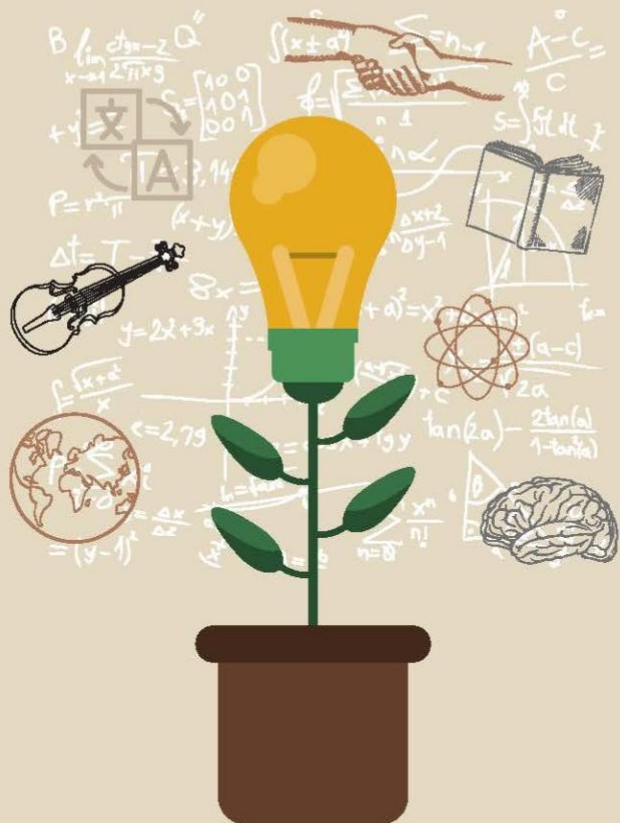


BOSTON UNIVERSITY KILACHAND HONORS COLLEGE



innovation & resilience

advancing knowledge through adversity

7th Annual Senior Keystone Symposium
April 25-26, 2020

*This symposium and booklet are
dedicated to the Class of 2020.
Your resilience is a gift, and your
ability to adapt and innovate during
a time of uncertainty inspires us all.*

Saturday Morning Schedule

9:00 am to 11:00 am

	Room A <i>Slide Presentations</i>	Room B <i>Poster Sessions</i>
9:00	Zachary Sager	Miyu Niwa
9:15	Zara Ahmed	Noah Conley
9:30	Johanna Wefes-Potter	Macella Molenari
9:45	Jessica Thai	Kaitlin Ragosta
10:00	Bayley Connors	Zachary Bachrach
10:15	Elizabeth James	Frances Gould
10:30	Abigail Horgan	Kimberly Eberenz
10:45	Erin Callahan	Elisabeth Palczynski



Saturday Evening Schedule

6:00 pm to 8:00 pm

Room A	Room B	Room C
<i>Slide Presentations</i>	<i>Slide Presentations</i>	<i>Slide Presentations</i>
6:00 Macken Murphy	Guy Jackson	Audrey Wack
6:15 Elyse Olesinski	Mackenzie Hall	Jacqueline Rayfield
6:30 Serene Bahi	Elias Kastritis	Tatiana Kovalsky
6:45 Julia Rowley	Anna Bottrell	Chloe Chibeau
7:00 Vindhya Kuchibhotla	Lucy Stowe	Sara Mack
7:15 Catherine Della Santina	Kabita Das	Daniel Burke
7:30 Normandie Essig	Sarah Maggipinto	Victoria Momyer
7:45 Michael Grinshpun	Caroline Jens	Sofia Koyama



Sunday Afternoon Schedule

11:00 am to 2:00 pm

Room A

Slide Presentations

11:00	Carina Terry
11:15	Justin Messmer
11:30	Gabrielle Miller
11:45	Jamie Clark
12:00	Misty Ouyang
12:15	Sarah Golden
12:30	Harshal Patel
12: 45	Anna Spier
1:00	Wiley Hundertmark
1:15	Ramya Vemulapalli
1:30	Mats Najberg
1:45	Glenn Korman

Room B

Poster Sessions

Joanna Wagner
Gabriel Lubbock
Emily Blaum
Anu Khanna
Antonia DeBianchi
Taylor Hazlett
Chance Rogala
Cameron Hill
Antranig Kechejian
Ina Joseph
Elizabeth Kotsalidis

2:00 – 2:30 PM CLOSING REMARKS & A TOAST TO THE CLASS
OF 2020



Keystone Project Abstracts



Patient-Provider Relationships in Asian and Hispanic Americans

Zara Ahmed

SAR Health Science

The goal of this research project is to learn more about patient-provider relationships in racial minorities in America. Generally, the term “patient-provider” relationship refers to how well the patient and medical care provider trust, communicate, and overall relate to each other. There has been little research on Asian and Hispanic Americans and their relationships with their medical providers. This is an important area of research to consider because without knowing about any differences, there could be Americans that might be experiencing less positive experiences with their providers without public health and medical officials knowing. The specific question is: how does the patient-provider relationship look for Asian Americans and Hispanic Americans? This data was collected quantitatively via an online survey. This data will inform the research question by reviewing the responses and reporting any trends and significant findings. Since these racial minorities and their relationships with their providers have yet to be explored academically, this data can be used as a starting point for looking further at Asian and Hispanic Americans and their experiences with the medical system in this country. Future research in this field can explore comparisons between different patient populations, provider perspectives, or in-depth evaluations of experiences.



Smart Oil

Zachary Bachrach

ENG Computer Engineering

This project enables homeowners to monitor their electric energy consumption and costs. Currently, 5.7 million homes use oil for heating, yet smart meter technology does not exist for heating consumption. The residential oil monitor developed in this project is intended to offer consumers a means to audit and to regulate their energy consumption for household oil-based heating systems using remote sensing and data collection. There is no built-in automated mechanism for tracking oil use and other related factors like efficiency in most homes; oil companies can, at best, estimate consumption to determine the schedule for deliveries, whereas customers can only assess how much oil remains via glass panes on the tank itself. It is difficult for users to make informed financial and environmental decisions with regards to heating their homes without simpler access to and more comprehensive data about their equipment and its operation. Additionally, it is important to most efficiently utilize heating oil in homes until the switch to alternative energies becomes ubiquitous. Given the present need for more intelligent oil heating systems, the project delivers a functional sensing and monitoring architecture ready for installation in a single-family home.



Agricultural antibiotic use and the spread of antibiotic resistance: a review

Serene Bahi

CAS Biology, Specialization: Neurobiology

The *Review on Antimicrobial Resistance* in 2016 estimated that 700,000 annual deaths can be contributed to resistant infections, a figure that they predict will increase to 10 million by 2050 if antibiotic use goes unchanged. As antibiotic resistance becomes an increasing threat to the world's population, the need for effective antibiotics becomes more urgent. The continued misuse of these critical antibiotics in agriculture has been demonstrated to be a source and major contributor to the prevalence of resistance. It is estimated that 70% of the antibiotics produced in the U.S. are used in agriculture as a growth promoter for livestock (Mellon et al., 2001). Since the introduction of antibiotics to animal feed, there has been a correlative increase in antibiotic resistance in bacteria that commonly cause food poisoning and that cause more serious infections. Despite an overwhelming amount of evidence that resistance emerging from agricultural antibiotic use poses a threat to humans, this issue remains controversial due to the meat industry's fear that they will not be able to meet production demands without antibiotics. The need for immediate legislative action is clear, and the lack of progress by federal organizations across the globe calls for consumer action. Consumers need to shift away from dependence on animal products, which will both decrease their individual risk of exposure to contaminated products and force the meat industry to decrease or discontinue this misuse of antibiotics.



The Role of Interleukin-2 in Autoreactive T Cell Responses

Emily Blaum

CAS Biology, Specializations: Cellular Biology, Molecular Biology & Genetics

The adaptive immune system consists of specialized cells that are responsible for our body's reaction against foreign pathogens. As part of an adaptive immune response, T cells are able to recognize and attack specific pathogens with their unique T cell receptors. Vital to T cell functioning is the protein signaling molecule Interleukin-2 (IL-2). IL-2 was initially discovered as a growth factor for T cells, signaling their proliferation and differentiation into specialized T cell subtypes. Current therapeutic efforts strive to use IL-2 derived therapy to combat T cells that attack the body's own cells, in the case of autoimmunity. The purpose of this investigation was to test the functioning and outcomes of a novel IL-2 knockout mouse model; using a retroviral transfection protocol, IL-2 deficient T cells were generated from non-obese diabetic (NOD) mice, an established model to study the autoimmune disease, Type 1 Diabetes (T1D). These IL-2 deficient T cells were injected into mice devoid of adaptive immune systems to understand the role of a reduced IL-2 environment on autoimmune disease development. Ultimately, these experiments show that even with modestly reduced IL-2 environments, T cell populations can be altered to favor autoimmune phenotypes. The generation and success of this novel IL-2 knockout mouse model suggests its further use for understanding the role that IL-2 plays in modulating autoreactive T cells.



Thick Moral Terms and Expressivism

Anna Bottrell
CAS Philosophy

Expressivism is the philosophical theory that claims that ethical statements are neither true nor false, but present a moral expression from the individual. This claim is to be disputed on the grounds that language is largely governed by what is coherently understood by the listener and therefore actually communicated. One's personal moral beliefs cannot be communicated if they go against the ethical values that are already embedded in the way that the English language discusses certain topics. This language that both describes and cannot help but communicate default ethical information is called ethically thick language. This does not mean that one cannot help but take certain ethical stances in an argument, because many arguments have premises that override the ethical sway of individual terms. However, the moral meaning of these individual thick terms must be communicated and also is inextricably tied with the descriptive meaning of the terms so as to make them unable to be separated in their use. Overall, this discussion of thick terms challenges whether ethical statements are separate from statements that are true and false by showing that statements often must be both descriptive and therefore factual as well as ethical, no matter the choice of the individual.



Conflict and Munitions Pollution in the Co-Selection of Heavy Metal and Antibiotic Resistance

Daniel Burke

CAS Biochemistry & Molecular Biology

Prolonged conflict and continued infrastructural decay in Iraq and Syria propagate a humanitarian crisis that threatens the healthcare of vulnerable populations, most notably in the proliferation and diversification of multidrug resistant (MDR) bacterial infections. Poor antibiotic stewardship, destruction of medical infrastructure, and a rise in traumatic injuries has had a synergetic effect on the emergence of MDR infections amongst casualties in Iraq and Syria. *Acinetobacter baumannii* and *Klebsiella pneumoniae* are pathogenic, Gram-negative bacteria associated with infections of the respiratory tract and traumatic soft-tissue wounds that have been implicated as significant contributors to the war-time MDR bacteria phenomenon. However, despite the clinical importance of MDR Gram-negative infections in the context of the Syrian and Iraqi crises, there has been a paucity of research conducted into how *A. baumannii* and *K. pneumoniae* develop pathogenicity in the context of conflict Settings.

