

# 2021 UNDERGRADUATE RESEARCH CONFERENCE

ABSTRACT  
BOOK



Brought to you by the Arts and Science Students'  
Union (ASSU)

At the University of Toronto

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**#URC2021**



2021 Undergraduate Research Conference

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## 2021 Undergraduate Research Conference

# Letter from the Conference Directors

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We are delighted to have you join us today at the fourth annual (and first ever virtual) ASSU Undergraduate Research Conference!

This project has been in the works for many months and we have dedicated numerous hours to organizing this event. An event like this is a team effort and we would like to thank all the student presenters, volunteers, faculty members, programs, departments, and Course Unions who supported us along the way. We would especially like to thank the students of our Selections Committee, along with Professors Rivanne Sandler, Lynette Ong, and Ashley Bruce.

Our goal is to showcase the dynamic research that is being undertaken by undergraduate students from a multitude of academic fields within the Faculty of Arts and Science. Presenters will have the opportunity to pose their research to a wide audience; such opportunities are often few and far between for undergraduates. Audience members will have the opportunity to witness some of the amazing research that is being done at U of T, engage with students, and think critically about the knowledge that is being shared.

Though times are different this year, we wanted to ensure that the conference was still able to go on. We believe that now more than ever, students can benefit from learning from and supporting their peers and appreciate that accomplishments continue to be made despite barriers. We truly are inspired by the resilience, resolve, and ingenuity of our students. Today's presentations will illuminate the work that our students continue to do and, most importantly, highlight their dedication to learning, finding solutions, and helping to initiate world change.

We hope that you enjoy today's experience, and we cannot thank you enough for supporting our Arts and Science community. Now, onto Zoom!

Sincerely,

**Victoria Chen**  
Cell & Molecular Biology | Psychology  
Treasurer, Arts & Science Students' Union

**Ikran Jama**  
Criminology & Sociolegal Studies | International Relations | African Studies  
President, Arts & Science Students' Union

Arts & Science Students' Union | University of Toronto | Room 1068, 100 St George Street, Toronto | 416-978-4903 | [assu.ca](http://assu.ca)

The University of Toronto is situated on the territory of the Huron-Wendat and Petun First Nations, the Seneca, and most recently, the Mississaugas of the Credit River.



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## Keynote Address

### *Stop Saving the World? Biblical Apocalypses and Colonialism in Superhero Films*

Apocalypses are not what they used to be. Instead of God destroying the forces of evil in a climactic battle, superheroes do this now. But superhero films have nevertheless kept many features of the biblical apocalypse. Aside from the fight between good and evil, many heroes are presented as messianic warriors. Their stories also sometimes feature a guide to an otherworldly realm. And perhaps most intriguingly, they are often focused on colonialism, a critical but often forgotten aspect of apocalypses in the Bible. What might some of these similarities AND differences mean? In his talk, Professor Derry offers a few thoughts on the answer to this question.

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### About the Keynote Speaker

Ken Derry is Associate Professor of Religion (Teaching Stream) in the Department of Historical Studies at UTM. His teaching and research focus is on the ways in which modern culture relates to more “traditional” religious beliefs and practices. He is particularly interested in the connections between religion and violence in Indigenous literature and film, as well as in popular culture. He has also written about teaching and learning in relation to grading, course design, and humour. Ken received his PhD from the University of Toronto and is the recipient of the 2013 UTM Teaching Excellence Award. He is married, has three cats, and continues to be surprised by how emotional some episodes of *The Great British Bake Off* can be.





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## Selections Committees

### *HUMANITIES SELECTIONS COMMITTEE*

- Academic Chair: **Dr. Rivanne Sandler**  
Associate Professor Emerita | Near and Middle Eastern Studies
- Student Members: **Psalm Tesalona**  
Criminology & Sociolegal Studies | Women & Gender Studies
- Juan Ignacio Murillo Vargas**  
Philosophy | Linguistics
- Nicole Vucemilo**  
Ethics, Society and Law | History

### *SOCIAL SCIENCES SELECTIONS COMMITTEE*

- Academic Chair: **Dr. Lynette Ong**  
Associate Professor | Political Science | Munk School of Global Affairs and Public Policy
- Student Members: **Xiyuan Gu**  
Economics | Statistics
- Grace Liang**  
Economics
- Arjun Singh**  
Political Science | International Relations | American Studies

### *SCIENCES SELECTIONS COMMITTEE*

- Academic Chair: **Dr. Ashley Bruce**  
Associate Professor | Cell & Systems Biology
- Student Members: **Sabine El-Halabi**  
Human Biology | Immunology
- Wenyuan (Kevin) He**  
Molecular Genetics and Microbiology



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# Humanities



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## **The Opioid Epidemic That's Killing Ottawa Youth: Trapped by Stigma, an Unforgiving System, and an Oppressive Socio-Cultural Environment**

