UM GradCon - A Graduate Student Research Conference

The 18th Annual UM Graduate Conference (GradCon) will be held in the University Center (3rd floor) on Friday, February 22, 2019. The UM GradCon is interdisciplinary and welcomes presentations from all disciplines and departments. This year, GradCon will continue to be organized by the UM Graduate and Professional Student Association and graciously sponsored by the Office of Research and Creative Scholarship. The conference is free and open to the public. All members of the UM campus community are encouraged to attend and participate.

GradCon Schedule Overview

<table>
<thead>
<tr>
<th>Time</th>
<th>Description</th>
<th>Location</th>
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</thead>
<tbody>
<tr>
<td>7:30-8:45am</td>
<td>Day of Questions, Oral Presentation Uploading (Poster/Visual Arts Display Set-up until noon)</td>
<td>UC Ballroom &amp; 300 rooms</td>
</tr>
<tr>
<td>9:00-12:00pm</td>
<td>15 minute Oral Presentations Blocks (9:00-10:00am, 10:00-11:00am, 11:00am-12:00pm)</td>
<td>UC 300 rooms</td>
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<tr>
<td>12:00-12:30pm</td>
<td>Lunch (Grab &amp; Go lunch provided for participants &amp; attendees)</td>
<td>UC North Ballroom</td>
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<tr>
<td>12:30-1:20pm</td>
<td>Panel Discussion - &quot;Elemental Needs: A Graduate Panel on Food, Water, &amp; Energy&quot; (All are invited)</td>
<td>UC North Ballroom</td>
</tr>
<tr>
<td>1:30-3:30pm</td>
<td>15 minute Oral Presentations Blocks (1:30-2:30pm &amp; 2:30-3:30pm)</td>
<td>UC 300 rooms</td>
</tr>
<tr>
<td>3:20-4:30pm</td>
<td>Performing and Visual Arts Presentations</td>
<td>UC North/South Ballroom</td>
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<tr>
<td>5:00-6:30pm</td>
<td>Poster Presentation Session (5:00-6:00pm) &amp; &quot;Best of GradCon&quot; Awards (6:00-6:30pm)</td>
<td>UC North Ballroom</td>
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Hors d'oeuvres and a no-host cash bar will be available during this time (please bring cash & an ID).
UM GradCon Committee
Chair: Scott Whittenburg, Vice President for Research and Creative Scholarship
Co-Chair Chair: Ashby Kinch, Associate Dean of the Graduate School
GPSA Chair: Rachel Smith, Graduate and Professional Student Association

Graduate and Professional Student Association (GPSA) Members:
Emily Hattouni
Jessica Ray
Nikki Manning
Bonnie Bishop
Mary Morgan Beavers
Hallee Kansman
Gretchen Neal

Conference Coordinators:
Michelle Eckert, Conference Planning Services, SELL
Rachel Smith, Graduate and Professional Student Association

Technology, Trainings & Support:
Glenn Kneebone, UM Paw Print
Gretchen McCaffery, Writing and Public Speaking Center
Laure Pengelly Drake, Writing and Public Speaking Center
Wendy Walker, Mansfield Library, ScholarWorks

CALL FOR JUDGES
Please consider volunteering to judge at the 2019 Montana Science Fair on March 18th, 2019. Please also encourage your colleagues (including retirees), graduate students, and science majors to volunteer.

All judging for the 2019 Montana Science Fair will occur from 11:10am – 6:00pm on Monday, March 18th in the Adams Center at the University of Montana. This is a valuable service to the students and is an excellent opportunity to engage youth in discussions about science. Please follow the link to the Montana Science Fair website for more information and to register.
hs.umt.edu/mtsciencefair

Join the GPSA Senate!
The GPSA is building a Senate with representatives from all graduate and professional programs at UM. Senators work to improve the graduate school experience for themselves and others while gaining insight into how the university works and forging valuable connections with students and faculty across the university. Senators serve as ambassadors between GPSA and individual graduate programs and students. Senators must attend monthly GPSA meetings.

Visit:
UM Graduate and Professional Student Association Website
to learn more on how to join the Senate or serve on a UM Committee today!
### GradCon Oral Presentations

The Oral Presentation block schedule is listed by:
- block number & name
- presentations room
- time
- primary presenter
- title of presentation.

** It is requested that all presenters be present as audience members for the entire block.

(Please see the Abstract/Artist Statement Section for the complete list of co-authors and faculty mentors).

<table>
<thead>
<tr>
<th>Block 1</th>
<th>Accessing and Distributing Mental Health Resources - UC Room 330</th>
<th>Death and Grief - UC Room 331</th>
<th>Detecting Bodies - UC Room 332</th>
<th>Spectral Bodies - UC Room 333</th>
</tr>
</thead>
<tbody>
<tr>
<td>9:00-9:15am</td>
<td>Bonnie Bishop: Barriers to Accessing Behavioral Health Services for Missoula Residents</td>
<td>Jensen Lillquist: Death in the Anthropocene: Coping with Loss in the Age of Extinction and Civilizational Collapse</td>
<td>Kaitlin Pipitone: Mapping Ideologies: Place Names in Glacier National Park</td>
<td>Esmaeil Parsa: Homomorphisms and cores of random digraphs</td>
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<tr>
<th>Block 2</th>
<th>Emergency Logistics - UC Room 330</th>
<th>Gender, Sexuality, and Power Imbalances - UC Room 331</th>
<th>Networks of Local Knowledge - UC Room 332</th>
<th>Studying Wilderness and Recreation - UC Room 333</th>
</tr>
</thead>
<tbody>
<tr>
<td>10:00-10:15am</td>
<td>Shea Gurney: Effects of Helmet Vents on Performance in Simulated WLFF Working Conditions</td>
<td>Rachel Schafer: Understanding the Factors that Influence University Environment: Gender Differences in Perceptions of Female and Male STEM Graduate Students</td>
<td>Abigail Marshall: Native trees can improve ecological function and increase economic value of exotic plantations: Lessons learned from the Panama Canal Watershed</td>
<td>Fischer Young: Decreasing error associated with calculations of freshwater pCO2 using more accurate pH measurements</td>
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### GradCon Oral Presentations - Continued

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<tr>
<th>Block 3</th>
<th>BRIDGES 1 - UC Room 330</th>
<th>(Dis)enfranchisement and Civic Duty - UC Room 331</th>
<th>Empty - UC Room 332</th>
<th>Healing, Nanotech, and Social Engagement - UC Room 333</th>
</tr>
</thead>
<tbody>
<tr>
<td>11:00-11:15am</td>
<td>Kristin Sleeper: Tribal Water Rights and Water Conflicts in Montana</td>
<td>Katjana Stutzer: Participating in the Organization Narrative: An Examination of Myth in ACLU Membership Emails</td>
<td>No Presentation</td>
<td>Taylor Clough: Differentiation and Screening for Hearing Loss and Cognitive Decline in Occupational Therapy Practice</td>
</tr>
</tbody>
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**Elemental Needs:**

A Graduate Panel on Food, Water, & Energy

12:00-1:30pm - UC North Ballroom

Join us for this debut event at GradCon, graduate students from across UM’s campus will discuss issues surrounding food, water, and energy. Informed by their research interest and academic work, the panelists will contribute their perspective on major issues relating to these resources as well as how their field contributes solutions.