A protracted state of conflict in Iraq has fostered not only a breakdown of basic medical services, but has caused severe environmental degradation in the form of toxic heavy metals deposited into the region by bombardments and small munitions. Outside of non-communicable diseases, sublethal levels of metals in hospital, industrial, and agriculture waste has been demonstrated to select for multidrug resistant strains of bacteria via mutagenesis, drug and metal efflux, and the transmission of plasmids conferring metal tolerance and antibiotic resistance genes.

My project focuses on investigating the phenomenon of multidrug resistance within the context of coupled antibiotic and heavy metal resistance perpetuated by heavy metal deposition during years of protracted conflict. Through an extensive review of the literature, I seek to consolidate our understanding of coupled heavy metal and antibiotic resistance in conflict regions, and establish a foundation for investigating how munitions pollution contribute to the wartime MDR phenomenon. This may incentivize certain actions, such as the removal of heavy metals from the region through concerted efforts of environmental restoration, as a means of combating the spread of MDR in areas affected by conflict.



Speak American

Erin Callahan

COM Film & Television, CAS French Studies

Linguistic Discrimination is one of the last socially “acceptable” forms of racism. Though the United States has no official language, there is a social expectation for all residents to speak English with the same degree of fluency. When an individual fails to meet this expectation, through the use of another language, a certain dialect of English, or simply having a perceived accent, they face various forms of biased aggression regardless of citizenship. How does language discrimination affect one’s ability to function in American society? This is the question that I will explore in the documentary *Speak American*.

Through the lenses of the workplace, the educational system, and social life in Boston, MA, this documentary shows audiences the impact that language has on everyday life. The film looks at lived experiences from Boston residents and linguistic experts on Spanish and Haitian Creole to see how language discrimination has impacted the lives of multilingual Americans.



Sanctions as a Foreign policy Tool: Case Studies on the Former Yugoslavia and Present Day Russia

Chloe Chibeau

Pardee International Relations

This paper explores the question of whether sanctions are effective in achieving their policy goals, especially when taking into account the humanitarian cost. Sanctions are a commonly used foreign policy tool, but their use can be controversial because of the frequent unintended humanitarian cost. As the use of sanctions has evolved, policymakers have designed a system for targeted sanctions that aim to reduce the humanitarian cost, but the efficacy of these sanctions is still under discussion. The two cases chosen to examine this question are the case United Nations sanctions on the former Yugoslavia in the early 1990s and the case of the current United States and European Union sanctions on Russia.

I conducted qualitative research inclusive of the stories of people across generations and across socio-economic backgrounds in order to uncover a narrative of the negative humanitarian effect and political success of each case. In the Yugoslav case, it was evident that the humanitarian effects were devastating. The economy collapsed and the society turned to the black market for survival. Milosevic's regime was able to guide public opinion towards anti-west sentiment using sanctions as the basis for propaganda. This gave him more power; the opposite of the goal of sanctions. In the Russian case, evidence points to a similar scenario with less devastating economic impact. Putin has been able to use sanctions as evidence of the inhumanity of the West and suppress internal dissent that is generally pro-western. In both cases, sanctions did not change public support of the political leaders targeted. In Yugoslavia, it took six years after the sanctions were lifted for citizens to turn against Milosevic. In Russia, citizens have not changed their opinions on Russian presence in Crimea or advocated for halting Russian aggression. In response to these results, I propose limited implementation multilateral targeted sanctions, only when less invasive measures fail.



“To Move the World, On a Child’s Heart”: How Nineteenth-Century Depictions of Street Children Impacted New York City’s Social Reform

Jamie Clark

CAS History, Minor: Psychology

The nineteenth century, riddled with economic and social issues, ultimately led to widespread homelessness among children in urban centers like New York City, London, and Paris. Depictions of street children, especially in fictional writing and magazine illustrations, grew in popularity as calls for reform, like Charles Dickens’ *Oliver Twist* and Horatio Alger Jr. ’s *Ragged Dick and Struggling Upward*. Historical literature has long praised such works as representative of reality. However, such depictions presented a “dressed up” version of reality that played to growing middle-class ideologies, such as the sentimentalized childhood. The mid-nineteenth century brought change to how children were valued to society: rather than economic tools, children became precious things to be protected and sheltered from violence and crime. For the vast majority of the nineteenth century, this view of childhood was limited to the middle-class. While such depictions of street children did lead to some reform, as historical literature has stated, it was not until Jacob Riis’s use of photography to depict street children that real reform was tangible at a governmental level. Using analyses of Riis’s photography in comparison to fictional and illustrative depictions of street children, as well as testimonials from street children from the Children’s Aid Society and Riis himself, I will argue that photography was instrumental regarding garnering middle class support for reform for street children in New York City. Although a large portion of historical literature has covered Jacob Riis’s photography, its impact on street children specifically has been understated, especially when compared against fiction and illustrations from the period. With this paper, I hope to illuminate the impact Riis had on the living conditions of street children in New York City in comparison to even that of Dickens, as well as to speak to the importance of how significant representation in media matters, especially for marginalized groups.



Preferred Mediums of Scientific Communication

Noah Conley
CAS Astronomy

To know how to best communicate scientific information, it's essential to look at how people access it. Since America's college students are the future of the country, we decided to look at how Boston University students access science. To do this, we sent out a Qualtrics survey to students, primarily through social media. The survey asked questions regarding what mediums students use to access scientific content, what specific sources they utilize, and what mainstream news outlets they trust to accurately report scientific information. We also asked them how they chose sources online, how frequently they access scientific topics, and what their favorite scientific topics are. We found that in our sample of Boston University students, the students primarily utilize the internet and social media to access scientific information. The population selects their information primarily based off of convenience, and most double check the information only if something doesn't seem right with it. While a large range of sources are utilized by students to access scientific information, their preferred one is the New York Times. In our research, we found that the student population doesn't consume scientific information very frequently, and also doesn't have a clear preferred scientific topic. Our findings demonstrate how the convenience of data accessibility affects what sources are read. In addition, if the data comes from a legitimate sounding source and sounds right to the reader, our data shows that it will likely not be double checked.



Some Kids Are Worth Less: The Neoliberal Politics of Indirect Social Spending

Bayley Connors

CAS Political Science BA/MA

The child tax credit (CTC) is the largest anti-child poverty policy in the United States, but it gives more benefits to upper-income households than it does to lower-income households. Meanwhile, traditional cash benefit welfare programs like Temporary Assistance to Needy Families (TANF) have shrunk over the past two decades. Why have American policymakers approached child poverty with indirect rather than direct spending solutions? This thesis argues that neoliberalism, defined as the reliance of policymakers on market means to achieve public goals, is to blame. Historical case comparisons between TANF and the CTC demonstrate that policymakers utilize neoliberal code words implicitly to divide target populations into deserving and undeserving groups. Additionally, an original survey experiment finds that political actors can increase public support for regressive economic agendas by incorporating indirect social spending into their legislation. Ultimately, neoliberal values challenge our conception of what constitutes good politics and good policy. It is clear that direct spending solutions to child poverty are present and available, but their attainability is falsely shrouded in clouds of skepticism from the neoliberal mindset.



Home, Reconstructed

Kabita Das

CFA Graphic Design

Homes are a place of reconstruction. Everyone carries with them an idea of what home is based on their own upbringings and their past experiences and this idea changes as they move through life. When an individual builds a place to live, they physically represent the moments and the memories they cherish most and that they choose to carry with them. As people have unique backgrounds, the makeup and structure of their homes is unique as well. However, the single unifying factor is that these homes are inextricably tied to their own life.

My thesis uses the home that I grew up in as a case study to better understand how homes are built from past experiences. It looks closely at how my parents, from different cultures, moved in together and pulled elements from their respective upbringings and have created a unique space for my brother and I to call home. I've deconstructed my home by documenting as many parts of it as I could through audio recordings, videos, and images. I've recorded my parents making coffee at seven in the morning, filmed shadows flickering in the setting sunlight, and have taken pictures of objects placed on shelves and that haven't been moved in years.

For my final project, I have reconstructed these documented moments into an interactive HTML page that houses all of this documentation, creating an experience that evokes feelings of nostalgia and appreciation. The single interactive feature is to download the files stored in the site, an act that allows users to view and own personal elements that have been removed from their original context, and allows them to draw connections to their own homes. I hope to use my thesis to push individuals to think more closely about what elements from their backgrounds have influenced them as well and how it has impacted the way that they build a home.



Virginia Woolf's London: One Century Later

Antonia DeBianchi

COM Journalism, Minor: English

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Throughout Virginia Woolf's works, she uses the spatial turn theory—the role of physical location in narrative and the reorientation of space. Experimenting with time and place, she blends the past and the present seamlessly into “moments of being,” suspending the conventional constructs of reality. She also incorporates Baudelaire's theory of the flâneur—the figure of a male observer of the streets—to break ground and create a flâneuse— a woman who also walks for pleasure without a societal leash. Her characters discover the vitality of London's urban landscape by walking alone. In turn, they cultivate their own autonomy.

In Fall 2019, I flew to London and followed in Woolf's and her characters' lofty footsteps. I visited all six of her London homes; I meandered the green squares of Bloomsbury where she was inspired to write; and I walked through several parks at the center of her works, including Kew Gardens where she wrote a short story of the same name. There, I felt the vitality of the streets, gathering research and observations and walking over 60 miles across Woolf's narrative terrain.

Applying my field research, I wrote three narrative essays in which I compare my time in London with that of Woolf. Through the spatial turn and flâneur theories, I analyze Woolf's London in relation to my own London adventure one century later, dividing each essay into physical places central to Woolf's works: **Streets, Squares and Circles**, and **Parks and Green Spaces**. Additionally, I created a map and a video component, mapping my itinerary. It is through this format that I compare Woolf's London—then and now.



Fluorescent Bead Assay for Small Analyte Sensing

Catherine M. Della Santina

ENG Biomedical Engineering, Concentration: Nanotechnology

In recent years, allosteric transcription factors (aTFs) have proven to be a powerful tool for *in vitro* small analyte sensing because of their conditional DNA binding affinity. aTFs are naturally occurring proteins that regulate transcription and gene expression in response to a specific secondary molecule. aTF based sensors are able to detect the presence of this secondary molecule by measuring the binding interaction between an aTF and its corresponding DNA binding sequence. The Dennis Lab at Boston University has developed a novel biosensor framework (termed *bead assay*) using aTF-labeled semiconductor quantum dots (QDs) and DNA-linked streptavidin coated agarose beads to efficiently translate nanoscale aTF-DNA-analyte interactions into a visible fluorescent readout. This project sought to redesign this existing sensor framework to detect novel analytes in order to expand its applications and demonstrate its customizability. Some compelling potential applications include the detection of insecticide and heavy metal pollution, clinical diagnostics, and tracking complex molecules throughout production via biosynthetic pathways. There are several other existing aTF-based sensors, but this sensor has advantages in accuracy, efficiency, speed, and convenience. Since this sensor is instrument-free and produces results in ≤ 2 minutes, it is conducive to implementation in low resource settings across a wide breadth of industries to improve methods of detecting and quantifying the presence of relevant small analytes.