**Kiera Farrell-Beaulieu**

*Political Science / Diaspora and Transnational Studies / Spanish*

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This paper seeks to explain the aspects of the social environment that perpetuate opioid use by young people living in an Ottawa suburb. It first addresses the onset of the opioid crisis in which vast supply created extreme demand, which when later withdrawn, turned demanding consumers to a thriving and highly competitive illegal drug trade. This paper goes on to examine “cutting” — a process in which street drugs are prepared using substances of varying toxicity and potency—a phenomenon that skyrocketed opioid overdose rates. The next sections study the social stigmatization and taboos about drugs that result in young people’s misinformation about drugs and using them dangerously, the criminal charges in Ontario for a first-time offense of narcotics possession, and general attitudes about mental health and seeking associated treatment. After that, this paper conducts a case study of one of North America’s most renowned festivals for drug use. In this, I look at the policing of and social attitudes surrounding substance use at the festival, any notable health and safety services available at the festival, and consider my study’s external validity. Finally, this paper proposes to alleviate strict criminal punishment for young people engaging with substances and instead improve the social attitudes and services available to assist this demographic in coping with mental health and addiction.



## Visiting Scratched Out Narratives: Gender and Contemporary Islamic Law

**Zara Lal**

International Relations | Modern Near & Middle Eastern Civilizations

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This study examines how the rewriting of socio-sexual scripts during the colonial era has affected Islamic law, by analyzing three case studies: Nasser’s Egypt, temporary marriage in Iran today, and the debate on same-sex marriage in Islam. Colonization created gendered hierarchies in international relations, which have interacted with existing systems of patriarchy to create gendered citizenships, institutions, and modernities in the postcolonial world. The case study of Nasser’s Egypt shows how the Egyptian state appropriated feminism to appear secular and modern, and inverted the colonial narrative of liberating women. The debate on temporary marriage in Iran is based on questions of modernity and represents the Iranian state’s appropriation and imposition of Western ideas of modernity, particularly sexual freedom. The debate on same-sex marriage in Islam brings together the lingering colonial specter of state ‘feminization’ and shows how socio-sexual scripts have generally been re-interpreted to align with Victorian anti-LGBTQ mores. This study challenges the view that Islamic law is static and rigidly patriarchal, by showing its dynamic history, and how it is a by-product of the aims and needs of the state—and indeed, of modernity.





## **From Fear to Laughter: A Rhetorical Analysis of Margaret Cho's *PsyCho***

**Ernest Leung**

*English / Practical French / Writing and Rhetoric*

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*Background:* Rhetoricians and comedians are alike. Rhetoricians persuade the audience to take their stance, while comedians persuade their audience to laugh at their jokes—even if the topic of the joke invokes disgust or discomfort. When studying the abject, which is a type of fear when we see a part of ourselves that we do not want (for example, our vomit), Julia Kristeva found that “laughing is a way of placing or displacing abjection,” meaning that a horrifying event can evoke humour based on the narration (8). Asian-American comedian Margaret Cho is an iconic comedian whose words play gracefully with abjection.

*Methods:* This qualitative study used rhetorical methods to analyze Cho’s 2015 stand-up comedy show, *PsyCho*. It explored the rhetorical concepts in the show that turn the fear for abject into laughter. Kristeva’s theory of abjection guides the data selection (204). This study focused on the diction of Cho’s jokes and the design of the show’s poster. Jokes were selected if their topics fall under the spectrum of the abject.

*Results:* Three topics of abjection were identified: vomit, anxiety, and racism. Four major rhetorical concepts were observed that turn these sensitive topics into laughter: *logos* (appeal to logic), *ethos* (construction of authority), *pathos* (appeal to emotions), and *identification*. *Logos*, *ethos*, and *pathos* were used to make laughter out of vomit, *ethos* was used for anxiety, and identification was used for racism. These strategies also establish Cho’s status as a funny comedian, which further helps her incite laughter.

*Implications:* The findings expand the scope of rhetorical study to stand-up comedy. In analyzing the rhetoric in Cho’s jokes on racism, the findings complicate the current understanding of rhetoric as a negative communication strategy. Instead, this paper informs the importance of rhetoric in the advocacy of social justice.