Our panelists include:

Conor Gilliland: Philosophy
Evora Glenn: UM BRIDGES
Ada Smith: Forestry and Conservation
Jacob Weill: Economics
Rebecca Elderkin: Public Health
Tim Schel: Social Work

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_Come for the free lunch & stay for the panel discussion!_
## GradCon Oral Presentations - Afternoon Sessions

<table>
<thead>
<tr>
<th>Block 4</th>
<th>BRIDGES 2 - UC Room 330</th>
<th>Inherited Codes and How We Read Them - UC Room 331</th>
<th>Protecting and Neglecting Elders and Youngers - UC Room 332</th>
<th>Drugs and Metabolism - UC Room 333</th>
</tr>
</thead>
<tbody>
<tr>
<td>1:30-1:45pm</td>
<td>Brian Stampe: An investigation into wheat's vulnerability in the western U.S.</td>
<td>Jarrett Hopewell: Hopilavayi Tenses and Interpretations</td>
<td>Kristen Pyke: Depressive Symptoms and Protective Factors: A Qualitative Study of Native American Older Adults and Elderly</td>
<td>Mariah Rayl: Using RNA Sequencing to Observe Biased Agonism in PPAR&amp;gamma</td>
</tr>
<tr>
<td>1:50-2:05pm</td>
<td>Nicholas Thiros: Investigating the Use of Environmental Chemical Tracer Concentrations to Reduce the Uncertainty of Modeled Groundwater Flow and Transport in a Fractured Rock System</td>
<td>Paige Plattner: Ancient DNA Extraction and Analysis of Bone Samples from Orton Quarry Ossuary.</td>
<td>Matt Buckner: Development of stuttering following a sport related concussion in an 18 year-old football athlete: A case study</td>
<td>Michelle Nemetchek: Biased Drugs: The many ways to turn “on” a receptor</td>
</tr>
</tbody>
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<tr>
<th>Block 5</th>
<th>Conflict and De-escalation - UC Room 330</th>
<th>Intimacy with Self, Others, and the Imaginary - UC Room 331</th>
<th>Resilience after a Cutting Blow - UC Room 332</th>
<th>What the Growing Things Control - UC Room 333</th>
</tr>
</thead>
<tbody>
<tr>
<td>2:30-2:45pm</td>
<td>Abby Seethoff: Mano a mano en la lucha intergaláctica / Hand in Hand in the Intergalactic Fight: Braided Images in El Eternauta</td>
<td>Alexandra Buscaglia: The Effects of Sexism on Communication in Dating Interactions</td>
<td>Rachel Steffen: State Sanctioned Cultural Heritage and Maya Self-Determination</td>
<td>Mariah McIntosh: Intraspecific variation in plant response to drought: assessing the current state of knowledge</td>
</tr>
<tr>
<td>2:50-3:05pm</td>
<td>Em Hattouni: Brief Mindfulness-Based Interventions to Address Individual School Needs</td>
<td>Shailee Woodard: Worldviews: Discerning and Measuring the Dimensions that Make Up Our Most Fundamental Beliefs</td>
<td>Meghan Montgomery: Adaptation Under the Canopy: Cooperative Membership, Certifications, and Coffee Producer Sustainability in Oaxaca, Mexico</td>
<td>Eryn Schneider: Tree spatial patterns modulate peak snow accumulation and snow disappearance</td>
</tr>
<tr>
<td>3:10-3:25pm</td>
<td>Jacob Bloch: Is higher self-compassion related to enhanced social functioning?</td>
<td>Anne Smyrl: Learning from Stone: Using Lithic Artifacts to Explore the Transmission of Culture at Bridge River, British Columbia</td>
<td>Alex Marks: Total energy intake and self-selected macronutrient distribution during wildland fire suppression</td>
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<tr>
<td>Time</td>
<td>UC North Ballroom</td>
<td>UC South Ballroom</td>
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<tr>
<td>3:20-3:35pm</td>
<td>Jane Best: Musical Theatre and the American Dream: The Hidden Language of Music</td>
<td>Aimee Paxton &amp; Jadd Davis: Musical Theatre School Tour: Inspiring Students to Explore History in Their Own Backyards</td>
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<tr>
<td>3:40-3:55pm</td>
<td>Hila Tzipora Chase: Interaction</td>
<td>Peter Philips: The Musical Collaboration of Tennessee Williams, Elia Kazan, Alex North in a Street Car named Desire</td>
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<tr>
<td>4:00-4:15pm</td>
<td>Alyson Spery: Sister Cities</td>
<td>Shane Lutz: Gained in Translation: Storytelling Through Theatrical Innovation</td>
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<tr>
<td>4:20-4:35pm</td>
<td>Kurtis Hassinger: Computer As Character</td>
<td>Elijah Fisher: Five Lil Birds: An Exploration of Depression and Anxiety Through Theatre</td>
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<tr>
<td>4:40-4:55pm</td>
<td>Stephanie Whitney: The Artist</td>
<td>No Presentation</td>
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**Poster Presentations - 5:00-6:00pm**

Humanities, Social Sciences & STEM (science, technology, engineering, mathematics)

<table>
<thead>
<tr>
<th>Poster #</th>
<th>UC North Ballroom</th>
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<tbody>
<tr>
<td>1</td>
<td>Withdrawn</td>
</tr>
<tr>
<td>2</td>
<td>Elina Berglund: Math Anxiety Among Teachers and Its Impact on Students' Math Ability</td>
</tr>
<tr>
<td>3</td>
<td>Jennifer Jones: Historic Costume in Science Fiction and Fantasy Film</td>
</tr>
<tr>
<td>4</td>
<td>Christopher Jones: Attributes of a Certified Athletic Trainer, Found Desirable by the Collegiate Athlete</td>
</tr>
<tr>
<td>5</td>
<td>Hunter Lindsay: Effectiveness of light therapy on superficial healing following cupping induced ecchymosis: A pilot project</td>
</tr>
<tr>
<td>6</td>
<td>Mckayla McNamara: Comparing the Acute Effects of Cryostretching to Traditional Hold-Relax PNF Stretching on Hamstring Flexibility: A pilot project</td>
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<tr>
<td>7</td>
<td>Tayleigh Talmadge: Aggressive Osteoblastoma of the Acetabulum in an 18-Year-Old Female Volleyball Player</td>
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<tr>
<td>8</td>
<td>MaKenna Turk: Qualities of Athletic Training Students that Collegiate Athletes Find Desirable.</td>
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<td>Poster #</td>
<td>UC North Ballroom</td>
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<tr>
<td>9</td>
<td>Kaitlin Kroll: Exploring the Effects of Moist Heat Pack Application on Hamstring Flexibility: A pilot project</td>
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<tr>
<td>10</td>
<td>Nate Schieffert: Neurocognitive Test Scores on Athletes Diagnosed with ADHD and Their Return to Play Following Sport Related Concussion: A Systematic Review</td>
</tr>
<tr>
<td>12</td>
<td>Tiffany Heeren: Shoulder Strengthening Injury Prevention Program for Collegiate Quarterbacks: A Critically Appraised Paper</td>
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<tr>
<td>13</td>
<td>Elly Wright: Examining Injury Trends in High School, Collegiate, and Professional Rodeo: A Systematic Review</td>
</tr>
<tr>
<td>14</td>
<td>Conor Marlatt: Effect of Helmets in Reducing the Risk of Concussion in Football: A Systematic Review</td>
</tr>
<tr>
<td>15</td>
<td>Cameron Musser: Vulnerability of Ponderosa pine needles to hydraulic failure across California</td>
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<tr>
<td>16</td>
<td>Katherine Jackson: An Overview of Forensic Trophy Skull Analysis in Montana</td>
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<tr>
<td>17</td>
<td>Taylor Manning: Parents’ Ability to Identify Concussion Symptoms in Youth Athletes: A Systematic Review</td>
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<tr>
<td>18</td>
<td>Ian Davies: Descriptive Analysis of Elbow Varus Torque in Adolescent Pitchers Using Wearable Technology</td>
</tr>
<tr>
<td>19</td>
<td>Jessica Keller: Exercises with the Greatest EMG Activation for Scapular Stabilizing Muscles: A Systematic Review</td>
</tr>
<tr>
<td>20</td>
<td>Kathy Molesh: The impact of salient naming targets during aphasia therapy</td>
</tr>
<tr>
<td>21</td>
<td>Alec Johnson: Initial steps in the development of an autonomous Dissolved Organic Carbons (DOC) Analyzer</td>
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<tr>
<td>22</td>
<td>Matthew Sydor: A Novel Method of Measuring ENM Induced Lipid Disruption in Macrophages and Model Membranes Systems</td>
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<tr>
<td>23</td>
<td>Ryan Rock: Leveraging machine learning algorithms and remotely sensed data to inform timber harvest on Montana State Trust Lands</td>
</tr>
<tr>
<td>24</td>
<td>Qipei Shangguan: Development and application of an in-situ alkalinity sensor</td>
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<tr>
<td>25</td>
<td>Anya Leyhe: Patient Perspectives of an Intensive Comprehensive Aphasia Program for Stroke Survivors</td>
</tr>
<tr>
<td>26</td>
<td>Kaitlin Perkins: Investigating the size, distribution, and associations of contaminants in the Upper Clark Fork River, Montana</td>
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</table>