Discovering New Transcription Factors that Affect HIV-1 Expression

Kimberly Eberenz

CAS Biology, Specializations: Cell Biology, Molecular Biology, & Genetics

Currently, HIV is well managed by individuals on highly active antiretroviral therapy (HAART) but fails to be cured due to a set of cells that are latently infected. When a cell is latently infected, it contains integrated HIV DNA within its genome, but does not actively produce new viral particles thus, making it undetectable for therapy. The determination of whether a cell will become latently infected is largely controlled at the transcriptional level with the help of cellular transcription factors. However, the full repertoire of transcription factors involved in the regulation of HIV transcription remains to be defined. In order to investigate this, we conducted an unbiased yeast-1 hybrid screen to identify novel transcription factors that recognize the HIV promoter. From this subset, we identified up to 49 transcription factors many of which are novel and are expressed in primary T cells, including KLF2 and KLF3. In both overexpression experiments and silencing experiments, KLF2 and KLF3 demonstrated repressive activity on HIV expression suggesting a role in the establishment of latent infection. Future experiments will help confirm the mechanisms behind how these factors work, perhaps indicating ways in which latency is controlled and could be targeted by new drugs.



Connect21: An App to Connect the Down Syndrome Community

Normandie Essig
CAS Computer Science

Young adults in the Down Syndrome community have a lack of resources and support to connect them to peers their own age. This shortcoming is due to recent advances in medicine that have led to longer life spans and a lack of response by major organisations. In addition, as it is a relatively small group of individuals, money and resources have not been put into creating a stronger community after the initial childhood stage. Through this project, I researched what resources do exist for young adults, what their daily lives look like, the major safety concerns, and the effect of social technologies, such as Facebook, Twitter, and Reddit, to foster connections. From there, I created a web based application, named Connect21, that will act as a forum for users to connect with others through discussions around shared interests, mimicking parts of well-known sites such as Facebook, Twitter, and Reddit. Built using Flask, Python, HTML, SQL, and CSS (coding framework and corresponding languages), users have the ability to create semi-anonymous accounts, post status updates, participate in discussion pages, and follow and interact with other users. While the application will not be released to the general public, the research completed and the building of the application would ideally improve the lives of those with Down Syndrome. It would allow them to create more meaningful connections in a safe and secure way.



Chasing the Summit: 48 Journeys to 4,000 Feet

Sarah Golden

SAR Human Physiology

<https://chasingthesummit.com/>

Since the mid-1950s, thousands of Northeast hikers have set out on a strange quest: to hike all 48 mountains above 4,000 feet in New Hampshire's White Mountain National Forest. Doing so grants a hiker membership to the "4,000 Footer Club". Upon learning about this organization, I was perplexed as to why people would spend so much time and effort summiting these seemingly arbitrary mountains; many of the 4,000 footers are incredibly strenuous yet have no views.

As a hiking enthusiast, I set out to discover for myself why people are so drawn to the 4,000 footers. In the summer of 2019, I summited all 48 peaks and became a member of the 4,000 Footer Club. I hiked hundreds of miles through enchanting forests, along stunning ridgelines, and across wildflower fields. I grew fond of the very hikes I dreaded—some of my favorite mountains were the ones with no views. I gained the upmost respect for the wild and came to understand that these 48 peaks are anything but arbitrary.

My newfound passion for these mountains compelled me to create a website, Chasing the Summit, which shares stories and lessons from my experiences on the 4,000 footers. It also provides practical information about the hikes in the form of guides and an interactive map. My aim is to encourage others to hike the 4,000 footers, or more generally, to spend more time outdoors. I believe that increased engagement with the wild is incredibly beneficial for both the natural world and ourselves, and it is my goal to promote this through my project.



Saline Agriculture or: How I Learned to Stop Seeking Answers and Love the Questions

Frances Gould

CAS Environmental Analysis & Policy

Research does not exist in a vacuum, and seldom does it answer more questions than it raises. These questions are often just as much about the researcher and her background as they are about the subject matter itself. This became clear to me while spending my junior year in Southern Israel at the Arava Institute for Environmental Studies, during which I began to conduct a comprehensive study of the issue of water scarcity in the hyper-arid Middle East/North Africa region and the pressing need for developing water-conserving forms of agriculture for communities in the aforementioned region.

The first stage of the research—a feasibility assessment of saline agriculture—was completed with the intention of using the collected data to guide the subsequent stages of the project. I completed one trial of the experiment and gathered data, but due to a lack of necessary research infrastructure the attempt at setting up a second trial during the second semester was unsuccessful. This research remains at the heart of what is an anthology of narrative essays about the process of conducting said research.

In these essays, I explore three “umbrellas” of ideas in this project: the structural/practical obstacles, the socio-political qualms of conducting this type of research in a volatile region, and the difficulty of doing environmental research in the face of climate catastrophe. I also examine themes of ambition and academia. I delve deeper into the messy, contradictory, and deeply human elements of studying science in a place far from home. I illustrate not only how research shifts and changes as its agent does, but also that any line of inquiry is inherently interdisciplinary when the praxis of methodology, the political ramifications of academic interests, and the value of research in and of itself are considered.



Measuring and Addressing Affordability of Water and Sewer in the United States

Michael Grinshpun
CAS Economics BA/MA

The United States is among the wealthiest countries in the world, yet it is not immune from affordability problems in housing, healthcare, and utilities, especially as these costs are rising faster than incomes. The United States can feasibly address these issues, but it is critical to measure and understand them properly. My research focuses on how to address water and sewer affordability in the United States, as water and sewer are among the fastest rising costs relative to other essential goods and services. This research began with a comprehensive literature review of the rising costs of water and sewer, as well as their affordability. Then an Excel tool was created to collect data and measure a variety of metrics for water and sewer affordability. This tool was then applied to analyze 25 metropolitan areas. Several cities with especially severe affordability problems or exceptional affordability programs were used as case studies. A key finding was that affordability metrics which measure how widespread and intense these issues are, could reflect affordability more comprehensively than the conventional metrics. Another finding was a general need for more national and state policies to specifically address water and sewer affordability. Finally, the insights gathered from a comprehensive literature review, consultation with water affordability experts, case studies, and data analysis were combined to produce a report about how best to measure and address affordability of water and sewer in the United States. The intention of this research is to provide a robust affordability assessment tool, a recommendation for a more comprehensive method for measuring water and sewer affordability, and an original report that compiles the data analysis, existing literature, expert opinion, and case studies. Ultimately this may inform proposals to utilities, local, and federal governments on potential approaches to water and sewer affordability policies.



Device for detecting environmental antibiotic residues in low resource settings

Mackenzie Hall

ENG Biomedical Engineering

Ever since the discovery of penicillin, physicians have relied on antimicrobial drugs to treat countless diseases affecting both humans and animals, but as a result of improper use, more and more of those drugs are no longer effective. Antimicrobial resistance (AMR) arises as a result of selective pressure on a population of microorganisms that favors the survival of strains that possess drug-resistant capabilities. The majority of research to date has focused on the development of drug-resistance in a living organism, but this resistance can actually develop in any situation where the microorganism and drug are interacting, including the lesser studied scenario where this resistance development occurs in the environment. The connection between environmental antibiotic contamination and AMR has been theorized for years, but never proven due to an extreme lack of data. My project seeks to design a device and methodology to obtain this data regarding environmental contamination of ciprofloxacin, a commonly used broad spectrum antibiotic, in order to inform research and policy.

Once we know how much ciprofloxacin contamination is in a particular area, researchers can make connections to AMR related consequences in the area, which can then drive the creation of policy to prevent this contamination and act as a tool to enforce those policies. As of now, there is no existing method that researchers can use to measure how much antibiotic is in the environment in low resource settings, where the issue of environmental antibiotic contamination is most acute; existing technologies like high performance liquid chromatography are too expensive and resource heavy to be feasible for use in these settings and as a result have limited researchers' capacity to gather data, monitor environmental status, and make policy recommendations. Our device will be the first equipped for field testing for ciprofloxacin contamination in environmental samples and thus will be a major improvement to the current set of tools available to researchers and regulatory agencies currently concerned with antibiotic contamination.

The rise in the development of antimicrobial resistant strains of disease is one of the most significant threats to global health in the modern world, but regulation of antimicrobial use in developing countries is crippled by the lack of regulatory power by governmental agencies as well as lack of funding and resources. A portable, low cost, and low resource tool capable of quantifying antibiotic presence in the environment is the first step towards equipping regulatory and policy making authorities with the tools necessary to stave off the looming threat of complete antibiotic failure.



Game Plan

Taylor Hazlett

CAS Computer Science and Economics

The goal of this project is to implement a customizable goal functionality for Game Plan, as a mobile application by Boston University faculty in conjunction with the Hariri Institute with the intention to encourage young adults with intellectual and developmental disabilities' (IDD) to set and accomplish health-related goals. Presently, the application prompts users to select goals from a list of hard-coded values. While predetermined goals are useful in prompting users with suggestions, the absence of a user-input functionality restricts young adults with IDD's ability to set goals custom to their needs and develop independence. Giving users more agency is necessary to the intention of this app as it encouraged IDD individuals to practice their independence and become comfortable with navigating tasks by themselves. I implemented this functionality using natural language processing tools such as Python's Natural Language Toolkit (NLTK) and Scikit-learn (Python's machine learning library). The technology is able to read a text input and classify the goals under one of four main categories: work, school, self-care, and leisure. To develop the classification model, the algorithm was trained against document containing sample user inputs that captured the span of each goal category. Upon receiving input, sentences are transformed into their vector representations for analysis. A voting classifier is then used to determine which category a sentence belongs to; the category with the majority vote will be selected. After defining a custom goal, users will be prompted with suggested first steps to take in accomplishing the task.



Bottom-Up Effect of Pedagogy Transfer Between Learning Assistants and Faculty

Cameron Hill

SAR Human Physiology

Faculty in higher education are experts in their respective fields, but ironically many faculty do not have a formal background in how to teach. The Learning Assistant (LA) Program is an internationally recognized near-peer teaching model designed to improve undergraduate STEM education. A key component of the model is the LA-faculty relationship, which is strengthened during weekly prep session where LAs and faculty discuss the student experience, upcoming concepts and procedures, and potential instructional techniques. First-time LAs enroll in a weekly pedagogy seminar to learn about evidence-based teaching methods, which then has the potential to impact faculty understanding and implementation of evidence-based teaching. Thus, we sought to determine whether there is a “bottom-up effect” where LAs influence how faculty approach their classroom and interact with students. Here, we present a cross-sectional survey that targets the LA-faculty relationship in which faculty ($n = 64$), who personally teach with LAs, from 19 institutions across the United States with LA Programs participated. Based on preliminary data, faculty are self-reporting that since working with LAs, their teaching style has changed; they have incorporated more active learning and discussion-based teaching; and that working with LAs have made them better educators. This survey provides a new perspective on the synergistic nature of the LA-faculty relationship and opens the door for further research into improving student outcomes, best practices with LAs in the classroom, and supporting faculty with evidence-based teaching methodologies.