## Can E-Learning Succeed in Ontario?

**Caitlin Stange**

*English / History / Digital Humanities*

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This project examines the Ontario Government's plans to require two online credits for high school graduation, which was originally set to begin in the 2020 school year. The premise of the policy was to give students access to 21<sup>st</sup> century skills before they graduate. Collected research for this project includes news articles, Ministry of Education press releases, and previous studies on e-learning and 'Bring Your Own Device' (BOYD) practices. My examination of the Ontario Government's new graduation requirement has revealed that this initiative is currently not beneficial for students in the province, regardless of how it is implemented. A study conducted by the Michigan Virtual Learning Institute of the 2017-2018 school year found that the online credit requirement in the state has not been successful at promoting STEM subjects online. Furthermore, the Ontario Government has not sufficiently trained its teachers for the online courses, nor have they appeared to have consulted them on the new policy. Since the fall of 2019, the online learning credits have been a reoccurring issue between the Government and Ontario teacher unions, as the unions oppose the policy altogether. There is a lack of equal access to computing devices and wireless internet with this new policy, which is an area of concern that is not adequately addressed by the province. This project hopes to show a counter argument to the Ontario Government's claims about the benefits of online education in the province, as well as highlight flaws within their current announced plans for its implementation.



## **Smartphone Scriptures: Authority and Communal Identity through the Vachanamrut Study App**

**Mukti Patel**

*Religion / Writing & Rhetoric*

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In the digital age, and more recently, with the onset of coronavirus, many religious practices have shifted from physical to online spaces. For example, mobile phone applications of sacred texts allow individuals to practice without entering a house of worship. Scholars like Wade Clark Roof and Rachel Wagner argue that because digital religiosity enables individuals to blend elements of religious traditions to create a new specialized practice, it often results in an increase in individualism. Thus, the religious community dismantles as power shifts from the institution to the individual. Many have assumed that access to various scripture applications threatens religious unity, since the increase in options leads to fragmented and rearranged religiosity. In theory, this means that access to a variety of sacred texts apps would result in the decentralization of religion, shifting power away from religious leaders and disassembling the religious community.

Thousands of sacred texts exist on app stores, many of which are Hindu scripture apps. In April 2017, a reputable transnational Hindu organization called BAPS launched the “Vachanamrut Study App,” an app containing a sacred text canonical to the religious tradition. Studying this app broadens our understandings of digital religion: in contrast to Roof’s and Wagner’s theories, I argue that the digitization of the Vachanamrut reinforces centralized guru authority while simultaneously building a global identity. An analysis of app layout, contents, functions, language, and launch packages reveals that the app includes the guru’s commentary on the scripture, which is held sacred by practitioners worldwide. While digital religion was previously understood as creating highly individualized religiosities, this paper demonstrates that religion can remain centralized because of online practices while shifting communities online. These insights not only contribute to the growing body of scholarship on digital faith, but they also help us make sense of socio-cultural changes, community, and power relations during the current pandemic.



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## **Social Sciences**



## **Evaluating Development Assistance: Comparing the Goals and Effectiveness of the Foreign Aid Policies of Japan to Asia and the EU to Sub-Saharan Africa**

**Iman Ahmed**

*International Relations / Political Science*

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The European Union (EU) is the largest donor of development aid in the world, and the largest recipient of aid is India, which receives most of its funds from Japan. However, despite the global proliferation of development aid, which surpassed 165\$ billion in 2018, the effectiveness of foreign aid remains a controversial issue in today's development discourse. This essay will compare the goals and effectiveness of the Development Assistance projects from the EU to Sub-Saharan Africa and Japan to Asia, concluding that while they originate from different historical dynamics, they have over time conformed to global aid trends. Employing diverse aid mechanisms within the umbrella of technical assistance, the Japan model is more theoretically sound, as it institutes aid ownership within recipient countries reducing uncertainty and creating legitimacy, crucial elements of aid effectiveness. In contrast, the EU model, due to the lack of cohesion between the different member states and the variety of aid bureaucracies that recipient countries have to negotiate with, causes coordination fatigue which greatly limits its effectiveness. However, Japan's more stable and participatory aid model has still had only limited overall success in Asia, due to their tendency to utilize tied aid and dependence on technical experts. Both models have struggled to effectively implement human rights conditionality, inadvertently legitimizing authoritative regimes that do harm against the marginalized poor foreign aid is supposed to uplift.



## **An Internationalized Civil War: Dissecting the role of external actors in Biafra**

**Korede Akinkunmi**

*International Relations / Political Sciences / African Studies*

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Since 1960, the African continent has seen the birth of nine contested states and the death of seven of them. The phenomenon of secessionism in Africa traditionally adopts dialogue of inter-ethnic conflict and other internal mechanisms that would cause the breakdown of social relations. In this paper, I use the Biafran War of 1967-1970 to demonstrate the significant influence of external actors on the foundations, duration, and conclusion of perceived civil wars. Additionally, this paper will explore alternative mechanisms to champion African agency in the pursuit of peacebuilding.