"Best of GradCon" Award Session
6:00-6:30pm - UC North Ballroom

Please join us for this exciting culmination event! “Best of GradCon” award winners will ONLY be notified at this time. Hors d’oeuvres and a no-host cash bar will be available. Make sure to bring cash & your ID.
Abstracts / Artist Statements
(sorted by the primary presenter’s last name)

The following are the complete list of Abstracts including:
Author, Co-Author, and Faculty Mentor

3D Printing of the Proximal Right Femur: It’s Implications in the Field of Physical Anthropology
Author(s): Myriah Allen
Faculty Mentor: Randall Skelton
Category: STEM (science, technology, engineering, mathematics)

Abstract / Artist Statement: 3D scanning and printing have become useful in many scientific fields over the last few years, and Physical Anthropology is no exception. With skeletal collections decreasing all over the globe and the question of preservation on the rise, it has become necessary to look towards different methods in which one can obtain valuable information. 3D scanning has become useful over the last few decades, and therefore it is essential to establish where this new technology can be of use. This paper will bring 3D scanning and printing into question and determine whether or not it should be used in the contexts of physical anthropology, such as forensic anthropology and preservation of archaeological remains.

This research will attempt to answer the question of whether or not a 3D scan and 3D print out of the proximal right femur will be identical to the original. This research will examine 30 right proximal femoral ends most of which will come from the collection of femurs at the Forensic Anthropology Center at Texas State and a few femurs that are present in the University of Montana Anthropology Department. These femurs will be hand measured before they are 3D scanned and printed. After the final printouts are made, an error rate will be established to determine if it can be of use in scientific fields that require quantitative accuracy to gather accurate information.

Author(s): Brittany August
Faculty Mentor: Jim Caringi
Category: Social Sciences

Abstract / Artist Statement: In 2016, approximately 20-25% of all cases handled at Child Advocacy Centers the alleged offenders of sexual abuse were under the age of eighteen (National Children’s Alliance, 2017). Identifying children who sexually harm one another as sex offenders is problematic. We should refer to them as children that exhibit problematic sexualized behaviors (PSB). Children with PSB describes the behavior as opposed to labeling the child. The most adopted definition in the literature of PSB is "children ages 12 and younger who initiate behaviors, involving sexual body parts (i.e., genitals, anus, buttocks, or breasts) that are developmentally inappropriate or potentially harmful to themselves or others" (Chaffin et al., 2008, p. 200). Chaffin et al. (2008) found that children exhibiting PSB have a wide range of heterogeneous experiences. Children with PSB experience a great amount of stigma and misinformation about childhood sexual experiences, which may result in consequences such as school expulsion and social isolation. Academics and practitioners use the term children with PSB because it labels the behavior as opposed to labeling the child as a sex offender. Chaffin et al. (2008) note that PSB is not a medical condition, psychological syndrome, or a diagnosable disorder. Rather, they are a, "set of behaviors that fall well outside acceptable societal limits," which may or may not be sexually gratifying (Chaffin et al., 2008, p. 200).
A formative and exploratory project was completed to gain an increased understanding of what PSBs are and how community members could support children and families. This evaluation seeks to guide and direct new programs and interventions and is based on model standards from The University of Oklahoma National Center on Sexual Behavior of Youth evidence-based programs (Allen, 2018; Royse, Thyer, & Padgett, 2016; St. Amand, Bard, & Silovsky, 2008). The project was part of an existing diversionary program of core community stakeholders. This multifaceted project will use applied research skills which is a practice that seeks to find a resolution to a specific problem. The project has explored the prevalence of PSB in Missoula, etiological factors, and the need for establishing an evidence-based model to support children and family health. To date, this project has discovered systems gaps that currently exist in data collection and analysis.

The exploratory study will be pilot-tested beginning spring 2019 with five families. The pilot will include a formative evaluation to seek increased knowledge within the Missoula community, clients, and stakeholders to lead to more informed choices and shape future programming and procedures. The diversionary committee is determined to initially focus on providing supports to school-age children and early adolescents (ages 6-14) that meet participant guidelines, including (a) having experienced trauma and exhibit trauma symptoms, (b) have engaged in problematic sexual behavior, and (c) have involved caregivers. Families and children that meet pilot program criteria will then be referred to clinicians practicing Trauma-Focused Cognitive Behavioral Therapy, an evidence-based treatment model for children with traumatic histories. Allen (2018) expanded upon existing model components and offered PSB-specific techniques, which include establishing family-defined sexual behavior rules and safety plans. The goal at the end of this pilot is to have developed an evidence-based and community-based PSB treatment model with a trauma-focus.

“You know, for a clownfish, he really isn’t that funny”: Implications of Grief and Masculinity Through a Narrative Analysis of Finding Nemo

Author(s): Kendyl Barney
Faculty Mentor: Sara Hayden
Category: Humanities

Abstract / Artist Statement: Cultural norms make up a dominant narrative of bereavement which assumes individuals detach from the deceased and eventually “get over” their grief, among other expectations. This narrative has yet to evolve despite recent theories that suggest grief is a lifelong experience that involves continuing bonds with the deceased (Dennis & Kunkel, 2012) and ongoing processes of meaning making (Neimeyer, Klass, & Dennis, 2014). The dominant narrative is perpetuated largely through prominent rhetoric, such as film and media. Further, the dominant narrative is gendered by appropriating expected ways of grieving to women and men. For example, emotional expressions of grief (e.g., crying) are often deemed feminine expressions in Western society, therefore stigmatizing men who express their grief emotionally and, therefore, influence men to be stoic, grieve in solidarity, or grieve through more action-oriented processes (e.g., adventure seeking).

Through a narrative criticism of Disney and Pixar’s Finding Nemo (Walters & Stanton, 2003), I illustrate that the film perpetuates the dominant bereavement narrative. Specifically, I critique Finding Nemo as a grief narrative that appeals to hegemonic masculine ideals of bereavement and perpetuates Western norms surrounding masculine bereavement among its audiences. I draw from the work of Fisher and McClure to conduct this analysis. Fisher (1984) introduces the narrative framework, including a concept of narrative rationality that assumes persuasive narratives constitute a coherent story that rings true to audiences’ real experiences. McClure (2009) critiques that framework to suggest it is an extension of Burke’s theory of identification, introducing the notion that persuasive narratives create means of identification for audiences.

Focusing exclusively on Marlin’s storyline in Finding Nemo (Walters & Stanton, 2003), I emphasize character traits implicative of grief when paralleled to findings in grief research and theory. Marlin’s narrative rings true to audiences due to the humanistic identification with the non-human characters that evokes audience responses as if the characters were indeed human. The characters communicate linguistically, participate in human practices such as attending school, and experience profound emotions such as excitement, love, fear, and
grief. Additionally, by upholding the dominant narrative of grief, the narrative allows for greater identification from audiences, though to the disidentification of others.