Mental Health Service Utilization Among Medical Students in the US

Abigail Horgan

SAR Human Physiology

While training to become doctors, medical students are under intense pressure, which can lead to increased risk of mental health issues like burnout and depression. Despite high rates of mental health concerns, the majority of medical students do not receive mental health treatment. This trend is concerning because it indicates a compromised quality of life among this population and because unmet mental health need can have implications for professional conduct and future care of patients. How can medical students be expected to take care of others when they are unable to take care of themselves?

Using national-level, population-based data from the 2017-2018 Healthy Minds survey, my Keystone project examines mental health service use among medical students (n=898) and explores how trends in utilization differ across student characteristics such as race, age, current financial situation, and gender. The data indicates that although students are generally satisfied with the convenience, quality, and privacy of on-campus services, there are many barriers leading them to receive fewer or no services for their mental health, with lack of time being the most commonly cited barrier. My research signifies a need for medical schools to expand gatekeeper trainings; to administer mental health screenings and link students to services as needed; and to focus on delivering services that fit the preferences of students.



Analyzing Forest Edge Characteristics Using NEON's Airborne Observation Platform

Wiley Hundertmark

CAS Earth & Environmental Science, Concentration: Earth Observations

As forests are converted to developed uses, the remaining forest matrix becomes increasingly fragmented, influencing growing conditions and nutrient cycling near forest edges. *In situ* measurements of edge effects on forest ecosystem properties are difficult and time-intensive. This study explores novel methods of ecological data collection by fusing *in situ* foliar samples and hemispherical photography with remote sensing techniques to characterize forest edge effects on a larger scale. This research utilizes hyperspectral and LiDAR data from the National Ecological Observatory Network's Airborne Observation Platform, which annually collects high resolution data over the Harvard Forest in Petersham, Massachusetts. Remote measurements of canopy height and relative nitrogen content are analyzed and compared with *in situ* measurements of canopy light transmittance and leaf-level nitrogen content. For the summer of 2019, the remotely sensed data show patterns in canopy properties with proximity to forest edge. This research highlights the potential for large-scale data collection on forest properties using remote sensing, with important implications for our understanding of forest structure and function at multiple scales.



Music and Memories: A Creative Exploration Through Scriptwriting

Guy Jackson

COM Film & Television

Our life always seems to have a soundtrack to it, from the songs of our adolescence to the first dance at our weddings and even the playlist on the road trip with our friends; songs stay connected to those memories, and often will bring emotions alive when they're played again years later. Unfortunately, not everyone maintains their cognitive memory, losing the battle to diseases such as dementia, yet evidence suggests that music can still help to keep the flame alive for a while longer. By interviewing individuals with firsthand experience with dementia or memory loss and comparing it to the empirical evidence already available from preexisting studies, this keystone project hopes to answer the question: how has the use of music therapy to recall autobiographical memories helped patients of dementia connect to their loved ones? Five family members of dementia patients were interviewed, each explaining their story and struggle. What was evident throughout my research was the bond that family can have to carry each other through darker times, and how music acts as one bridge to keep people together. Those stories, combined with scientific research on dementia and music, became the basis to a short film screenplay about a father with dementia and his son reconnecting through music. This project isn't revolutionary, rather it aims to touch at the emotions of the audience to tell a compelling story with an interesting subject. What the research and screenplay do show however, is that music does in fact make a difference in the lives of dementia patients and their families, bringing them a moment of levity in an incurable situation.



Writer's Website

Elizabeth James

CAS Computer Science, Minor: Deaf Studies

writerswebsite.herokuapp.com

How do I get feedback on my writing? A common question I have heard from many of my peers, and even asked myself. Many budding authors face adversity and fear when it comes to releasing their work out into the world in order to get feedback- be it that they don't fit the stereotype expected to be writing a certain genre, that they are writing about a difficult topic usually kept under wraps, or that they aren't expected to be a writer at all.

This project is an exploration of both the benefits of a web-based interface that allows writers to receive anonymous feedback, as well as the technical challenges that come along with creating such a platform. This platform is created using a back-end algorithm that matches readers with writers based upon their preferences and experiences, aiming to help remove the barrier to an accessible pool of feedback from an audience with interest in the writer's area of work. The writers and willing readers will create profiles and rank preferences of topics and types of writing, and readers will be given a story- written by a writer- that fits their preferences. It is then up to those using the platform to share their wisdom and voice to give constructive critiques to one another to help writers blossom. The generated feedback will then be delivered anonymously in hopes of helping both writers and readers alike create a community of support and growth for everyone involved.



The Wellness Challenge Subscription Box

Caroline Jens

SAR Health Science

In Boston University's 2018 Healthy Minds Survey, 84% of Terriers felt overwhelmed by all they had to do. Feeling overwhelmed is particularly acute in first year college students, as they suddenly have to seek out a new community, take care of themselves, and balance an increased course load. I hoped to address this population with the Wellness Challenge Subscription Box in partnership with BU's Wellness and Prevention Services by literally meeting students where they're at. I recruited and surveyed first year students to better gauge what their greatest wellness struggles were. Based on these results I created four themed boxes that would go straight to a student's mailbox: time management, nutrition, feelings verbalization, and movement. I curated information and activities for each box to support students in learning how to implement new wellness practices. I had planned to evaluate this pilot's success by comparing pre- and post-program surveys regarding students' mental health, however the campus closed the week I was set to send out my boxes. Despite my not being able to complete the project, all of the box materials are ready to ship should the Wellness Office decide to move forward with the pilot next semester; otherwise, my first year survey results can be used to inform future programming aimed at this population.



Mental Health on the Margins: How BU Can Better Support the Mental Health of Black Students

Ina Joseph

COM Journalism and Public Relations, Minor: Women, Gender, Sexuality Studies

mijportfolio.com/mental-health-on-the-margins

At large institutions like Boston University, buzz terms like “self-care” and “mental health” often get thrown around by professors, advisors, and other student-support entities without thought to those groups of people for which “self-care” and “mental health” are not easily accessible or realistic.

My Keystone will explore the issue of mental health among Boston University’s undergraduate students of color. Using audio as my medium, I will juxtapose mental- health expert interviews with the recorded stories of black BU students. My project will answer the following research questions: “How does mental health care, and related stigma, differ in the lives of young people of color,” “What are the ways in which higher institutions of learning must specialize their mental health resources for marginalized students?”, and “What is the biggest commonality seen in black students regarding their attitudes towards mental and emotional health?” The end product—an audio-enterprise piece about seven to ten minutes in length—will place the lived experiences of this university’s minorities in conversation with long-standing research on racial disparities in mental healthcare.

There can never be too many voices contributing to the portrayal of lived experiences, especially those of marginalized students who are in the care of a large institution for the most formative years of their lives. According to my findings, BU’s black students feel their university’s mental health resources do not meet their needs as young people of color. Instead, the onus is often placed on them to seek means of treatment or coping. Additionally, the culturally-minded measures necessary for black students to thrive would also benefit the entire student body (regardless of race), and thus enhance the inclusivity of BU’s campus culture. I plan on presenting these findings to the Office of the Provost, BU Wellness, the Associate Provost for Diversity and Inclusion, and Student Service. The project itself, in its journalistic nature, will serve as a proposal to improve the resources that exist on this campus for marginalized students. The voices of BU’s very own students are the most compelling when it comes to revealing inadequacies and convincing an administration to see the need for change.



Syntactic and Semantic Features of Mathematical Objects

Elias Kastritis

CAS Mathematics & Philosophy

I completed a researched senior thesis in the Philosophy Department, in partial completion of Honors in the Major in Philosophy. The senior thesis was an extended paper concerning the philosophy of mathematics that incorporated the methodology and perspective of a linguist, specifically drawing from the subfields of syntax and formal semantics. The principal focus of the paper was to examine particular proof techniques in mathematics, with two examples drawn from corpora data: proof of the product rule for derivatives in real (and complex) variables, and derivation of the integrating factor in ordinary first-order differential equations. I wondered if particular steps in the respective proofs, considered “unintuitive” in their utility, could be elucidated by treating those maneuvers, and the objects that they manipulate, as quasi-linguistic, or even fully-linguistic, artefacts. Essentially, I analyzed mathematical objects as though they possessed natural syntactic categorization, in addition to considering mathematical propositions as possessing dynamic semantic values. More generally, the paper sought to typify the process of mathematical discovery, particularly in how the establishment of rigorous mathematical objects via a mathematical syntax begets semantically-driven results. Ultimately the paper was motivated by attempting to help bridge the lack of bidirectional exchange between the methodologies of linguistics on the one hand, and of mathematical methods on the other. Modern syntax and formal semantics draw heavily on mathematical methods to explain natural language phenomena; could other linguistic methods in turn explain the unique characteristics of mathematical ontology?



An Analysis of Macroeconomic Factors that may be Associated with Phishing Cyber-attacks from Russia

Antranig Kechejian

CAS Economics, Minor: Statistics

In 2017 alone, Russian hackers compromised hundreds of United States utilities, manufacturing plants, and other facilities using phishing attacks. Phishing is the process of tricking individuals to give away their sensitive information via email, and it is the most widespread form of cyber-attacks today. Cyber threats of this nature have been on the rise for decades, and understanding what macroeconomic factors are associated with these attacks may help us prevent them from growing further. To understand what macroeconomic conditions in Russia are related to the rise of these attacks, this study uses a combination of regression modeling and both primary and secondary source analysis to identify connections between three economic factors in Russia and the rate of attacks. The economic factors that this paper considers are GDP, unemployment, and primary school enrollment. The World Bank measures primary school enrollment as the ratio of total enrollment, regardless of age, to the population of the age group that officially corresponds to primary school. Data used to attain the number of attacks per year include all reported public cyber-attacks in which Russia was confirmed as the aggressor, and is not limited to phishing attacks. Key findings from the regression models include that both unemployment and education have a relatively strong association with the rate of cyber-attacks. The primary and secondary sources used in the study further explain the trends that the regression models suggest, and provide further insight into what macroeconomic conditions are associated with phishing attacks.



Perceptions of Student's Own and Other Health Professions: A Study of Students Enrolled in Interprofessional Education at Sargent College

Anu Khanna

CAS Biochemistry & Molecular Biology

In the United States, most health professions require completion of professionally accredited masters or doctoral level qualifications in order to practice. Traditionally, students in the health disciplines have studied separately, learning the necessary knowledge and skills relevant to their own discipline. When practicing, however, practitioners from different health disciplines are expected to work collaboratively and communicate effectively. To prepare students for this collaborative practice, some colleges have introduced programs that include the co-education of different disciplines, known as interprofessional education (IPE). The College of Health and Rehabilitation Sciences: Sargent College, has implemented an IPE curriculum for students in occupational therapy (OT), physical therapy (PT), nutrition, athletic training (AT) and speech language pathology (SLP) programs, with the first IPE module being delivered primarily online.