## **Democracy, Constitutionalism, and Islam: Shaykh Mohammad Hussain Gharawi Naini's *Tanbih al-Ummah wa Tanzih al-Millah***

**Zoheir Asnaashary**

*Political Science / Near and Middle Eastern Civilizations*

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Unlike Western Europe, where ideas of modern state-nation, democracy, and constitution were native, Iran and many other polities did not have any philosophical, cultural, intellectual, and political grounds for such ideas to thrive from organically. These concepts were all the results of Western intellectual projects and were imported either by force through colonialism, or willfully to avoid falling behind from the swiftly advancing West. That these Western political ideals were not rooted in the native intellectual superstructure of non-Western civilizations made the “modernity vs. tradition” struggle an attrition warfare between the two. In Iran, some traditionalists resisted the new modern system, while some attempted to comprehend it through their own sources of knowledge and understanding. In the case of Iran and the constitutional movement of the early 20th century, the battlefield was divided between the Western-educated intellectuals and conservative clerics of the Shia. The Ulama (Clergymen) were, however, not united in rejecting the idea: some believed that democracy and constitutionalism are compatible with the political theory of Shi'i Islam.

One Mujtahid that is well known for defending the constitutional movement was Shaykh Mohammad Hussain Gharawi Naini, also known as “Mirza-ye Naini” (1860-1936). In his book *Tanbih al-Ummah wa Tanzih al-Millah*, he argues for the legitimacy of constitutionalism from the Shi'i Theological perspective. Endorsed by prominent constitutionalist mujtahids—e.g. Mohammad Kazem “Akhund Khurasani” and Abdullah Mazandarani – the book sets the groundwork for future pro-constitutionalist Shia scholars such as Sayyad Mahmud Taleghani, who edited and republished the book in 1956, and other figures involved in the 1979 revolution. In this research, I intend to examine Naini's theological argument regarding modernism, and compare it with that of Shaykh Fazl Allah Nuri who stood in opposition to the constitutional revolution of 1900s. understanding this challenge among the clergy of that age enlightens the Academia's understanding of how modernism is perceived among the Islamic intellectuals.



## **Hominin capacity for religious thought**

**Arman Behrooz**

*Sociology | Human Geography | Near and Middle Eastern Civilizations*

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Some people think religion has always been part of what it is to be human. They seek to demonstrate this by looking at brain capacity and other evolutionary factors. Some people think that the intentional disposal of the dead means that early humans had concepts of the afterlife, and that concepts of the afterlife = religion. But is this necessarily so? The only way to retrieve data from this deep in prehistory is through archaeology and its affiliated branches of investigation, paleontology, and evolutionary biology. So, can we find the way to turn supposition and assumption into fact? This problem requires a literature review in order to collect information on the chronology of hominin development in conjunction with its archaeological context; it requires an analysis of data to find evidence of religion. But to do so, we had to build links from archaeological remains to hominin behavior and then from behavior to thought.

The questions we were faced with were “when do hominins have the physiological capacity for complex thought?”, “When do hominins show material evidence that that complex thought might be religious?”, and “do other evolutionary branches (e.g. Neanderthals) also show this capacity and behavior?”. Approaching such questions, we focused on chronology, physiology, behavioral events, and interpretation. This meant that we had to avoid viewing information at face value and accepting interpretations about archeological evidence to be true. The research process thus became less about looking for information within a single place, but more about comparing information across multiple areas and verifying scholars’ interpretations through evaluation of their sources. Understandably, more questions rose than answers by the end of the research. However, the body of evidence that I will present will help illuminate answers to the three questions we were given.





## **Wipe the Slate Clean: Replicating the Connection Between Physical and Psychological Cleansing**

**Isabella Giancola**

*Economics (Focus in Data Analytics)*

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The connection between physical and psychological cleansing appears extensively in popular literature, media, and religion. Notable examples include the Shakespearian character, Lady Macbeth, who obsessively washes her hands in an attempt to remove the guilt of murder; lyrics from former lead guitarist of the Eagles, Don Felder, “wash away, wash away the pain”; and the Christian ritual of baptism where individuals are bathed to free them of past sin. However, only recently has physical cleansing become a fascination in experimental psychology. For example, after recalling an unethical deed, individuals who cleanse their hands face reduced guilt and shame, and diminished preference towards cleansing products (Zhong & Liljenquist 2006). Outside of the moral domain, washing one’s hands increases perceived optimism of future performance after failing a task (Kaspar 2013). Why do these phenomena occur? Effects in the context of morality are often explained by the “Morality is Cleanliness” conceptual metaphor whereby individuals relate morality to a state of physical cleanliness (Lakoff & Johnson 1999). What, then, about effects outside of the moral domain? To investigate, we attempt to replicate the findings of Dong & Lee (2017) who propose that physical cleansing is an embodied procedure of psychological separation (equating washing off dirt to separating feelings from the mind). While we find no significant evidence to replicate their core findings, we use our data and a review of previous literature to discuss alternative reasons behind the psychological effects of physical cleansing and examine conceptual limitations of the replicated research.