Marlin’s style of grieving upholds a hegemonic narrative of male grief by suggesting that grief is an unmasculine experience. This narrative disenfranchises the real bereavement experiences of many men. Given the popularity of Disney films and the opportunities for identification presented throughout the film, this rhetoric is extremely powerful and, therefore, not without rhetorical consequence. Perpetuating these ideals closes conversations about what bereavement is actually like for those experiencing it. Finding Nemo perpetuates hegemonic masculine ideals of grief by insinuating that grief is not a masculine trait at all, which has detrimental effects against the effort to expand the dominant narrative beyond one that is unmasculine, linear, and temporary.

**Death-Related Grief and Disenfranchised Identity: A Review of Key Concepts and Findings**

*Author(s):* Kendyl Barney  
*Faculty Mentor:* Stephen Yoshimura  
*Category:* Social Sciences

**Abstract / Artist Statement:** Throughout this review, I argue that grief is an aspect of identity given its continuous and reoccurring nature. The death of a significant person forces one to reconstruct their own narrative, resituate their relationship with the deceased individual, and develop a new sense of self post-loss. Further, I expand Doka’s (2002) theory of disenfranchised grief to argue that all grief is disenfranchised. I make this argument under the contention that the dominant narrative of grief always assumes the experience to be finite, linear, and a process of detachment. Given the reality that few people actually identify with this conceptualization of grieving, their experiences are always disenfranchised.

Those who have experienced the death of a significant person, such as a family member, commonly mention feeling isolated in their experience (Ironside, 1997; Goodrum, 2008). Difficulty communicating about grief occurs not solely because the loss is saddening, but because grief is disenfranchised. The purpose of this literature review is to support the contention that grief is an aspect of identity that is always disenfranchised by the dominant narrative of grief, making grief and loss difficult to communicate about. Grief deserves to be understood as a hidden illness of sorts; one that suddenly and permanently becomes a part of one’s identity, making them a member in a club they never asked to join.

Experiences of grief following death-related loss are always disenfranchised given the “dominant narrative of grief” (Neimeyer, Klass, & Dennis, 2014), which assumes appropriate bereavement is detaching from the deceased, getting over the grief in a certain amount of time, and abiding by social norms surrounding what grief is and ought to be. This dominant narrative reinforces the performative nature of grief and upholds barriers to grief communication, thus disenfranchising the experiences of those who continue to grieve the death of a loved one. By not acknowledging this problem, researchers, practitioners, bereaved, and non-bereaved individuals alike fail to gain deeper insight into the actual experiences of individuals affected by grief, thus perpetuating the issue and turning a blind eye toward opportunities to participate in validating, compassionate, and honest conversations about grief, death, and dying. Conclude by argue that, given the impact that grief has on individuals’ identities, failing to acknowledge and validate their real experiences with grief is failing to acknowledge and validate their full identities.

Understanding grief as a continuously constructed and narrated part of identity will yield many opportunities to manage of the problem of disenfranchised grief by, a) redefining the dominant narrative that confines individuals experiencing loss to a single assumed experience and, b) breaking down the barriers that inhibit grief communication. By reviewing previous grief research, I highlight gaps in current knowledge that can be filled by conceptualizing grief through this framework. Therefore, within my review, I pose areas for future research within the field of Communication.
Math Anxiety Among Teachers and Its Impact on Students’ Math Ability

Author(s): Elina Berglund
Faculty Mentor: Georgia Cobbs
Category: Humanities

Abstract / Artist Statement: Fear and anxiety about math can impede an individual's math achievement, and math anxious people tend to perform worse than their abilities would indicate. When self-doubt and distress occurs, thinking and reasoning can be compromised. In fact, the fears that individuals with math-anxiety experience when they are forced to do math often prevent them from using their knowledge (Ashcraft & Kirk, 2001; Beilock, Gunderson, Ramirez, & Levine, 2010; Chipman, Krantz, & Silver, 1992). Math anxiety is more common among women than men and tends to manifest itself as an unpleasant emotional response to math or the prospect of doing math (Hembree, 1990). Due to these negative reactions, individuals with high levels of math anxiety tend to stay away from math courses and math-related career paths (Ashcraft & Kirk, 2001).

At most United States universities, elementary education majors have minimal math education requirements, and these students have been found to harbor the highest levels of math anxiety of any college major (Beilock, Gunderson, Ramirez, et al., 2010). When these teachers are charged to teach elementary school students mathematics, their own anxieties may impact their students’ math achievements (Banilower et al., 2013). Ninety percent of elementary school teachers in the United States are female, and since children are more likely to model the behaviors of same gender adults, girls may be more likely to notice their teacher’s attitudes and fears than boys (Beilock et al., 2010). Math anxious teachers have been found to transfer their anxiety to their students, and this has been correlated to decreased student performance.

Beilock et al. (2010) investigated the relationship between math anxiety, math achievement, and gender ability beliefs among first and second grade female teachers and their students over the course of a year. By the end of the school year, the higher a teacher’s math anxiety, the lower was the math achievement of her female students. No correlation was found between teachers’ anxiety levels and the achievement of their male students. Very few studies have evaluated whether or not these trends hold true among male teachers or if math anxiety persists as students move through elementary school. As a result, this study serves to address this gap in the research.

Math anxiety and math achievement among teachers from a suburban school in Montana, along with their students in grades kindergarten to eighth grade, were evaluated based on their math ability and anxiety over the course of a school year. Significant negative trends were determined, as teachers with higher levels of math anxiety tended to have students with lower standardized test scores. The resulting implications will be discussed in this poster.

Lessons from 45 Years of Wilderness Fire Management in the Northern Rockies

Author(s): Julia Berkey, Carol Miller
Faculty Mentor: Andrew Larson
Category: Social Sciences

Abstract / Artist Statement: Wildfire management is a hotly debated subject in the western United States. When it comes to forest fires and fuel loads, everyone from the president down to the local homeowner has their own opinion on the best management practices. For the large part of the last century, fire management in the American West has defaulted to aggressive suppression of all fire ignitions. Where this has been successful, the result has been denser, more homogenized forest stands and increased risk of uncharacteristically severe wildfire due to high fuel loading. In contrast, in the early 1970s a few wilderness areas began to allow some naturally ignited fires to burn. These landscapes now serve as laboratories for the ecological effects of reintroduced fire, as well as the challenges inherent in implementing such a strategy.
This research is aimed at synthesizing the fire management history from three large northern Rockies wilderness areas. A summary of the program, including its challenges and successes, will inform fire managers and policy makers on the history and lessons learned from over 40 years of wilderness fire management. To accomplish this, a literature review was first conducted to compile the existing papers, reports, and interviews related to wilderness fire. In addition, geospatial fire history data dating back to 1889 were collected to analyze the impact of different management strategies on total area burned. Following initial data collection, interviews were conducted with past and current fire managers and policy makers to fill in the persisting data gaps.

Results from the spatial fire history analysis indicate that the percent of total area burned has returned to or surpassed pre-suppression levels for all three wilderness areas. From both the literature and interviews, an emerging theme is that this success depends on management personnel with a strong wilderness ethic and willingness to accept the risks of long-term fire management. We therefore recommend training and incentive programs to cultivate and encourage the ethic and skills crucial to successful backcountry fire management. However, this reliance on personality over policy leaves the fate of the wilderness fire program up to chance. We conclude that management of wildfire as an ecological process would be more likely to occur if policy were written to better support non-suppression tactics. Ultimately, this research will provide information to both the local fire managers and regional and national policy makers on how to better implement and support the wilderness fire program. Such actions taken to strengthen the program will provide exceptional public benefits, such as millions of dollars saved on firefighting costs and ecological restoration of fire-dependent forest ecosystems.

Musical Theatre and the American Dream: The Hidden Language of Music

Author(s): Jane Best
Faculty Mentor: Pamyla Stiehl
Category: Visual & Performing Arts

Abstract / Artist Statement: What does music add to a theatrical production? What depth can lyrics, melody, and harmony add to a story? As a music director, it is my job to answer these questions. Music illuminates the subconscious mind of a musical; the melodies, harmonies, and musical stylings in a show add depth to a theatrical production. These tools can guide actors to more effective and honest storytelling. The musicals in UM’s 2018-2019 season, White Christmas and Assassins, provide an excellent exploration of content and contrast through the way music is used to portray their viewpoints on Americana and the American Dream.