Adopting a grounded theory approach, the current study conducted in-depth interviews with year 1 graduate students at Sargent College to explore student's perceptions of their own and other disciplines, and how these were influenced by the IPE curriculum. Twenty-one students participated in the interviews after the completion of their first IPE module, and a sub-set of interviews with OT students were analyzed. Seven key themes were generated: 1) the creative, client-centered and diverse nature of OT, 2) the undervaluing of OT in the community, 3) the dynamic between OT and PT students, 4) the limited understanding of AT and nutrition professions, 5) the collegial relationship between OT and SLP, 6) the value of interprofessional collaboration and how it's influenced by professional hierarchy, and 7) the need for in-person IPE experiences. This research informs future IPE efforts by highlighting perceptions and knowledge gaps which require further attention in the IPE curriculum to better prepare students for interprofessional collaborative practice.



Assessing Changes in Mental Health, Substance Abuse, Nutrition, and Physical Health During College Students' First Semester

Francesca Kishkill

SAR Human Physiology

During the transition to college, many students find themselves overwhelmed and anxious. Freshmen must adapt to many new changes, such as dealing with a more rigorous academic environment. Students must also learn how to balance these academic demands with extracurricular activities and socialization time. This can prove to be quite difficult, and many students choose to partake in risky behaviors, such as alcohol or recreational drugs, in lieu of a better coping mechanism like therapy. Many also struggle with mental health issues, and may face physical health decline due to a combination of these factors.

This research paper examines the timing of any changes in mental health, substance use, and physical fitness during the freshman year of undergraduate college via a pilot study. If changes are present, any trends that indicate a relationship between the variables will be defined. Students have had these variables tracked over the course of a year through various questionnaires on mental health, substance use, and nutritional status. Fitness will be tested with weight, blood pressure, heart rate, and a maximal exercise test that records VO_{2max} . VO_{2max} is taken with a mask that measures the amount of oxygen intake and carbon dioxide output. The higher the VO_{2max} is, the more physically fit the individual.

The findings of this research will largely shape preventive measures taken by students, and implemented by colleges, to limit negative changes to wellbeing. If there is a significant decline in health during this transition period, this research can also be used by colleges to pinpoint this period as a critical time; they can then know when to intervene and give students additional resources to smooth the transition from home to college life.



Civilian Nuclear Power & Negotiating the Convention on Nuclear Safety

Glenn Korman

Pardee International Relations

The goal of this research project was to determine the political factors that influenced the ability of pro-nuclear power nations to accept legally binding international safety standards in the early 1990s, as created by the Convention on Nuclear Safety. There has been little research into how the nuclear industry influenced the development of this international nuclear safety convention. This is a relevant area of research due to the inability of the international community to secure legally binding improvements to the international nuclear safety regime following the 2011 Fukushima-Daiichi accident. The specific questions that guided this project involved what political factors influenced the Canadian, German, and U.S. negotiating positions from 1991-1994, what influenced when these three countries specifically ratified the Convention, and what influenced their ability to accept legally binding international nuclear safety standards? This project used an inductive reasoning approach, three-in-depth case studies, and a combination of primary and secondary sources. It is therefore qualitative in nature. This data serves as a starting point to analyze the ability of the nuclear industry to influence their individual government's stance on international nuclear safety developments. Future research in this field should explore nations that are anti-nuclear and either operate smaller nuclear power programs or none at all.



The Hero's Dilemma

Elisabeth Kotsalidis

*CAS Classic Civilization and Ancient Greek & Latin, Minor:
Anthropology*

The ancient Greek epic the *Iliad* tells the story of the Trojan war through the perspective of individual heroes. Given this specific focus, the characters themselves, their temperaments, and their conflicts become the focal point within the larger context of the battle that frames the narrative. This research explores how these heroes engage with their communities, with particular attention to how the heroes operate within the bounds of the heroic code. The code dictates a certain set of expectations for men which include bravery and self-sacrifice in combat. It is a means by which men are able to achieve eternal fame, as well as transcend their own mortality and endure in the legends of their achievements. The code governs how men should act and what they are owed for their valor. However, the code is called into question throughout the course of the epic. This research attempts to understand the function of the code by understanding how heroes conduct themselves within it. The two heroes selected for this research are Achilles, the semi-divine Greek warrior and Hector, Trojan prince. Analysis included a close reading of the ancient Greek text from individual word choices to rhetorical devices, reviewing commentaries, and researching scholarship about heroism in Greek epic. The research shows that the two heroes respond in different ways to the expectations the code sets out. On the one hand Achilles directly criticizes and rejects the heroic code. Whereas Hector is not able to balance his responsibility as the protector of Troy and its people and his obligation to be the selfless warrior as stipulated by the code. Given the inability of either hero to succeed within the bounds of the heroic code, the epic suggests the fallibility and futility of a human custom when pitted against fate and divine powers.



Do Title IX and Sexual Misconduct Policies Vary across College Campuses?

Tatiana Kovalsky

CAS Psychology

This research examines the Title IX and sexual misconduct policies at Boston University (BU) as well as the respective policies at their peer institutions within the Patriot's League. Data was gathered through an in-depth comparison of these documents to bring to light variation as well as what a comprehensive policy could look like. Each policy has been dissected in order to ensure compliance with federal Title IX regulations as well.

The data has been ultimately extrapolated into graphs and tables displaying the key points of each schools' policies, how they differ, and delineate whether they are in accordance with federal regulations requirements. The major components looked at include reporting policy, prevention policy, whether they have a specific center listed within the policy, and more. Information exposes each university's similarities and differences in their approaches, and can definitely inform further research on what a comprehensive Title IX policy would look like. This work will inform further research that must then be done to implement procedures to enhance university policy, and the way Title IX issues are tackled in order to move towards best practices.



The Rise of Superfoods in the Food Industry

Sofia Koyama

COM Journalism

There may not exist a time or culture in which food does not play some sort of vital role in people's lives. Whether it be the intertwined nature of eating and socializing, the role of foods in spirituality and religion, or the "foodie" influence culture that has arisen today, our relationship with food has evolved over time but the connection itself is a constant. Against the backdrop of capitalism and consumerism characteristic of modern Western society, our current food landscape has become disrupted by fleeting health fads and ever-changing discourse around the best eating habits. One of the ways in which our society has responded to these elements is in the emergence of superfoods. Despite having no FDA-backed definition and the ambiguous research surrounding self-proclaimed superfoods, rhetoric and hype surrounding these foods is ubiquitous. My Keystone Project explores what factors fuel our attraction to superfoods, how they interact with our relationships with advertising and nutrition, and the effects, if any, that have cropped up as a result. It was my initial understanding that we turn to superfoods for quick fixes in our health, while advertising companies led us to believe that shortcuts in our diet could provide enough benefits—but it did not answer the question of why we continued to fall for the ploy even when conflicting information argued for a simple well-rounded diet. Following standard journalistic practices, my project relies on interviews with nutritionists, psychologists, anthropologists and more to provide insight into the rise of superfoods as well as their unintended and overlooked consequences. It culminates in a long-form journalistic piece to be either self-published or pitched that will attempt to deeply explore the various factors driving the superfood phenomenon in our society.



Low-Power Embedded Fisheye Camera for Deep Computer Vision

Vindhya Kuchibhotla

ENG Computer Engineering, Minor: Mathematics

Understanding where and how many people are present in various parts of a building is the goal of a project funded by the Advanced Research Projects Agency – Energy (ARPA-E). With the help of Professors Janusz Konrad, Thomas Little, and Prakash Ishwar in the Department of Electrical and Computer Engineering, my team of four are working towards this objective of determining room occupancy that can be applied in minimizing energy waste (through optimized HVAC and lighting control), for emergency response, and for space management. While detecting and counting people can be accomplished using multiple surveillance cameras in each room and a powerful computing server, this solution is not only costly and complicated in deployment but also inefficient in energy use.

Our solution is a single camera with a fisheye lens (at least 360x180-degree field of view) in an enclosure mounted overhead with an embedded low-power processor running a proprietary deep-learning algorithm trained to detect and count humans from fisheye images. My team is working to adapt the deep-learning algorithm for an embedded architecture, to establish operating states such as a “sleep” mode and a “reporting” mode to conserve energy during stagnant or zero occupancy, to support image acquisition in low-light conditions, to establish network connectivity for data transfer and communication, and to build a graphical user interface to track room occupancy. My responsibilities include making the hardware design choices based on our requirements, designing a robust enclosure, developing the user interface, and integrating these components into our system to ensure end-to-end functionality. We planned to evaluate the entire system with testing over a long period of time in a realistic environment that includes lowlight conditions. We also hoped to use our test results to analyze room occupancy and system power consumption.



Methods of eye tracking exploration of social media

Gabriel Lubbock
CAS Neuroscience

This project's goal is to examine natural eye gazing patterns for cell phone users in a social media environment. Eye tracking patterns have been studied in great detail for newspaper use and generalized text-based websites. However, there is little publicly available data detailing natural eye tracking patterns on social media platforms viewed in mobile formats. This study focuses primarily on the mobile phone version of Instagram and examines how users naturally interact with it. In order to determine eye movement patterns, we asked subjects to scroll through several social media timelines while we tracked their eyes with an Eyelink II eye tracker. We then looked for general eye pathing patterns used while viewing Instagram.

We overcame many challenges to repurpose the eye tracker in the lab (Eyelink II) since it's a tool used primarily for abstract neuroscience experiments based on reactions to simple visual stimuli. Changes allowed us to use the precision of the Eyelink II on the Instagram timeline. We wrote code which made it possible for Psychtoolbox, a toolbox which normally runs psychophysics experiments, to render something close to an Instagram timeline. This code may be helpful to others who want to do applied eye tracking research with the Eyelink II or Psychtoolbox.

Although we weren't able to collect all the data needed to begin analysis (Due to covid-19 Situation), we see several possible outcomes. We may find a constant, repeating pattern shared between subjects. We aim to understand why the design choices made by Instagram and other social media sites may create an environment that encourages mobile phone users to come back repeatedly. In particular we aim to investigate the effect of color in eye movement patterns and its effect in grabbing the attention of the user. Future directions of this work could include making small design changes to the Instagram page, or using an EEG cap to understand more precisely what's going on in the brain while a subject is viewing an Instagram page.



Where Farms Once Stood: The Changing Landscape of the Indian Valley

Sara Mack

CAS Environmental Analysis & Policy, COM Public Relations

My research focuses on the cultural shifts, agricultural preservation programs, and development pressures experienced by longtime residents of the Indian Valley in Southeastern Pennsylvania. Although this area has many features that make it distinct, such as a large concentration of Mennonites and a history of meatpacking, agricultural preservation attempts through similar easement techniques have been recorded across the United States for many decades. As population continues to increase worldwide, similar conservation programs are being enacted, with varying levels of success. Using this case study, I created a documentary with the intention that my work can be used as a resource to Indian Valley farmers and residents, as well as individuals facing a loss of agricultural land due to an increase in development globally. In order to formulate this documentary, I conducted interviews with more than 20 individuals from across the Indian Valley region. Through this project, I pinpoint specific aspects of development pressures faced by these citizens, such as the loss of industry and culture, as well as areas for improvement in the agricultural preservation programs such as in improvement in marketing and communication, an increased transparency regarding the options available to farmers, and a decrease in asymmetrical funding county to county.