## **From Benevolence to Harsh Refoulement: Access to Legal Rights for Refugee Populations in India**

**Vamika Jain**

*International Relations / Contemporary Asian Studies / Political Science*

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Questions of citizenship, identity, and refuge have persisted and amplified within the foundations of the modern Indian nation. Conflicts over these questions emerge most strikingly in India's approach towards the wide spectrum of refugee populations seeking asylum within its borders. A non-signatory on most international frameworks governing refugee protection, India also lacks any form of national legislation that could provide a basis for access to legal rights for asylum-seekers in the country. This creates room for immense precarity and ambiguity, leaving the status of refugees vulnerable to varying judicial interpretations, arbitrary executive and administrative decisions, and geopolitical maneuvering. Indeed, through case-studies on four primary refugee populations in the country, Tibetan, Chakma, Sri Lankan Tamil and Rohingya, this paper reveals the large variation in the access to legal rights accessible to each group, ranging from benevolent state support for Tibetans to forced deportation for Rohingya. The absent national policies and scant international obligations have evidently left refugees in India vulnerable to fickle foreign policy, erratic decision-making within states, differing cultural affinities, and changing governments and economic interests. Driven by the imperative of this vulnerability, this analysis of access to legal rights for refugee populations in India provides a lens into the state practice, internal conflict, and foreign policy matrix of an aspiring great power that is increasingly shaped by polarized nationalist rhetoric.



## **Building the Bridge from Downstream to Upstream: Housing First and Homelessness Prevention Initiatives in an International Context**

**Lucy Stark**

*History | Economics*

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Since the early 2000s, communities around the world have approached their solutions to homelessness through a Housing First (“HF”) framework in which individuals are permanently housed without preconditions of mental health treatment or sobriety. Salt Lake City (“SLC”), Utah is one such location which has received attention for its implementation of HF. The goal of this research is to understand how, through the Consolidated Framework for Implementation Research (“CFIR,” see Methods section), HF interventions in SLC compare to similar efforts internationally. This research finds that, when compared to Helsinki, Finland and Calgary, Alberta, SLC’s implementation of HF shares similar elements within three CFIR domains: Characteristics of Intervention, Outer Setting, and Process of Implementation. While a successful HF approach remains an integral component of reducing homelessness, all three locations prove that HF alone is insufficient to maximize and sustain these reductions. To progress significantly towards their goals of ending homelessness, these communities and all others must pair HF with robustly funded and institutionalized prevention measures.



## **A Function of Correlates or a Failure in Bargaining? Theoretical Inquiry into the Onset of the Second Sudanese Civil War**

**Diego Vásquez**

*Peace, Conflict & Justice / Political Science*

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For most of its history since its independence in 1956, Sudan has stood at the mercy of protracted civil wars. The Second Sudanese Civil War claimed two million casualties, four million displaced peoples, and saw the outset of child soldiers, genocide, famine, and several violations of human rights and the international law of armed conflict. Current literature on intrastate violence spans multiple disciplines, including political science, economics, psychology, and history. Further, this scholarship examines many causal factors for war such as primary commodity exports, political leaders, failed states, economic growth, state fragility, asymmetry, ethnicity, and rational models. Understanding which of these approaches provides benefits for analyzing civil war remains pivotal. That said, which of these theoretical models best explains the outbreak of the Second Sudanese Civil War? In this presentation, I propose, and test three leading civil war onset theories to understand the Second Sudanese Civil War: 1) correlational approaches; 2) bargaining approaches; and 3) contentious politics framework. By outlining each theories' assumption with history on Sudan's war, I cross the bridge from theoretical inquiry to empirical investigation. Explaining the mechanisms causing the Second Sudanese Civil War has significant policy implications. After two decades, the Second Sudanese Civil War concluded with a referendum and the birth of South Sudan. Much of the turmoil in present-day South Sudan is a direct aftershock of the political fragility experienced throughout earlier wars. Therefore, identifying actions which lead to this relentless and continuous bloodshed may aid future policymakers in recommending solutions. By applying concepts from history, political science, and economics, this research contributes to an interdisciplinary dialogue in testing the onslaught of the war in Sudan.



## **Imagine all the people: characterizing social music sharing on Reddit**

**Veniamin Veselovsky**

*Math | International Relations*

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Social groups form and develop their collective identities through cultural activity, such as music sharing. Although online community platforms have been extensively studied, the social context of music sharing in online communities has been difficult to include. Datasets derived from online platforms often do not contain structured data corresponding to the music being shared on them, and music datasets are mostly either acoustic in nature or contain traces of private listening behavior. In this work, we join these two literatures with a large-scale analysis of social music sharing on Reddit. We find significant patterns in how artists are publicly discussed, and cluster them into new “social genres”. These often follow musical genres, but there is also a significant amount of extramusical sharing. These new social genres provide a cultural grouping of various musical artists into groups like memes, sports, and female pop. Next we use information about the underlying communities where the artists are shared to extract information about artists like how partisan and political they are, what is the typical affluence of the listeners, and how the audience breaks down on the age and gender dimensions. Finally, we characterize the artist embedding by developing two scores, the GS-score and a meme score, that capture the extramusicality and memeness of an artists' sharing, respectively.