Musical theatre is a topic with a smaller body of research than many other art forms, and scarcely any of the research that exists is from the viewpoint of a music director. Viewing research through the lens of music direction allows for synthesis of literature about the social history of musical theatre with music theory and music history. Specifically, it is fascinating to explore how the stylistic similarities in White Christmas and Assassins are used to wildly different effects. Their scores and interpretations are informed by the history of musical theatre in America, the use of folk and jazz styles throughout the 20th century, and the ways that theatre and music can make a social and/or political statement.

White Christmas uses the music of a master songwriter from the early 1900s, Irving Berlin, to tell the story of a classic musical comedy. His music was a vehicle for escapism and optimism, painting a picture of an America that could be carefree, fun, and full of love and hope. Berlin used big band jazz stylings, witty wordplay, and pleasant harmonies to allow audiences to escape the troubles of the Great Depression and World Wars I and II via the music. Nowadays, audiences can still use this music to escape the anxieties of the modern world.

Contrarily, Stephen Sondheim’s music for Assassins, a much more intentionally political musical, uses folk music to peel back the curtain of idealistic Americana to reveal the darknesses that lie beneath. He uses music that sounds familiar and nostalgic to our ears, but when sung by killers, we see what can happen when the American Dream is taken too far. The contrast between what is being sung, how it is being sung, and who is singing it puts audiences on edge. Instead of escaping via the music, they find themselves drawn in and confronted by the uncomfortable.
Music is a powerful force for connection and empathy. Both musicals in UM’s current season use this force to opposite ends. Musically, one show comforts; one show confronts. The subtleties in the melodies, lyrics, and stylizations allow the actors to more convincingly portray their stories to an audience. As musical theatre artists entertain our audiences, we also open them up to social, moral, and/or political themes that create a fuller artistic and human experience.

**Barriers to Accessing Behavioral Health Services for Missoula Residents**

**Author(s):** Bonnie Bishop  
**Faculty Mentor:** Annie Sondag  
**Category:** Social Sciences

**Abstract / Artist Statement:** The American Public Human Services Association states that behavioral health includes both mental health and substance use, encompassing a continuum of prevention, intervention, treatment and recovery support services (Neese, 2017). Missoula City-County has an abundance of behavioral health professionals and programs, yet public documents consistently rank lack of access to behavioral health services as a dire community need. Despite the above average number of providers and support services located in Missoula County, the persistent evidence of poor mental health is a reminder that having sufficient numbers of providers does not automatically improve access to services (CHIP, 2017).

Missoula County residents consistently report more frequent poor mental health days in the past month than the US average (in 2015, 3.4 compared to 2.8, respectively) even while Missoula County’s ratio of mental health care providers per population being 270:1, which is a greater ratio compared to 410:1 for Montana and 360:1 in the top 1% of counties in the US. Substance abuse is also a pressing issue in Montana. The Centers for Disease Control estimates that there were 390 alcohol attributable deaths in Montana from 2006 to 2010, for an overall alcohol attributable death rate of 37.7 per 100,000, the highest rate in the country.

While access to care has been a well-known barrier acknowledged by behavioral health professionals, very little data has been collected within the community to quantify this issue. In 2018, the Missoula City-County Health Department (MCCHD) developed a Community Health Improvement Plan (CHIP) prioritizing data collection on lack of access to behavioral health services. In pursuit of this data, a partnership was developed between the University of Montana School of Public & Community Health graduate program and the CHIP Behavioral Health work group. In a collaborative effort, a survey was created and distributed in Missoula to collect data on barriers that low-income adults face when attempting to access behavioral health services in Missoula.

After reviewing the 2018 CHIP Report, 2017 Community Health Assessment (CHA) and other literature, the graduate students created a 16-item survey using Qualtrics, an online survey platform. After the survey was finalized, MCCHD distributed it to key informants including 68 individuals from 38 different organizations in Missoula. From those 68 individuals, we received a notable 62 responses. Graduate students utilized a process called thematic analysis to identify patterns of meaning across the 62 survey responses. After doing so, six recurrent barrier themes were identified: access to services, affordability, case management, crisis services, community and social support and system reform.

This presentation will summarize the data collected from the survey and will elaborate on current efforts to identify viable solutions amongst community agencies and organizations in hopes of alleviating the opposition Missoula residents face when attempting to access behavioral health services.

**Is higher self-compassion related to enhanced social functioning?**

**Author(s):** Jacob Bloch, Jennifer Waltz  
**Faculty Mentor:** Jennifer Waltz  
**Category:** Social Sciences

**Abstract / Artist Statement:** Self-compassion has become a popular topic of research in psychology since the publication of Kristen Neff’s seminal articles in 2003 (Neff, 2003a; Neff 2003b). Research demonstrates that
the construct, which involves responding to oneself with kindness, balance, and understanding when faced with personal failure, consistently relates to well-being (Barnard & Curry 2011), which underscores its significance as a target for therapeutic intervention. Most extant research has focused on the intrapersonal benefits of self-compassion, such as its positive relationships with happiness, optimism, positive emotions (Neff & Vonk, 2009), and life satisfaction (Neff, Kirkpatrick, & Rude, 2009). Meanwhile, little research has addressed how engaging in self-compassion may be beneficial to one’s relationships. The purpose of this study was to investigate whether self-compassion is related to social connectedness and interpersonal competence. 231 participants from a university in the pacific northwest completed validated measures of self-compassion (the Self-Compassion Scale; SCS; Neff, 2003b), social connectedness (Social Connectedness Scale-Revised (SCS-R; Lee, Draper, & Lee, 2001), and interpersonal competence (Interpersonal Competence Questionnaire (ICQ; Buhrmester, Furman, Wittenberg, & Reis, 1988). Data analysis was performed using correlations and simultaneous multiple regression.

Regarding existing knowledge about these constructs, there is strong evidence that social connectedness (one’s enduring sense of closeness with their social world; e.g. Lee, Draper, & Lee, 2001; Lee & Robbins, 1998; Mauss et al., 2011; Neff, 2003b) and interpersonal competence (e.g., Fiori, Antonucci, & Cortina, 2006; Berkman & Syme, 1979; Delongis, Folkman, & Lazarus, 1988) are positively related to well-being in a variety of ways. Meanwhile, responding to oneself with self-compassion may allow a person to be more present and attentive to others in interpersonal contexts, rather than being self-critical and focused on one’s own manner of engaging. Self-compassion was examined in terms of a global construct and its six subscales, “(a) self-kindness——extending kindness and understanding to oneself (b) common humanity——seeing one’s experiences as part of the larger human experience, and (c) mindfulness——holding one’s painful thoughts and feelings in balanced awareness,” as well as each of their opposites (self-judgment versus self-kindness, isolation versus common humanity, and over-identification versus mindfulness; Neff, 2003b). Our results indicated that: 1) self-compassion and all of its subscales are significantly related to social connectedness, 2) the self-kindness and isolation subscales of self-compassion are predictive of social connectedness, 3) people reporting a greater tendency toward self-compassion were more likely to report initiating interpersonal interactions with others, engaging in more self-disclosure, and offering more emotional support to others, and 4) the facets of self-compassion are significantly related to the initiation and self-disclosure domains of interpersonal competence, but have a more complex relationship with emotional support. These results lend further support to the importance of self-compassion to interpersonal functioning, underlie its importance to well-being overall, and substantiate its relevance as a target of therapeutic intervention.

Development of stuttering following a sport related concussion in an 18 year-old football athlete: A case study.