An Optical Device for the Detection of Counterfeit and Substandard Antimalarial Drugs

Sarah Maggipinto

ENG Biomedical Engineering

Malaria is a disease that greatly impacts the world population, with a majority of the deaths from malaria occurring in Africa. Antimalarial drugs are used to treat this disease; however, counterfeit and substandard antimalarial drugs are highly prevalent. The prevalence of counterfeit and substandard antimalarial drugs pose a significant public health problem, especially in developing countries where there is often less oversight and testing of the quality of medications. There is a significant need for a low cost, portable, and user friendly test that can be done in a clinical setting. In this project, optical spectroscopy techniques were determined to be the most efficient methods for verifying the quality of a drug sample. Elastic scattering spectroscopy and fluorescence spectroscopy were used to evaluate the optical properties of counterfeit, substandard, and standard antimalarial medications. Statistical analysis was done to compare the resulting spectra of the counterfeit and substandard medications to known good quality antimalarials. The results of these experiments established that these two spectroscopy techniques can be used to accurately ascertain whether a drug is counterfeit or not. Based on these findings, a device was designed to provide immediate information in a clinical setting about the quality of an antimalarial drug before it is administered to a patient. This device is designed to be portable and easy to use through a simple graphical user interface. Such a device will help to alleviate the public health problems that are caused by counterfeit and substandard antimalarial drugs.



***Manufacturing Consent* in the Age of the Internet: Reexamining and Reapplying Herman and Chomsky's Propaganda Model**

Justin Messmer

CAS Classical Civilization and Political Science

In the year 1988 Edward S. Herman and Noam Chomsky published their book, *Manufacturing Consent*, in which they argued that the American mass media acted more as a propaganda network than as a counterbalance to established power. However, following the massive media changes brought about by the advent of the internet, Alan MacLeod makes the bold argument that Herman and Chomsky's theory is still relevant to current times in his new book, *Propaganda in the Information Age: Still Manufacturing Consent*. This Keystone seeks to determine whether the effects described by Herman and Chomsky's propaganda model can be observed on the video sharing website, YouTube.com, a platform which has made drastic changes to their content policies at the behest of advertisers over recent years. To do this, this project provides an examination of the arguments of Herman, Chomsky, and MacLeod, and then provides a small-scale study of three independent news outlets on YouTube.com to determine whether YouTube policy changes have affected their reach. Since the most significant YouTube policy changes occurred around September 1., 2016, this project compares the totals views, likes, dislikes, and comments on the most-viewed and least-viewed videos uploaded to the website by these independent news outlets from the year prior to September 1., 2016 to current day. The results from the project are inconclusive due to the scale of the study and warrant further research that considers more factors, such as changes in rate of audience growth for examined news outlets.



More of the Best Summers of Your Life: How to Improve Summer Camp Staff Retention

Gabrielle Miller

QST Business Administration, Concentration: Marketing

So much of the magic of summer camp comes from the talented, passionate, and dedicated counselors working there, many of whom are college students. Camps across the country pour time and resources into training and developing exceptional staff members, only for them to leave camp in pursuit of other opportunities. This phenomenon led to the research question: what can camps do to better retain these staff members? After gaining insight from information already available through the American Camp Association (ACA), this project collected data through phone interviews with both individuals in the target market (college students who have worked at summer camp) and experts in the field (directors and assistant directors responsible for hiring). Those in the target market primarily described academics, the need for professional experience, the desire for a more competitive salary, lack of flexibility, and other people at camp as factors in their return decision. Experts in the field discussed offering networking opportunities, internship programs, more flexibility, and the chance to provide feedback as techniques designed to increase staff retention. From these interviews, it became clear that camps are on the right track but could benefit from additional resources. This project culminated in a guide detailing recommendations based on this research, which includes information on how camps can provide professional opportunities, offer flexibility, and communicate more effectively throughout the off-season. This document can be distributed and shared among summer camps to assist them in addressing the issue of staff retention.



Snowed In: The Effects of Inclement Weather Closures on AP Exam Performance

Macella Molenari

CAS Political Science BA/MA

This thesis examines the impacts of inclement weather days on AP exam scores in public schools, specifically low socioeconomic districts, and the assessment of their current closure procedures. By investigating the potential disruption in scores by inclement weather days, I can create a new dataset in analyzing a field that has yet to be studied through this lens, in addition to advising future policy for district superintendents and state government officials. The areas studied include Massachusetts and Georgia, representing states that are properly prepared for inclement weather closures and are under-prepared for inclement weather, respectively.

I use two research methods to fully understand the quantitative and qualitative effects of inclement weather closures. The first is a quantitative analysis of district-level data on inclement weather days and AP exam scores over the past five years. To accomplish this, I contacted public-school districts in the two states involved in the case study to get raw data on school closures and combine this with already available datasets on AP exam score performance. The second is a qualitative account of inclement weather days from teachers and superintendents from districts across both states to establish their opinions regarding school closures and investigate the decision-making process in canceling school. In this qualitative assessment, I observe the roles that socioeconomic status and public transportation, among other factors, play in cancellations.



Methane Concentrations and Microbial Community Structure in Boston Groundwater Wells

Victoria Momyer

CAS Biochemistry & Molecular Biology and Biotechnology BA/MA

Methane is a powerful greenhouse gas with a global warming potential 34 times that of carbon dioxide. Recent work has demonstrated high methane concentrations in groundwater wells. While previous research has focused on non-natural sources (e.g., gas leaks) of methane in groundwater wells, it is also possible that methane is produced here via archaea, a kingdom of special microorganisms. Here I determine the source(s) of the high methane concentrations in groundwater wells in Boston, MA. I also identify the groundwater well methanogen (methane-producing) and methanotroph (methane-consuming) microbial community. To do so, I collected gas, water, and DNA samples from nine groundwater wells throughout the city between 2017 and 2019. Methane concentrations were determined using gas chromatography. DNA samples were extracted, replicated with archaeal and bacterial DNA primers, and sequenced. The mean (\pm standard error) groundwater well concentrations were 26251.02 (+11195.49) ppm and 339.35 (+171.79) ppm for methane including and excluding gas leaks, respectively. I defined natural gas leaks as methane concentrations $>2.5\%$ and found that almost 30% of measurements could be attributed to leaks near the groundwater wells. In groundwater wells with no natural gas leaks, methane concentrations were negatively correlated with dissolved oxygen concentrations and positively correlated with salinity. Additional data on the groundwater well microbial community is forthcoming and will also be presented. Overall, this study shows how various environmental conditions such as salinity, dissolved oxygen, and distance to seawater impacts methanogen and methanotroph populations. Additionally, it could give insight into how microbes contribute to excess methane emissions in an urban environment, helping scientists create more accurate modeling of methane emissions in cities in order to better determine how to mitigate it.



A Boston Bestiary

Macken Murphy

CAS History and Biological Anthropology

A Boston Bestiary is a whimsical book about our city's wildlife. Bostonians, by and large, are under the impression that we are the only species in our ecosystem. In truth, our concrete jungle is teeming with life. This book is designed to cut through our illusion of solitude by giving our neighborhood creatures the attention they richly deserve. Each of the least-appreciated animals in our city gets a chapter to themselves, filled to the brim with fun facts and amusing anecdotes. This interdisciplinary project draws from historical archives, newspapers, scientific journals, and scholarly articles, to produce a tribute to our local creatures that is both informational and entertaining. From gangster turkeys taking over intersections to rats driving cars, from English-speaking starlings to seagull saboteurs, this book contains true stories and facts about local wildlife you've never heard, that will completely reframe your relationship with your nonhuman neighbors. This project endeavors to inspire its readers to pay a little more attention during their strolls through the city, and appreciate the fascinating wildlife that they have free and constant access to. Every day, we have the opportunity to enjoy observing wild animals in their unnatural habitat—too often, we pass it up. We are sleepwalking through the zoo; it's time to wake up.



Cybersecurity in the UK: Impact of the 2016 National Cyber Security Strategy on Domestic Cyber Resilience

Mats Najberg

Pardee International Relations

<https://drive.google.com/file/d/1ARt5JdSfutIYxF1gFDg3zC0tzcCfG1RD/view?usp=sharing>

Terms like “cybersecurity,” “cybercrime,” and “cyberattack” are increasingly familiar, but people rarely realize the impact cybercrime has on individuals, companies, governments, and economies. By 2021, cybercrime will cost the world economy \$6 trillion annually.^[1] Many countries have taken steps to improve the cybersecurity of their country but few have taken cybersecurity as seriously as the UK has. Since 2016, the government has allocated £1.9 billion towards cybersecurity through the 2016-2021 UK National Cyber Security Strategy. Using this document as the basis for analysis, this research paper will seek to answer the question: To what degree do formal cybersecurity strategies adopted by states impact public and private cyber resilience outcomes? Specifically, how have public & private sector cyber resilience, and the development of a resilient cybersecurity ecosystem in the UK been impacted by the initiatives, standards, and goals put forward in the 2016-2021 national cybersecurity strategy? We used government status reports for ongoing initiatives, news media coverage, government websites, crime and awareness statistics, and in-person interviews with British cybersecurity experts to answer this question. Findings showed while private sector cyber resilience is currently poor, the public sector is effectively managing its cyber risk, and the UK government has laid a strong foundation for a resilient cybersecurity ecosystem. Therefore, the paper seeks to offer insight into which types of initiatives are effective, which initiatives do not produce results, and how a government can raise societal awareness about the seriousness of cybersecurity.

[1] <https://www.herjavecgroup.com/wp-content/uploads/2018/12/CV-HG-2019-Official-Annual-Cybercrime-Report.pdf>



Examining Extreme Cold Weather-Related Health Incidences among Urban Residents in the Greater Boston Area from 2005-2015

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On average, Boston experiences around 25 days a year where the temperature remains below freezing, while an extreme cold weather temperature of 0F or less occurs once per year on average. A consequence of such harsh weather conditions include cold weather injury and related health conditions, and more than 200 patients were diagnosed in the emergency department at Boston Medical Center (BMC) from January 1, 2013, to December 31, 2014, with a cold-weather injury, 25% of which were admitted to the hospital. The cold weather conditions pose a significant challenge to individuals who lack security in housing, and past studies have shown that regardless of whether housing instability caused, or is a consequence of, various health problems seen at the hospital, several health conditions are most prevalent among this population. The purpose of this project is to characterize the burden of cold weather injury and its associated risk factors among Boston residents seeking care at BMC, the leading safety-net hospital and emergency services in New England. Emergency department health records from November 1, 2004, to March 31, 2005, with a cold-weather injury, were taken from BMC's Clinical Data Warehouse. Case-control study analyses were made using conditional logistic regressions on STATA, accounting for risk factors such as gender, race, age, homelessness, and histories of mental health and drug abuse. This project identifies such related risk factors and the patterns in hospital admissions among those most vulnerable in Boston. The increases in related hospital admissions seen during extreme cold weather conditions call for prevention strategies that would help protect or mitigate the impacts on the Boston residents.



