic practices in *The Collective* (August 2023).
- Commissioned two women composers (Liliya Ugay, Caroline Lizotte) to write works for flute and electroacoustic harp in early 2024.

future research/creation

- Continuing qualitative research on the works of female experimental electronic musicians and composers, to learn new techniques and approaches to electronic sound.
- Applying the above to develop unique electroacoustic harp arrangements of vocal music inspired by the Virgin Mary, with the goal of creating an LP-length recording in 2025/26.
- Creating electronics for "ASMR Girlfriend," a concert-length narrative program for amplified harp and mixed media.
- Premiering the two commissioned works by Ugay and Lizotte in late 2024.

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FairCod: A Fairness-aware Concurrent Dispatch System for Large-scale Instant Delivery Services

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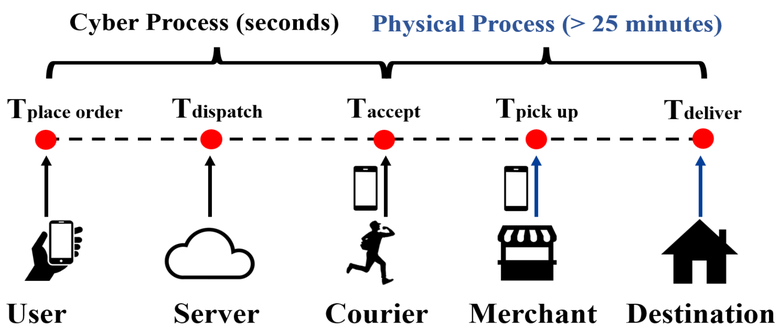
Introduction

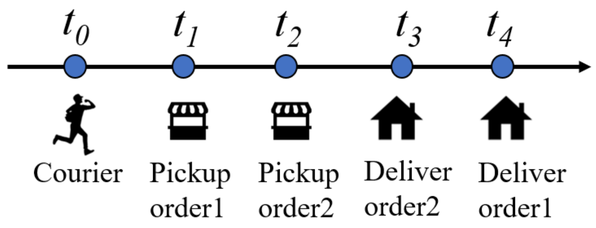
Background

Instant delivery (e.g., UberEats, Instacart, and Eleme), as an emerging paradigm to provide timely door-to-door delivery services, has rocketed up in recent years. A unique characteristic of instant delivery services is the concurrent dispatch mode, where (i) one courier usually simultaneously delivers multiple orders, especially during rush hours, and (ii) couriers can receive new orders when delivering existing orders. Most existing concurrent dispatch systems are efficiency-oriented, which means they usually dispatch a group of orders that have a similar delivery route to a courier. Although this strategy may achieve high overall efficiency, it also potentially causes a huge disparity of earnings between different couriers. To address the problem, we propose to design a Fairness-aware Concurrent dispatch system called FairCod, which aims to optimize the overall operation efficiency and individual fairness at the same time.

Instant Delivery Services



Concurrent Dispatch System



(i) Couriers simultaneously delivers multiple orders.

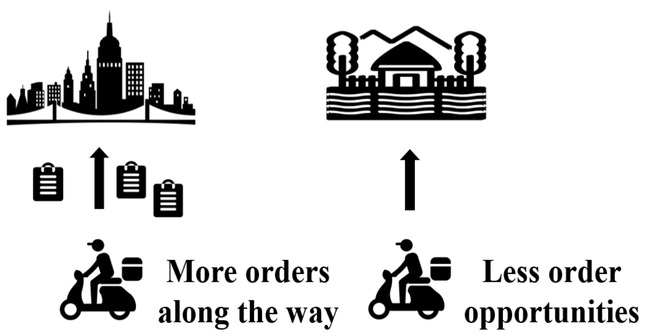
(ii) Does not follow the first-come-first-served principle.