Author(s): Matt Buckner
Faculty Mentor: Valerie Moody
Category: Social Sciences

Abstract / Artist Statement: Background: An 18-year-old collegiate offensive lineman was participating in individual drills at practice when another lineman was thrown into him, initiating a low-intensity helmet-to-helmet impact. After practice, concussion-like symptoms including headache, nausea, sensitivity to light and dizziness developed. As symptoms progressed in a short time, his speech fluency began to deteriorate. Within an hour after head impact, the dysfluency evolved into a neurogenic stutter with the inability to produce full sentences. The patient reported a similar instance while playing football 4 years prior, where the stutter lasted 3 days. The patient reported a history of ADD/ADHD; however, there was no history of mental health disorders. A SCAT5 and cranial nerve assessment was performed by an athletic trainer resulting in an initial diagnosis of a sport related concussion (SRC). Differential Diagnosis: Potential differential diagnosis includes sport related concussion, cranial hemorrhage, and anxiety/psychological episode. Treatment: The patient was referred to a neurologist/concussion specialist for further evaluation. Upon evaluation, the physician confirmed the diagnosis of a SRC and placed the patient in the return to play protocol per the AT staff. The athlete was referred to a speech and language pathologist (SLP) for management of his stutter. The pathologist addressed psychological and neurocognitive therapy for the stutter management. The goal was to reduce anxiety from the
stutter and challenge neurocognitive functions through various assessments to properly retrain the brain. These assessments heavily focused on verbal working memory and retention and recognition memory. Word fluency and motor coordination was addressed in early sessions. The AT staff managed the graduated return-to-sport concussion protocol. At six weeks, the patient was re-evaluated by the physician where it was determined that he was continuing to improve and his stutter had resolved. Although the athlete was still managing chronic headaches and light sensitivity, the stuttering had resolved, concluding the case.

Uniqueness: Based upon recent infodemiological studies, few unique cases of new-onset stuttering following sport related concussions have been reported. Although there is no known research comparing the relationship of ADHD and neurogenic stuttering, similarities have been identified in the hypothesized pathophysiology of the two disorders. Interprofessional teams consisting of ATs, SLPs and physicians are recommended for concussion management. These teams use a variety of tools for neurocognitive rehabilitation and assessment to identify areas of vulnerability from a SRC. This consists of established tests that focus on areas such as verbal working memory, retention and recognition memory, visual scanning, cognitive speed, mental flexibility, and even word fluency and retrieval. These programs help rehabilitate patients in an efficient and holistic fashion that return them back to the playing field in a timely manner. Conclusions: It is necessary for athletic trainers to know, understand and recognize the possibilities of the development of severe symptoms like neurogenic stuttering in post-concussive patients. Although healthcare providers cannot prevent these complications, they can be properly and effectively managed through a comprehensive treatment and rehabilitation plan. Return to play, academics and life following SRCs should be equal priorities when managing both neurobehavioral and neurocognitive symptoms. Word Count: 498

The Effects of Sexism on Communication in Dating Interactions

Author(s): Alexandra Buscaglia
Faculty Mentor: Christine Fiore
Category: Social Sciences

Abstract / Artist Statement: Previous research has suggested that ambivalent sexism biases individuals’ dating initiation preferences, in that individuals who score higher on measures of sexism seem to prefer gender stereotypical dating initiation behaviors (e.g., the man opens doors for the woman, the man pays for dinner; McCarty & Kelly, 2015; Glick & Fiske, 1996). Ambivalent sexism theory (Hall & Canterberry, 2011) maintains that sexism serves to disempower women, perpetuate gender stereotypes and aggressive attitudes toward women, and inhibit gender equality. Ambivalent sexism has also recently been tied to sexual harassment (Diehl, Rees, & Bohner, 2012). Previous research has focused primarily on men initiating dating interactions with women. The present study examined both men initiating dating interactions with women, and women initiating dating interactions with men. The purpose of this study was to examine perceptions of women’s dating initiations toward men, to increase understanding of the initial screening process that occurs during heterosexual dating interactions, and to determine how sexism influences perceptions of dating interactions.

A pilot study involving 45 undergraduate psychology students between the ages of 18 and 25 (M = 19.07, SD = 1.32) from Western Kentucky University was conducted to evaluate the validity of the Dating Initiation Questionnaire (DIQ), which was created for this study. In the final study, 152 undergraduate psychology students between the ages of 18 and 40 (M = 20.30, SD = 3.01) from Western Kentucky University completed measures of sexism (Ambivalent Sexism Inventory; ASI), social desirability (Marlowe-Crowne Social Desirability Scale; MCSDS), and dating initiation preference (DIQ). It was hypothesized that, for passive dating initiations, high scores on the ASI would be associated with high ratings of dating initiation effectiveness for men but not women; for aggressive dating initiations, high scores on the ASI would be associated with high ratings of dating initiation effectiveness for women but not men; for assertive dating initiations, regardless of gender, low scores on the ASI would be associated with high ratings of dating initiation effectiveness.

Results showed that gender and stronger ambivalent sexist beliefs were associated with higher effectiveness ratings for aggressive dating initiations. The model F statistic was significant for gender (B = -4.76, SE = .68, p <.001) and standardized ASI score (B = 1.54, SE = .55, p <.01), but not for their interaction term (p = .20). Independent t-tests confirmed that men reported higher preference of aggressive dating initiation than women.
(t(115.76) = 7.78, p<.001). In addition, higher ASI scores, regardless of gender, were associated with higher effectiveness ratings of aggressive dating initiations (t(141.69) = 3.62, p <.001). Therefore, individuals who held negative attitudes toward non-traditional women and positive attitudes toward gender stereotypical women preferred aggressive dating initiations. Importantly, men were more likely than women to endorse ambivalent sexist beliefs, which were associated with higher preference of aggressive dating initiations. Such individuals may approach others in an aggressive manner. One could argue that to prevent such harassment, individuals should be educated about communication styles and gender equality. Future research should focus on applying such interventions to men and women, and on revising the intervention to suit individuals with sexist beliefs toward women and men.

**Estimating Detection for Gray Wolf (Canis lupus) Pups in Yellowstone National Park**

**Author(s):** Brenna Cassidy  
**Faculty Mentor:** Mark Hebblewhite  
**Category:** STEM (science, technology, engineering, mathematics)

**Abstract / Artist Statement:** Carnivore restoration has gained attention all over the world for being a solution for bolstering not only individual species, but ecosystem processes such as predation at a level that sustains the structure and function of an ecosystem. Reintroduction of gray wolves (Canis lupus) to Yellowstone National Park (YNP) has been amongst the more innovative ‘natural’ experiments in the world, and successful in bringing these large carnivores back to their native range. While wolf packs are visible traveling in many areas of YNP, estimating detection for young wolves at den sites remains a challenge due to location, cover, and access. Recruitment of pups into the population remains an important factor in population growth and stability, although there has been little work on estimating detection of pups at den sites. This project’s aim is to estimate the validity of pup detection at individual den sites in YNP.

Before beginning analysis of real data, simulated data has been used as the first step to test the feasibility and scope of the project. Simulated data for this project consists of individual wolf packs, months of a biological year (April-May), and particular visits to den sites throughout a month in a three-dimensional array. This arrangement is very similar to data collection methods in YNP. Initial average litter sizes, 4.8, populated the array from previous research (Stahler et al 2013), and survival is fixed at 90% per month.

Results from the N-mixture model with simulated data include: maximum and average litter size of any pack per month, maximum litter size at any point in time, the total pups per month in the entire population, and detection per month. For the total pups in the population by month, the starting value was 26.275 and final value was 10.821, peaking in month three at 38.992. For the average litter size per month, the starting value was 5.254 and final value was 2.169, peaking in month three at 7.810. Detection, varied from a low of 0.583 in month three to a high of 0.925 in month six. By examining total population size (of pups) in the first and last month, survival throughout the year (recruitment) was 41% which is in the realm of biological probability. This model is not overly complicated, it was a great exercise to pick apart what each piece was doing to understand how it will work when more complexity is added.