Overcoming Venetoclax Resistance in Acute Myeloid Leukemia

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The prospect of curing cancer is no longer unfathomable, but remission rates for different cancers vary, since each cancer type is really a distinct disease. In particular, survivorship for acute myeloid leukemia (AML), a cancer of white blood cells, severely lags behind that of other hematological malignancies, and its standard of care has remained largely unchanged over the last fifty years. On November 21, 2018, the FDA approved the groundbreaking drug, venetoclax in combination with hypomethylating agents for elderly AML patients who are ineligible for aggressive chemotherapy. In spite of tremendous 69% overall response rate, most patients relapsed after 16 months. This suggests an unmet need to identify and to exploit vulnerabilities in venetoclax resistant cells.

The purpose of this project was to identify drugs effective in the venetoclax resistant setting. To this end, the anti-leukemic activity of novel drugs were evaluated in leukemia-bearing mice that were made resistant to venetoclax by continuous treatment. Forty targeted agents were screened using dynamic BH3 profiling assay that can indicate which drugs that cancer cells may be susceptible to. Using this assay, four drugs – S63845, LCL-161, birinapant, and quizartinib – were selected as promising candidates for testing in mice. Based on the efficacy of drugs, measured by detecting levels of human leukemia cells in mice blood, genetic sequencing, and protein levels of molecular targets, the anti-leukemic activity of these four drugs in venetoclax resistant AML were shown.

In summary, this project identified four novel drugs that showed persistent anti-leukemic activity in the venetoclax resistant setting. Further, it rationalized the power of dynamic BH3 profiling as a predictive biomarker to individualize patient therapy. With leukemia being a heterogeneous disease, it is increasingly important to tailor therapies to each person's unique disease presentation, an approach commonly known as personalized medicine. Though the technology is still in its infancy, it may have the capacity to propel cancer treatment to newer, productive heights.



Around the World and Back Again: Examining the Potential Impacts of Childhood Transnational Separation

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Thousands of immigrant families in North America experience transnational separations every year. The practice of transnational separation is widely held and is believed to be increasing in some communities, such as those of Chinese Americans. “Satellite babies,” in particular, are children who are sent abroad to live with extended family, only to be reunited with their immediate family when their parents are financially stable, can find affordable childcare, and/or have made plans for them to attend school. Like satellites in space, these children depart from and return to the same place. While some research has been conducted on the dangers of parent-child separation and the motivations behind the satellite baby phenomenon, much is still unknown about the impacts of this particular type of family arrangement on parent-child relationships, family systems, and mental health. Thus, the present study seeks to compare Chinese American adults ages 18 to 42 who have and have not had a separation experience in childhood on the following outcomes: parenting behavior and communication, family communication and cohesion, and self-esteem and resilience. Within the group of adults who have had a separation experience, the study seeks to examine how the aforementioned outcomes vary based on different factors related to the separation experience (e.g., duration, age of separation and reunification, birth order). Through an online survey, this study hopes to elucidate the variables that may have an effect on relationship formation, communication, and mental health as well as what protective and risk factors exist that mitigate or worsen these outcomes. Ultimately, this research hopes to inform others (e.g., parents, teachers, psychologists) about the impacts of this practice and provide some insight into attachment from a cultural perspective.



Listen with Lis: Exploring How the COVID-19 Pandemic is Affecting our Relationship with Food, Mental Health, and Local Business

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<https://listenwithlis.com/>

When COVID-19 started spreading into the US, it was apparent that drastic change was coming. However, few could have predicted the massive toll it has had on our mental health, as well as the impact on local businesses. As a means of researching the fallout from the pandemic, I have created a podcast series, Listen with Lis. I aim to examine the myriad of issues surrounding Covid 19 as they continue to manifest themselves in both Boston and my hometown of Dover, NH.

At the time of writing, I have spoken with two of my peers: a Boston University student and restaurant industry professional. Both have been affected by the pandemic. The student was forced to leave behind her belongings in her Boston apartment while the other, like so many other food workers, has lost her main source of income. Future episodes will focus on the impact of the restaurant industry in Dover, NH from the perspective of a local restaurant owner, as well as an interview with a mental health professional to discuss the effects of isolation and how we might mitigate those.

The second piece to this project is the website I have created at www.listenwithlis.com. Here, viewers will be able to listen to my podcast, as well as view resources for dealing with this crisis and recipes for cheap and healthy meals; something that is needed more and more as the virus threatens supply chains and grocery stores worldwide and forces restaurants to close.



Characterization of Parathyroid Adenomas

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Pre-operative localization of parathyroid (PTH) lesions with ultrasound (US), nuclear scintigraphy or computerized tomography (CT) allows for minimally invasive PTH surgery. US provides point-of-care imaging, allows description of parathyroid glands and avoids exposure to ionizing radiation. This study is a retrospective chart analysis of patients who underwent parathyroid surgery between 2014 and 2018 at Boston Medical Center (BMC) with the aim of evaluating the effectiveness of pre-operative imaging in localizing parathyroid lesions and to determine practice patterns of providers. 295 patients were included in the final analysis- 41 male and 105 female patients with an average age of 57.7 ± 14.6 years. Of these, 199 were referred to the surgeon by BMC endocrine providers. Criteria suggesting successful removal of the PTH lesion(s) varied based on preexisting medical conditions such as end stage renal disease in which intraoperative PTH values were normalized. In patients managed by BMC endocrinologist, when US was the initial modality of imaging, 38.7% had additional alternative parathyroid imaging. When considering patients with BMC endocrine providers, 98 (49.2%) had one imaging study, 77 (38.7%) had two studies, 22 (11.1%) had three studies performed, and 2 (1%) had no studies on record. When including all providers, 182 out of 264 (68.9%) US images had correct localization of at least one parathyroid lesion and 154 (58.3%) identified all lesions removed by the surgeon. This illustrates increased utilization of US to localize PTH adenomas. Given the efficacy of US imaging in correctly identifying parathyroid abnormalities in patients, endocrine providers need to develop confidence in US imaging over other methods to reduce radiation exposure to patients and decrease long-term health care costs.



Structure Groups of Linear Combinations of Canonical Algebraic Curvature Tensors

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Algebraic curvature tensors are a tool that can be used to study the curvature of manifolds. They can be expressed in a variety of ways, and it is helpful to study invariants that can distinguish between the different expressions. One such invariant is the structure group of an algebraic curvature tensor, defined as the subgroup of linear transformations that preserve the algebraic curvature tensor under precomposition. It has been shown previously that there are many cases in which the structure group of the sum of two canonical algebraic curvature tensors is equal to the intersection of the structure groups of each individual canonical algebraic curvature tensor. This paper demonstrates that there are some cases in which the intersection of the structure groups of two canonical algebraic curvature tensors is properly contained in the structure group of their sum by constructing a family of examples which do not preserve either of the canonical algebraic curvature tensors but do preserve their sum. Additionally, this paper investigates the measure of the set of ordered pairs of canonical algebraic curvature tensors such that the structure group of the sum properly contains the intersection of the structure groups of each canonical algebraic curvature tensor in dimension 3 or lower.



A Lost Generation: How Government Policy Creates Systemic Barriers to Refugee Education

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Education is among the most important and frequently cited factors contributing to refugee integration with host communities. In Istanbul, education and language acquisition act as gatekeepers to further technical training and the Turkish job market. Yet despite general consensus on education's importance, NGOs in Istanbul continue to face policy barriers making educating Syrians even more challenging. This paper addresses why systemic barriers still exist and how NGOs provide services even in this challenging environment. To do so, I analyze a series of seven interviews with NGO employees and volunteers in Istanbul. Based on their responses, I argue that policy on education of Syrians in Turkey is a result of the broader post-coup political context. I also examine the strategies that NGOs in Istanbul employ to continue providing services, both by deliberately renaming programs and via a public-private partnership model. Through this analysis, this paper presents how national politics affects refugees' ability to access education, shifting the current conversation in refugee education literature to state and non-state actors.



Discrimination in Wartime

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Following the United States' declaration of war against Germany in 1917, suspicion of German Americans developed into multi-faceted prejudice that targeted German language usage in public areas, German American association membership, and German culture. Previous studies have documented the impacts of these actions, taken both by the American federal and state governments and privately by American citizens, on German cultural identification through the late 1910s and 1920s in America. This research aims to expand on this body of work by examining shifts in German-American political identification as a result of the pressures faced during World War I.

I surveyed changes in membership rates of the American Turner Society, a German American organization that supported physical education and liberal political ideology, from 1902-1930 in order to capture any changes in civic organization participation, a well-documented avenue for political expression. Additionally, I compared state voting results from 10 counties in Texas containing a majority or significant plurality of self-identified German Americans from 1914-1928 to statewide voting averages across the same time span in order to measure changes in party identification and political participation. I then use the results of these two methods to determine how significantly Texas German American political participation and national German American civic society participation changed due to external influences during World War One. I hope that the project will also contribute to the larger body of work that examines the politicization of culture and cultural assimilation through U.S. history.



Examining Heroes and Villains through 21st Century Children's Literature: The Hostile Hospital

Julia Rowley

Wheelock English Education, Minor: Linguistics

Chances are you have experienced a Socratic seminar or a discussion about morality in your high school English class: perhaps whether Huckleberry Finn's character had developed by the end of his titular novel or if Atticus Finch was a hero instead of just another white savior stereotype. But when we rely on the literary canon – severely lacking in diversity and many components of which have been written centuries ago – are we limiting the depth of information we can draw upon for discussions about morality? This research project investigates whether using material from *A Series of Unfortunate Events*, published in the early 21st century, to discuss heroes and villains can provide a glimpse into what readers reference when discussing modern works. Will readers still cite characters, themes, and lessons from the literary canon when discussing a more recent material or will they draw upon knowledge from its contemporaries? In this presentation, I hope to show that using 21st century children's literature adds dimension to the literary canon by providing new scenarios and characters for students to discuss. These findings, if significant, could be a call to action for schools and teachers to branch out of the canon and be empowered to include more modern literature written for younger readers.



Anyone Can Whistle: Investigate the use of theatrical artifice as satire

Zachary Sager

CFA Lighting Design

How does a seemingly outdated, poorly structured, and often forgotten musical become relevant in today's political climate? Stephen Sondheim's *Anyone Can Whistle*, formerly playing at the Booth Theatre April 24-26, has potential but only when given new life. In a new interpretation of Sondheim's first flop, Mayor Cora Hoover Hooper leads a circus of henchman presiding over her town's sole economic resource, a sanitarium for the non-conformer, only to have the grotesque artifice of her rule and her miraculous new scheme to save the town (and her own power trip) revealed by the team of Nurse Fay Apple and her new romance, Hapgood.

Zachary Sager's KHC Keystone project and BFA lighting design thesis is to help reveal these characters over time, help to move time and space, and to be one part of the design concept: the mayor's trumped up regime is shown to be artificial through the ever-increasing grotesque theatricality and presentationality of her character and those that align with her, while Nurse Fay Apple and Hapgood are shown to be in sincere pursuit of a society without the likes of the mayor. The satirical script attacks religion, McCarythism, theatre and art. The lighting design is meant to lean in to theatrical tropes and classic devices in an especially grotesque effort to create heightened spectacle, that asks the audience to think critically and discover the relativity of this microcosm's disposition to our own. Using a background of text-based research, this newly theoretical project is showcased using renderings of key moments throughout the musical and a package of the documents and technical drawings required to produce a lighting design.