Motivation

Unfairness in Concurrent Dispatch

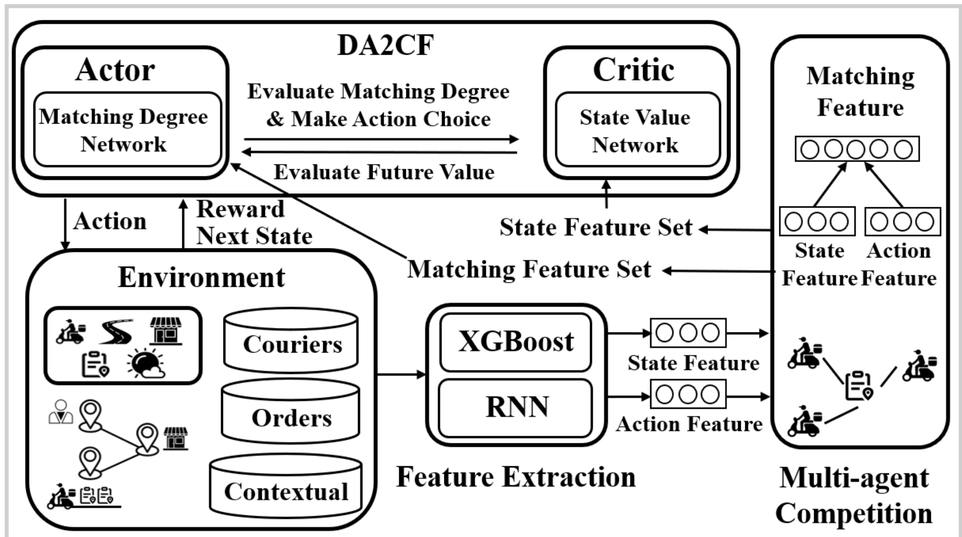
Matthew Effect in Couriers' Income:

The rich get richer and the poor get poorer

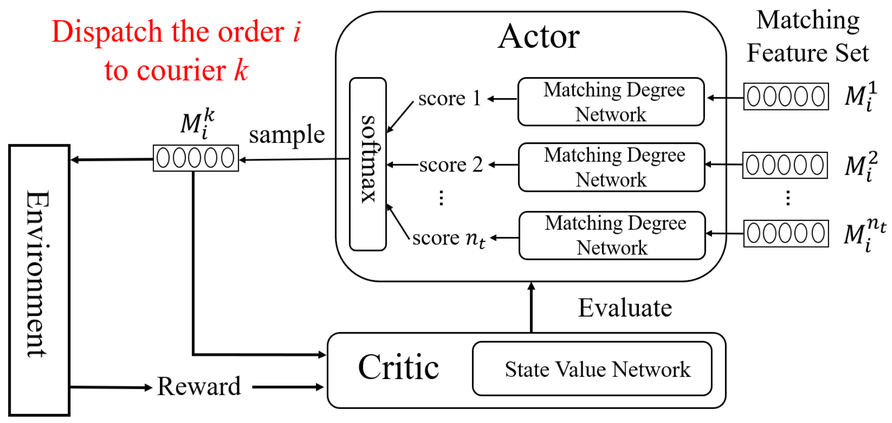


Design

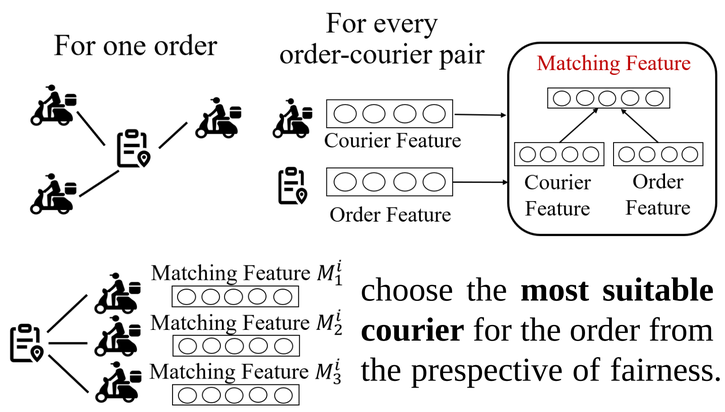
FairCod Framework



DA2CF Algorithm



Multi-agent Competition Module



choose the **most suitable courier** for the order from the prespective of fairness.