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## Sciences



## **The BDNF *Val*<sup>66</sup>*Met* and COMT *Val*<sup>158</sup>*Met* Genetic Polymorphisms Influence Memory and Executive Function in Women with Bilateral-Salpingo Oophorectomy**

**Aanya Bahl**

*Ecology & Evolutionary Biology | Physiology | Spanish*

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Abundant evidence suggests that 17 $\beta$ -estradiol (E2) supports learning and memory. Women with prophylactic bilateral salpingo-oophorectomy (removal of both ovaries and fallopian tubes; BSO) prior to spontaneous (natural) menopause, experience an abrupt and early decline of E2. These women are at an increased risk for developing later life Alzheimer's Disease and dementia without E2 therapy (ET). Endogenous E2 is known to interact with the Val<sup>66</sup>Met brain derived neurotrophic factor (BDNF) gene polymorphism, which affects BDNF protein levels in the brain, and the Val<sup>158</sup>Met catechol-o-methyltransferase (COMT) gene polymorphism, which affects prefrontal dopamine levels, to influence memory. However, no study has investigated the effects of these genetic polymorphisms on memory in women with BSO. In the present study, we investigated whether midlife BSO and ET post-BSO interacts with the Val<sup>66</sup>Met BDNF and Val<sup>158</sup>Met COMT genetic polymorphisms to influence memory. We tested women with BSO either taking ET (BSO+ET; n = 34) or not taking ET (BSO; n =30), and age-matched premenopausal controls (AMC; n = 44) on the Spatial Working Memory Task, Digit Span Task, Rey's Audio Verbal Learning Test, and Logical Memory Test. Using linear regressions, we found that BSO+ET COMT *val/val* (n = 7) exhibit better working memory than BSO+ET COMT *val/met* (n = 5). Contrarily, AMC COMT *val/val* (n=7) exhibited poorer working memory than AMC COMT *val/met* (n = 11). Further, BSO BDNF *met* carriers (n = 8) showed worse episodic memory than their *val/val* counterparts (n = 9), while the opposite relationship was found in the BSO+ET group (*met* carriers, n = 2; *val/val*, n = 13). These preliminary results suggest that exogenous E2 may not interact with the COMT and BDNF polymorphisms in the same way as endogenous E2, and supports that estrogen interactions with genes should be considered in investigations of cognitive performance.



## **From a novel campus tour to better memory: Replaying spatial routes improves real-world navigation in older adults**

**Miranda Chang**

*Psychology (Research) / Neuroscience*

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The ability to successfully learn and navigate through new spatial routes is compromised with age. This can have a profound impact on personal autonomy and quality of life, emphasizing the importance of developing novel interventions to mitigate age-related declines in spatial navigation. Digital memory augmentation (DMA) is a promising tool to mitigate episodic memory loss, using portable devices to capture day-to-day events for later review. However, no study to our knowledge has attempted to use DMA to directly improve spatial navigation of novel routes. In the present study, we aimed to investigate whether reviewing rich navigational cues of novel routes would improve spatial memory of those routes. Thirty-one older adult participants learned novel routes on a real-world guided walking tour of the University of Toronto St. George campus. We used a within-subjects design where twenty-seven older adult participants returned to learn distinct non-overlapping routes at a separate session; however, all thirty-one participants were included in the analyses. Participants were randomly assigned to one of two experimental conditions at the first session: (1) a replayed condition, where participants reviewed video cues of their initial route learning, or (2) a non-replayed condition, where they did not, and participated in the alternate condition at the second session. All participants were asked to return two days after the guided walking tour for a series of follow-up memory assessments. We found that participants had better temporal order memory and allocentric memory for locations encountered along the guided tour in the replayed condition. Participants also recalled replayed routes with more vivid re-experiencing and detailed egocentric representation of space compared to non-replayed routes. Additionally, we found that participants showed stronger temporal reinstatement for replayed routes such that recollection of those routes was better organized in a contiguous manner. These findings suggest that reviewing rich video cues can optimize learning of novel spatial routes in older adults.