You Voted Red, I Voted Blue: A Romantic Comedy About Cross-Party Relationships

Anna Spier

COM Film & Television

The current political climate in the United States has resulted in animosity between liberals and conservatives. This research project examines how political affiliation affects the relationships between people of different political parties. The findings were used to write a romantic comedy screenplay about a democrat and republican who start dating after Donald Trump is elected president. I communicated with democrats and republicans between the ages of 18 and 23 about their introductions to politics, the issues they care about, and issues they are not willing to compromise on. My research left me with four main takeaways that would help with the development of characters and plot: people knew about their partner's politics, people who had been in a cross-party relationship believed that it was possible to respect their partner's beliefs, people were less willing to compromise on issues tied to their values, and it is difficult to change someone's political beliefs. These takeaways helped me develop characters and storylines for my screenplay. The people who had dated across party lines helped shape the main characters while those who had not helped influence the supporting characters who do not believe the relationship will work. Additionally, learning about the issues people are less willing to compromise on determined the conflict in the story. This screenplay follows a couple trying to focus on what they have in common as their friends, families, and the media constantly remind them of what makes them different. Conducting this research on political affiliation's effect on relationships allowed me to write a topical screenplay that has a basis in fact.



An analysis of distributive and procedural justice: Children's interpretations of inequality produced by a fair procedure

Lucy Stowe
CAS Psychology

Children and adults dislike inequality, but they tend to have a stronger aversion to receiving less than a peer compared to receiving more (Blake & McAuliffe, 2011; Blake, McAuliffe & Warneken, 2014; Blake et al., 2015; Loewenstein et al., 1989). However, recent research has found that children will accept less than a peer as long as they perceive the procedure that produced the inequality to be fair (Shaw & Olson, 2014; Shaw et al., 2016). The research reviewed here offers some evidence that procedural fairness matters more than distributive fairness with age but that this result varies depending on the context. The sample we collected consisted of 48 participants (29 females) with a mean age of 76 months ($SD = 16.7$ months, range = 43-105 months). All children participated in a coin flip game where they could either win a few or many stickers depending on the coin used and the outcome. They also played a third-party version of this game where they received no stickers themselves but helped distribute stickers to two absent peers. We found that sensitivity to the coin flip emerged with age, with older children rating a fair coin flip that gave them only 1 sticker instead of 6 stickers as more fair than how the younger children rated the same procedure with the same outcome. We also see that younger children are more likely to rate a third-person inequality as more fair than a first-person inequality, suggesting that younger children hold different norms for themselves than they do for others. The results of this study clearly show that there is a developmental trend towards procedural justice in older children. In light of the current COVID-19 pandemic, studies could look at the fairness of how testing kits and ventilators are distributed. For instance, would the procedure by which these resources are distributed (i.e. a lottery system, a first come, first serve basis, a hierarchy by which those who can afford treatment receive it first) make the severity of this kind of inequality either more or less fair?



Can We Escape the Urban Noise? Noise Pollution in Protected Areas near Boston

Carina Terry

CAS Earth & Environmental Science, Minor: Biology

Levels of environmental sound have been greatly increased by industrialization, creating what is frequently referred to as “noise pollution.” Noise pollution has a variety of negative effects: for humans, it can cause hearing damage, increase stress, and cause cardiovascular issues, while for animals it can impede communication and reproduction. Unfortunately, noise pollution is becoming increasingly prevalent in protected areas. The goal of my project was to identify the extent of anthropogenic noise pollution and the contribution of car and plane traffic in protected areas near Boston. Working with the lab of Dr. Richard Primack, we measured sound levels at the Blue Hills Reservation, Hammond Pond Reservation, and Hall’s Pond Sanctuary. With this data we created detailed noise maps of each area and developed a model to predict the sound level at any location within the parks. We found that car traffic has the greatest impact on sound level; sound level decreases logarithmically with increasing distance to the nearest road, with the greatest decrease occurring within the first 50 meters and a limited impact after 300 meters. Plane traffic causes an increase in sound level as well, but the major impact from planes comes from the variability of the noise they create. We also found that lower frequencies inaudible to humans contributed an additional 10 decibels to the soundscape. Overall, our data indicate that protected areas near Boston are heavily impacted by anthropogenic noise pollution, particularly by sound from car traffic. This finding suggests that an effective way to reduce noise pollution could be the installment of sound barriers near roads to reduce the intrusion of noise into the interior of the region. Future studies could build on the predictive models we created to investigate the ability of sound barriers to reduce noise in protected areas.



The Role of Acculturation: A Review on Somali Refugee Women's Mental Health Outcomes

Jessica Thai

CAS Psychology, Minor: African Studies

Acculturation is a complex process that can influence a refugee's physical and mental health. This systematic review focuses on the effects of acculturation within Somali refugee women living in the United States, Canada, and Europe. The purpose of this review was to examine how acculturation influences Somali refugee women's mental health outcomes, including the psychopathology and perceptions of mental health. A total of 26 articles were retrieved and reviewed using electronic databases. Overall, the literature suggests that acculturation is one of the many factors that influences and is influenced by other determinants of individuals' mental health outcomes. Acculturation was found to interact with four interconnected health domains: (1) traditional explanations for mental illness; (2) social support; (3) health seeking behavior; and (4) post migration stress. Results from the literature underline the need for community-based approaches to mental health services.



Let's Talk About Sex, Baby!

Ramya Vemulapalli
SAR Health Science

<https://anchor.fm/ramya-vemulapalli>

With a lack of federal regulation or guidance to promote equality, the United States' sex education is highly variable between states, counties, school districts, and even classrooms. Ranking among the highest teenage pregnancy and sexually transmitted infections (STIs) in developed countries, the United States is years behind in its understanding of the importance of quality sex education. Contrasting the United States' lack of universal, holistic sex education, Sweden has a national comprehensive sexuality curriculum that has been ongoing since the 1950s. This comprehensive sexuality education has proven to be beneficial as Sweden's teenage pregnancy rate is almost one fourth of the US's, has lower rates of STI transmission than the US, and ranks number one in gender equality according to the UN. This project aims to compare the current sex education in the US with that of Sweden's, and ultimately advocate for a comprehensive curriculum similar to Sweden's. Information was collected through five in-person interviews with various Swedish professionals in the sex education industry and compared with published research and statistics regarding US sex education. This information is presented in the form of a six-episode podcast mini-series—*Sexcapades*—that offers a unique insight into why holistic sexuality education is both beneficial and necessary for teenagers. By addressing issues such as identity, sexual violence, communication skills, relationships, and safe practices it becomes clear throughout *Sexcapades* why the US needs to shift its perspective to the Swedish model.



Painting Douglas Adams's *Hitchhiker's Guide to the Galaxy*

Audrey Wack

CAS Neuroscience, Minors: Visual Arts and Chemistry

A variety of approaches can be utilized to illustrate or adapt a piece of literature, and science fiction in particular can conjure interesting images. Through careful consideration of the prose and description in the science fiction novel *Hitchhiker's Guide to the Galaxy* by Douglas Adams, I painted a series of pieces in oil on canvas or acrylic on paper in an attempt to adapt the novel into a short form picture book. Each piece has a basis in specific areas of text in the novel which were then translated into sketches before the painting process. Additionally, I found a technique of using the sketches as the plans for acrylic prints made by scratching out the sketch into an acrylic painted surface and stamping onto another page. Since the prints present an intrinsic time restraint, they allowed me to manipulate the pace of the images in the project and reflect on how this temporal aspect of construction affected the images – especially in comparison to the slow paced oil on canvas works. Still in progress, the book will incorporate the writing in its original format or paraphrased along with the corresponding images. I demonstrate the connections between plot, prose, and imagery as well as explore adapting humorous asides in the work by creating tangible images for the reader. Through the process I learned about the approach and execution of adapting a literary work as well as the planning and construction of visual images from written prose.



The Massachusetts Sustainability Summit

Joanna Wagner

Pardee International Relations, Minor: Environmental Analysis and Policy

For my thesis, I chose to organize and create an event bringing together representatives from environmental nonprofits based in Massachusetts. The Massachusetts Sustainability Summit was a free event for members of environmentally driven Massachusetts nonprofit organizations, consisting of a day of discussion on a variety of topics including shared strengths, weaknesses, obstacles, goals and priorities. This summit was designed to act as a conduit for organizations to share current opportunities for collaboration and partnership, and jumpstart these partnerships where possible. The expected attendees from 30+ organizations covered a range of backgrounds, with missions including environmental justice, land conservation, and social mobilization. Following the completion of the summit, it was my intention to conduct an extensive write-up of the event, including a section that analyzed whether or not more similar events could be valuable and productive to strengthening the environmental nonprofit network in Massachusetts. Unfortunately, due to the coronavirus outbreak, I had to cancel the event three weeks before it was scheduled to take place. In lieu of an in-person event, I chose to condense the questions we were supposed to cover at the summit into an in-depth questionnaire, and sent that questionnaire to all organizations that had RSVP'd yes. Using the results, I was able to compile and send out a report detailing shared obstacles and opportunities for engagement, along with a directory that had the contact information for all would-be attendees to encourage partnership at a later date.



Profiling the Proteomic Landscape of Human Breast Cancer Subtypes

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Breast cancer is the second leading cause of cancer death in US women and its diagnosis relies primarily on breast exams and breast imaging. However, these methods are not effective at detecting either metastatic cancer or the initial stages of cancer. It is imperative to discover and implement ways in which breast cancers can be detected and diagnosed at earlier stages and differentiating between molecular subtypes is a crucial step.

Breast cancer is comprised of many subtypes, each with a specific morphology, and these subtypes are classified based on the presence of receptors on the cells' surfaces. Luminal tumors are the most commonly diagnosed and are classified as either luminal A or luminal B. The third most prominent subtype is the basal subtype, which is commonly referred to as triple-negative because it lacks all three receptor proteins that are used to classify the other subtypes. The prognoses of and therapies for each subtype vary widely, further emphasizing the importance of subtype-specific treatment that can be implemented at an early stage.

Both secreted proteins and signaling proteins from nine cell lines of the three most prominent subtypes were studied using cultured cell media and cell pellets, respectively. Three replicates of each cell line were analyzed using mass spectrometry to detect mass-to-charge ratio of ions, thereby determining the abundance of proteins in a sample. It was observed that the different clinical breast cancer subtypes revealed unique and novel molecular signatures of secreted proteins. This may provide mechanistic insights into the disease related molecular pathways, in addition to constituting useful patterns of protein biomarkers in circulation. The hope is that this knowledge may serve as a foundation for the development of diagnostic methods that will allow for early detection and prognosis of breast cancer.



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Given the unique circumstances governing the symposium this year, we want to first acknowledge the members of the senior class. For all you have done to be flexible in this uncharted territory as well as for all the sacrifices you have had to make, we honor you all.

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