This work is the first step in understanding how detection changes the perception of survival of young animals, important drivers of population growth and stability. Additionally, this work can be extrapolated to other species that are not as heavily studied as gray wolves in North America.

**Interaction**

**Author(s):** Hila Tzipora Chase, Stephanie Klein  
**Faculty Mentor:** Bret Tobalske  
**Category:** Visual & Performing Arts

**Abstract / Artist Statement:** "Interaction" is an integrative performing arts piece drawing from biological concepts and communicated through movement arts. Colloquially it is a dance piece, though it involves techniques from circus arts, improvisation, and other performing arts disciplines. The piece was born from a
shared love of combining biology and movement arts between graduate student Hila Tzipora Chase and research mentee Stephanie Klein (both biologists with a background in movement arts).

Join us in exploring some of the most intimate and fundamental interactions in nature. From predator-prey relationships to interactions between humans and wildlife; from the dynamics of wind meeting wings to the strangling tension between competing plants. Explore what it means to interact- to be defined as an active entity by those around you and they in turn by those around them. To be a constantly shifting network of interactions. This is how life works.

This brief dance piece will tell several stories of interaction, and seeks not only to evoke emotions and impressions from the audience, but also to educate and engage the audience in specific biological concepts. These stories include specific examples from biological research and highlight some of the active research currently going on at UM, particularly with regard to bird biology and ecology.

The Effect of Vented Helmets on Heat Stress During Wildland Firefighter Simulation

Author(s): Katherine Christison, Shae Gurney
Faculty Mentor: Charles Dumke
Category: STEM (science, technology, engineering, mathematics)

Abstract / Artist Statement: Heat related illness is a common issue in wildland firefighters (WLFF) and other occupations due to an inability to maintain thermoregulation over an extended period of time. Heat stress increases during continuous exercise and is magnified by the addition of personal protective equipment (PPE). PPE in the form of shirts, pants, and load carriage loads has been previously shown to result in heat accumulation leading to heat stress. Little research involving the effect of the standard WLFF helmet on heat dissipation exists. While it is understood there is a significant heat accumulation from wearing a helmet, little is known on how helmet vents affect heat stress. PURPOSE: The purpose of this study is to compare heat accumulation in simulated working conditions while wearing standard non-vented WLFF helmets (H) versus a vented helmet (VH). METHODS: In a randomized crossover design, ten male subjects with a VO2max of 59.8 ± 3.6 ml/kg/min walked for two 180-minute trials (at 3.5 mph, 5% grade) in a heat chamber (35○C and 30% relative humidity). Following a 10-minute acclimation period, the trial consisted of three intervals of 50 minutes of exercise and 10 minutes of rest. Separated by two weeks, subjects performed the opposing helmet trial. Each trial measured physiological strain index (PSI), skin blood flow at the head and neck (SBFh, SBFn), visual analog scale (VAS), helmet temperature and relative humidity (Th, Rh), rating of perceived exertion (RPE) and heart rate (HR). Data was analyzed using a 2X6 repeated measures ANOVA. RESULTS: All 10 subjects completed both trials. At the end of the 3 hour trial, PSI (6.08±1.45 H, 5.89±1.24 VH), SBFh (238.4±16.8 au H, 225.9±27.6 au VH), SBFn (85.6±8.9 au H, 74.3±10.7 au VH), Th (35.52±0.47○C H, 35.75±0.50○C VH), Rh (45.6±5.1% H, 41.0±5.9% VH), RPE (14.2±1.7 H, 13.3±1.7 VH), and HR (146.8±17.2 bpm H, 144.3±17.9 bpm VH), showed a significant main effect of time (p<0.05) but were not significant between trials. There were trends towards a significant main effect of trial and interaction on RPE, helmet humidity, and VAS (p≤0.08). SIGNIFICANCE: This study is one of the first to examine the difference between heat accumulation and physiologic stress indices within non-vented WLFF and vented helmets for a duration beyond 90 minutes. While these physiological variables (HR, VAS, PSI, SBFh, SBFn, RPE, Th, and Rh) did not reach trial significance, trends for RPE, helmet humidity, and VAS suggest greater heat dissipation and individual comfort with the vented helmet. This suggests the standard unvented WLFF helmet may contribute to heat gain over time, which may contribute to work output and safety in the field.

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Differentiation and Screening for Hearing Loss and Cognitive Decline in Occupational Therapy Practice

Author(s): Taylor Clough
Faculty Mentor: Al Yonovitz
Category: STEM (science, technology, engineering, mathematics)

Abstract / Artist Statement: After arthritis and hypertension, hearing loss ranks as the third most prevalent chronic health condition impacting the older adult population. Research is currently exploring a possible relationship between cognitive decline and hearing loss. Cognitive decline and hearing loss present with similar signs and symptoms, including repetition or reinstruction requests, frustration, depression, and social withdrawal. Occupational therapists, nationally, are being surveyed regarding knowledge of best practice with patients experiencing hearing loss and dementia. National survey data will be made available in March 2019. However; the Montana clinicians’ data reported concerns about a patient’s cognitive function (100%) and hearing ability (88%). 94% percent had received instruction administering cognitive screening tests, while 85% could interpret results. 91% had not received audiometer operation instructions; 88% could not interpret an audiogram. Audiologists collaborating with occupational therapists could help ensure best practice.

Treating the Whole Patient: Respecting the Complicated Nature of the Depressed Mind

Author(s): Nicholas Coombs
Faculty Mentor: James Caringi
Category: Social Sciences

Abstract / Artist Statement: Purpose: Depression has a recurring negative impact on quality of life, is heavily associated with increased risk of suicide, and has no universal safeguard to definitively prevent its development. The magnitude of this challenge is evident when acknowledging the steady rise in suicide across the United States with even steeper rises in states with already high rates, particularly Montana. Considering its elevated, vast, rural geographic setting, the inability to control for long, dark winters, psychiatric services existing few and far between in a state that is 4th largest in area but 3rd least largest in population density, and the inherent stigma that prevents mental health from adequately being addressed, individuals who reside in Montana are susceptible to countless overlapping mental health issues as they relate to depression. As a result, many clinical and scientific professionals mark Montana as the epicenter of mental health crises. The purpose of my research is to evaluate and disseminate more holistic approaches to better serve individuals experiencing depression in Montana by studying the physiological pathways that invoke certain treatments for depression between contrasting geographic regions and areas of practice.

Methods: A diverse sample of mental health and primary care practitioners currently practicing in Montana will be enrolled in this cross-sectional mixed methods study. Each provider will undergo a comprehensive qualitative interview to detail their patient populations, credentials, provider toolkits, and attitudes towards all independent treatment options for depression. This will identify distinctive biased underpinnings and how they may affect an individual’s pathway to treatment through the governance of different practitioners. Additionally, aggregate results from the most recent Montana Behavioral Risk Factor Surveillance System will be evaluated to provide patient-derived attitudes towards mental healthcare access, quality, and cost in corresponding geographic regions of Montana.

Originality: When considering all possible routes an individual may take to develop depression, the countless combinations of symptoms that may be exhibited when one has depression and the established differences individuals hold by their distinct physical, social, and cultural environments, one may infer that no two cases of depression are the same. To date, there has been no research conducted in Montana or in a comparable population to investigate the ambiguous nature of the depressed mind from neither the view of practitioners nor personal characteristics of patients, thus producing original value to this scope of research.
Significance: Although there are an abundance of treatments successful in reducing depressive symptoms, they each vary with respect to an individual’s perception of cost, convenience, and feasibility. As mental health professionals, we must recognize the array of options at our disposal and be careful not to administer treatment before considering the unique needs of the patient. When carried out properly, this can improve response of all forms of treatment, empower individuals to take their mental health more seriously, and allow more individuals in crisis to seek out treatment for which they have never done before.