## **Searching for Belonging: Sense of Belonging as a Protective Factor against Mental Illness amongst Uyghur Refugees**

**Hala Bucheeri & Shahd Fulath Khan**

*Psychology / Neuroscience*

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Uyghurs have fled their homes in Xinjiang due to the ongoing oppression by the Chinese government, resulting in large numbers of refugees and diaspora communities around the world. While Uyghurs are facing several post-migratory challenges in their host countries, having a sense of belonging to their new home can be a protective factor against the development of mental illness. In this study, we hypothesized that a higher sense of belonging would be associated with lower incidences of depression, PTSD, and distress. A mixed-method study consisting of interviews (n=10) and questionnaires (n=109) was used to investigate the research question. Interviews were conducted in English using online video platforms. The interview questions were semi-structured and centered around belongingness and wellbeing. The questionnaire consisted of demographic questions, and the General Belongingness Scale (GBS), the Centre of Epidemiological Studies Depression Scale (CES-D), PTSD Symptoms Scale (PSS), and Kessler's Psychological Distress Scale (K10). Majority of participants were between 21 and 50 years old (86%). Participants were recruited from different host countries, including Canada, Turkey, United States, United Kingdom, Germany, and Australia. Pearson's correlation was conducted between the questionnaire scales. The total summation scores were calculated for each participant in order to obtain the mean score on each scale measure. We found that higher scores on the GBS was associated with low scores on the CES-D scale ( $r=-.653$ ), PSS ( $r=-.508$ ), and K10 scale ( $r=-.565$ ), demonstrating a moderate negative relationship. We also found that Uyghurs are facing a variety of challenges that deplete sense of belonging, such as absence of political support, lack of cultural programs, uncertainty about loved ones' status, language barriers, and frequent cyber-attacks by Chinese governments while abroad, offering important implications for policymakers and community workers. Future studies should investigate identity and its relationship with sense of belonging, especially among Uyghur children and adolescents.



## **How 17 years of on-road surveys detected a 73% decline in a seemingly common amphibian**

**Claudia Lacroix**

*Environmental Science / Biodiversity and Conservation Biology*

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Recent work suggests that freshwater turtles communicate by sound. Hatchling vocalizations among turtles, for instance, may be important for communication, perhaps to encourage hatching synchrony and coordinate group emergence from subterranean nests (the ‘Social Facilitation Hypothesis’). Here we explore whether the presence of siblings during hatching and nest emergence in hatchling turtles increases fitness—a basic pre-requisite of the Social Facilitation Hypothesis – using the broadly distributed snapping turtle (*Chelydra serpentina*) as a model organism. First, we demonstrate that *C. serpentina* hatchlings have a vocal repertoire: we detected vocalizations of 5 different types in a simulated nest environment; most vocalizations occurred in the 24 hrs following egg pipping and hatching. Next, we demonstrate that hatchlings benefit energetically from emerging with sibling’s vs emerging alone: we manipulated egg burial depth (shallow or deep) and sociality (presence or absence of siblings) in a 2 x 2 factorial design and found that eggs in the social treatment hatched earlier and lost less weight while emerging from the nest. We then examine behavioural response of hatchlings to vocalization playback and show that vocalisations do not cue hatching. Our data provide incremental support to the Social Facilitation Hypothesis, while contributing to a growing literature on reptile sociality.



## **BEHST: genomic set enrichment analysis enhanced through integration of chromatin long-range interactions**

**Zhiyuan Lu**

*Computer Science / Data Science*

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To discover biological mechanisms mediated through intergenic regions, we recently developed a computational method, Biological Enrichment of Hidden Sequence Targets (BEHST). BEHST takes advantage of long-range chromatin loops from Hi-C data to precisely associate intergenic regions to genes, and then generates an enriched list of functional annotations related to those genes. However, currently there are no systematic criteria to evaluate and compare the performance of such gene set enrichment analysis (GSEA) tools. Researchers have to manually categorize ontology terms as expected or unexpected functions, which is biased from ad hoc interpretation by the authors.

In this project, I developed a new benchmarking method to examine whether a tool produces Gene Ontology (GO) biological process and molecular function terms that one would expect, in a systematic way that does not have bias from our manually ad hoc interpretation.

Our new method will help us choose the tool that can generate more specific and precise GO terms. Using an appropriate tool will accelerate the discovery of affected pathways mediated through intergenic regions such as non-coding hits in genome-wide association study (GWAS) or genome editing screens. Overall, using gene set enrichment analysis techniques will result in a better understanding of the genome, such as with the genetic mechanisms leading to disease.



## **LncRNAs AC114803.3 and CTC-297N7.5 significantly expressed in hepatocellular carcinoma cell lines; AC114803.3 associated with worse prognosis**

**Shruti Misra**

*Neuroscience | Psychology | Writing and Rhetoric*

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*Background and Aims:* Hepatocellular carcinoma (HCC) is the most common type of primary liver cancer and is the second most lethal cancer type. With the majority of diagnoses being at advanced stages with few treatment options available, it is imperative to find new diagnostic biomarkers and therapeutic targets for the cancer. Given the importance of long non-coding RNAs (lncRNAs) in liver cancer development and progression, here we investigated the expression levels and mechanistic roles of two novel lncRNAs, AC114803.3 and CTC-297N7.5, in HCC cell lines.