Conclusion

We designed a fairness-aware concurrent dispatch system called FairCod to balance the **overall system efficiency** and **courier fairness** with a core algorithm called DA2CF, which includes an Actor network combined with a multi-agent competition mechanism to make order dispatch decisions and solve the problem of dynamic action space, and a Critic Network to evaluate the dispatch decision effectiveness from a fairness perspective. We implement our model based on the datasets from a real-world instant delivery platform, which includes 36.38 million orders from 42,000 couriers. Extensive experiment results show that our FairCod **improves courier fairness without sacrificing the overall system benefit**.

Scan me to learn more!

Evaluation

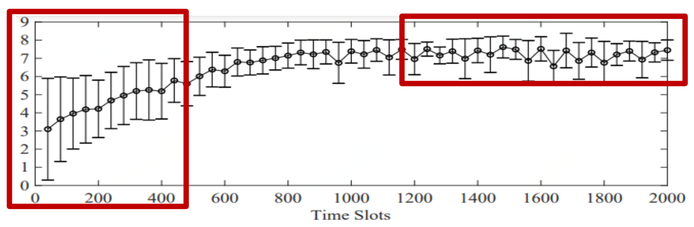
Fairness Definition

Proportional Fairness: Most Couriers want their earnings to be proportional to their working hours.

$$\frac{\text{Earnings}}{\text{Working Hours}} = \text{Profit Efficiency}$$

Courier Fairness =

The Variance of Courier's Profit Efficiency



Experiment Results

Method	Overall System Benefit		Courier Unfairness
	$mean_{eff}\% \uparrow$	$odrate\% \downarrow$	$var_{eff}\% \downarrow$
RD	100.0	100.0	100.0
SD2[23]	102.1	79.6	425.8
RGD[30]	105.5	43.9	372.5
DQND[17]	105.5	43.5	242.5
DDQN-as[28]	107.6	30.4	120.5
AC-bgm [7]	107.0	35.1	108.9
FairCod-0	107.6	30.1	126.5
FairCod-0.2	107.4	32.0	106.4
FairCod-0.4	**107.9**	**27.7**	**70.7**

Supporting Optimal Aging through Research: Project SOAR

Questions:

Will an adapted scale of abuse, maltreatment and neglect (AMN) better capture AMN in Sexual and Gender Minority (SGM) populations ages 50 and older?

What are provider perspectives about screening for AMN in SGM and people living with HIV?

Highlights:

- Novel Scale: 86.14% of participants indicated as experiencing AMN.
- Vulnerability to Abuse Scale: indicated 74.26% as being at risk for AMN

Table 1. Preliminary Univariate Summaries in a Sample of Sexual and Gender Minority People Ages 50 and Older (n=101)

Variable	Mean	Standard Deviation
Age	59.07	6.08
	N	**%**
Sexual Identity		
Straight/heterosexual	2	1.98
Gay	72	71.29
Bisexual	16	15.84
Pansexual	4	3.96
Queer	7	6.93
Gender Identity		
Cisgender man	42	41.58
Cisgender woman	30	29.7
Transgender man	11	10.89
Transgender woman	11	10.89
Non-binary	4	3.96
Another identity	3	2.97
Ethnicity		
Latino/Hispanic	86	84.15
Non-Latino/Hispanic	15	14.85
Race		
American Indian/Native American	4	3.96
Asian	4	3.96
Black or African American	37	36.63
Native Hawaiian or Pacific Islander	2	1.98
White	48	47.52
Another Identity	5	4.95
Multiple Races	1	0.99
Novel Maltreatment Measure		
None	14	13.86
At least 1 form	87	86.14
Vulnerability to Abuse Screen Scale		
None	26	25.74
At least 1 form	75	74.26

Next Steps:

- Currently at 30% of planned data collection for quantitative arm and 24% of qualitative arm. Will finish recruitment before November.
- Drafting an R-series submission for a follow-up study with the National Institutes of Health.

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