*Methods:* The expression levels of both lncRNAs were examined using quantitative reverse-transcriptase polymerase chain reaction (PCR) assay in four HCC cell lines: Huh7, HepG2, Hep3B, and PP5. The lncRNA AC114803.3 was silenced in the PP5 cell line using short interfering RNA, and cell viability and confluence were measured using an Alamar Blue viability assay and a 72 hour zoom confluence assessment respectively.

*Results:* Significant expression of lncRNA CTC-297N7.5 was found in the Hep3B cell line and significant expression of lncRNA AC114803.3 was found in the PP5 cell line. Cells with lncRNA AC114803.3 silenced showed reduced viability and confluence in comparison to the control cells.

*Conclusions:* Both lncRNAs are significantly expressed in at least one cell line. Reduced viability and confluence in cells with AC114803.3 silenced suggests that the lncRNA is potentially associated with worse HCC outcomes.



## **Factors predicting Non-Response to Stress Management Training in Cardiac Rehabilitation**

**Isham Umair**

*Neuroscience / Psychology / Buddhism, Psychology and Mental Health*

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*Objective:* To investigate the demographic, physical and psychological factors that predict non-response to stress management training (SMT) in cardiac rehabilitation (CR)

*Methods:* Data was collected from 16 CR patients who attended a 7-week-long SMT intervention. Demographic variables were assessed at baseline with a questionnaire booklet asking about gender, marital status and employment status. Physical and psychological variables were evaluated at baseline using the STOP-Bang, Post-Traumatic Stress Disorder checklist for DSM-5 (PCL-5), Aversive Childhood Experience (ACE), Difficulties in emotion-regulation (DERS). Performance measure was assessed at post-treatment by asking participants to record their average practice time each day. The primary outcome was psychological stress, which was evaluated using the Centre for Epidemiological Studies-Depression (CES-D), Beck Anxiety Inventory (BAI), Sleep Condition Indicator (SCI) and the Kessler Screening Scale for Psychological Distress (K6).

*Results:* Low practice time ( $r^2 = 0.33$ ,  $p < 0.05$ ) and low risk of moderate to severe risk of OSA ( $r^2 = 0.22$ ,  $p < 0.05$ ) were the strongest predictors of non-response of SMT. Moderate predictors included gender ( $r^2 = 0.012$ ,  $p < 0.05$ ), and marital status ( $r^2 = 0.025$ ,  $p < 0.05$ ) The weakest predictor was childhood aversity ( $r^2 = 0.005$ ,  $p < 0.05$ ).

*Conclusion:* Practice time plays the most key role in improvements of outcomes in CR patients, highlighting the importance of SMT program instructors encouraging patients to practice more than 30 minutes each day. Also, males and unmarried patients will likely be non-responsiveness to SMT, though, to a lesser degree than patients with a lower practice time. This stresses the importance of modifying the present SMT program to include a wider range of patients or offering alternative psychological interventions to males and single CR patients. Finally, SMT can be an effective strategy to improve psychological stress outcomes in patients with a moderate to severe risk of OSA.



## **Moonshot Project: A Therapeutic Device for Psychological Disorders**

**Zhiwei Xue**

*Biochemistry / Physiology*

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Many psychological disorders are affecting thousands of patients worldwide, such as post-traumatic stress disorder, depression, and bipolar disorder. The cost of treating these diseases is enormous, both on the government and on the patient family, and typically disorders as such cannot be completely cured but appropriately managed. Electroencephalography can unveil changes in brain waves and brain functions at different stages of neurological disorder, which can aid in diagnosis and monitoring treatment efficacy. It has been known that few physical interventions have been proven effective in managing these disorders, such as magnetic resonance therapy and deep brain stimulation. In this study, we devised the prototype of a therapeutic device treating such neurological disorders using the above-described treatments. The device consists of three major parts: sensor, computer, and effector. Upon diagnosis, the disease and patient biological information are first uploaded to the computer. The sensor will continuously monitor the patient's brain wave, heart rate, blood pressure, oxygen level, glucose level and feed this information to the computer. The computer then determines the mode of treatment, which is then carried out by the effector. This device will combine both artificial intelligence in computation and nanotechnology in manufacturing and will be inserted intracranially. The sensor and the effector span the cerebral cortex to achieve high target specificity and minimize energy consumption, and the computer is located at the upper left thoracic cavity, which provides enough space without interfering respiration. This device functions as an artificial physician which can erase the need for frequent visits to the clinic and relief the healthcare burden. It can also perform more frequent treatments automatically for a variety of diseases without significantly interfering with the patients' daily life. Finally, it can prevent the detrimental side effects of consuming chemical drugs.