Descriptive Analysis of Elbow Varus Torque in Adolescent Pitchers Using Wearable Technology

Author(s): Ian Davies  
Faculty Mentor: Valerie Moody  
Category: STEM (science, technology, engineering, mathematics)

Abstract / Artist Statement: Purpose: The complex and explosive nature of the baseball pitching motion takes years to master and subjects pitchers to high risk for overuse injury. Adolescent baseball pitchers who throw at least 8 months per year are considered 5 times more likely to sustain an elbow or shoulder injury. Despite recommendations against this behavior in literature and recommendations by the Baseball Medical and Safety Advisory Committee, many adolescent pitchers continue to throw year-round. The purpose of this study was to assess the magnitude of elbow varus torque in adolescent baseball pitchers that throw at least 8 months per year. Methods: In total, 10 adolescent pitchers were included in the study and 200 pitches were analyzed. Participants self-reported throwing between 10-12 months per year. Average height, weight, and age were 180.3 cm ±6.6, 72.7 kg ±11.8, and 15.2 years ±0.63 respectively. Data was collected during the participant's regularly scheduled team practice. Participants performed their team's dynamic warm-up and throwing drills prior to data collection as part of their practice routine. The motusBaseball sensor, a triaxial gyroscope and accelerometer, was placed directly over the medial elbow. Each subject pitched a 20-pitch fastball-only training bullpen session to a catcher. Elbow varus torque data was wirelessly transferred to the motusThrow application on the researcher’s mobile device. Descriptive statistics were used to determine mean standard deviation and confidence intervals for elbow varus torque. Results: The mean elbow varus torque across the 200 pitches was 36.05 Nm ±9.6; however, a wide range (14-68 Nm) was observed. Conclusion: The mean elbow varus torques observed were similar to those in the existing literature which did not control for annual throwing volume (throwing at least 8 months per year). Similarly, the wide range in elbow varus torque is also consistent with the literature.

Prevalence of a Best Practice Emergency Action Plan in Montana Class AA Secondary Schools

Author(s): Alexandra Davis  
Faculty Mentor: Valerie Moody  
Category: STEM (science, technology, engineering, mathematics)

Abstract / Artist Statement: Research suggests the high rates of sport related deaths in secondary school athletics may be preventable with adequate planning, preparedness, and resources. An Emergency Action Plan (EAP) is designed to describe these protocols and provide a foundation for care with site-specific instructions. Efforts for schools to implement these documents have been significant in recent years, and have led to the development of evidence-based best practice recommendations (BPRs). The purpose of this study was to determine if existing EAPs in Montana Class AA secondary schools met BPRs. A cross-sectional study design and convenience sampling technique was used to target Montana Class AA secondary schools (enrollment size larger than 779 students). The Montana Secondary School Best Practice EAP survey (MSSBPEAPS) consists of 37 closed ended questions and was developed based on current BPRs concentrating on emergency planning, environmental related considerations, sudden cardiac arrest, catastrophic neck injuries, and emergency medical conditions. The MSSBPEAPS was piloted to establish content validity. The MSSBPEAPS was disseminated electronically to athletic trainers employed at the 14 Montana Class AA secondary schools with a request to complete the MSSBPEAPS and attach their most
current EAP. Eleven responses were submitted. Responses were eliminated if more than 5 questions were unanswered or if an EAP was not attached, leaving 5 responses eligible for review for a response rate of 36% (n=5/14). The remaining 5 surveys and EAPs were blinded then scored independently by two members of the research team. A scoring rubric to quantitatively assess survey responses and EAP congruence with BPRs was developed, whereby points were awarded for meeting outlined criteria. The weighted scores were tabulated to calculate an aggregate score and schools were then ranked based on the aggregate score achieved. This research is the first to compare current practices to evidence-based BPRs related to emergency preparedness in athletics in class AA secondary schools in Montana. The development of the MSSBPEAPS and the EAP content rubric provide a new approach to understanding the current practices of secondary schools within the state. While there has been research done on a national level, narrowing to a more local lens provides the ability to present practical strategies applicable to the current procedures at each school. The intent of the study was to observe the adoption rate of BPRs, which illustrate the school’s anticipation and readiness for an emergency situation to occur. While Montana Class AA secondary schools provide evidence of development and implementation of EAP, there is significant room for improvement to meet BPR. Strengths were identified in the development of the EAP to include policies regarding environmental illness, cardiac arrest, and catastrophic neck injuries; however, areas of improvement are warranted in documentation, mitigation of risk, and emergency medical conditions. Additional investigation is necessary to determine to what extent athletic trainers use BPR to develop their EAP as well as to identify any barriers that exist that prohibit implementation.

Estimating Erosion and Validating Sediment Yield Models in the Magdalena River Basin, Colombia

Author(s): Luke Fisher
Faculty Mentor: Andrew Wilcox
Category: STEM (science, technology, engineering, mathematics)

Abstract / Artist Statement: The Magdalena river basin (MRB) occupies 24% of Colombia’s national territory and is home to 77% of its people and the 80% of the nation’s GDP. Colombia’s geography in the northern Andes combines steep mountains with ample precipitation, creating an environment that is, on the one hand, ideal for hydroelectric development, but on the other hand leads to intensely eroded landscapes and sediment-rich rivers. The dams and reservoirs associated with hydroelectric development interrupt the natural flow of large rivers and block passage of sediment, causing loss of aquatic habitat, incision of the river bed, and other downstream environmental impacts.

Colombia’s electricity demand is increasing. With numerous hydropower projects currently planned or under construction across the MRB, there is a need to gain a greater understanding of how sediment moves through the basin. One important element that has yet to be explored in depth is the amount of sediment generated by erosion that will eventually reach the river and be exported from river basins (i.e., sediment yield).

Because field data on landscape and river processes in the MRB are limited, modeling to estimate erosion and sediment yield is needed. In the MRB modeling techniques can be applied to estimate sediment yield on a range of scales using existing geospatial data and other parameters derived from the literature. These modeling techniques are built on statistical methods linking observable characteristics of the landscape to sediment yields at a specific location in the basin. This level of specificity allows the user to investigate how erosion varies across the basin and how specific factors may influence sediment yield.

This project tests two existing sediment-yield models. Inputs to these models are derived from publicly available geospatial data including digital elevation models (DEM), geologic maps, climate data, remote sensing and published characteristics of large reservoirs in the river network. These models will be used to estimate sediment yield in the Sogamoso, Saldaña and Alto Magdalena sub-basins of the broader MRB. These basins either have existing hydropower projects or have hydropower potential. Comparisons will be made between modeling results to quantify how sediment yield and erosion varies across the broader MRB and the quality of each model in predicting sediment yield. Validations of both models will be made with data from
gauging stations in all three study areas as well as geochemically derived erosion rates in the Sogamoso basin.

A study evaluating the applicability of established models has not been published for the MRB. The results of this work are valuable in constraining values for sediment yield in the basin. Additionally, evaluating the efficacy of these models is valuable in developing tools and methodologies that will help us gain a greater understanding of how rivers work in mountainous tropical basins.

**Five Lil Birds: An Exploration of Depression and Anxiety Through Theatre**

**Author(s):** Elijah Fisher  
**Faculty Mentor:** Bernadette Sweeney  
**Category:** Visual & Performing Arts

**Abstract / Artist Statement:** Mental health is an issue that has risen to the top of our society’s discussion. Specifically, depression and anxiety are two conditions of mental health that many people deal with on some level or other. According to the Anxiety and Depression Association of America (ADAA), 18.1% of the US population deals with anxiety while 6.7% of the US population deals with depression which is 40 million adults and 16.1 million adults, respectively. In my experience, there is a large group of people around me that deal with either one or both. So, I wrote a play, Five Lil Birds, to explore the issues of depression and anxiety to help foster a dialogue between those affected and those not affected.

Five Lil Birds personifies depression and anxiety as characters in relation to one character, named Gertrude. In this play, there are also birds that examine what's going on with Gertrude through dialogue and dance. In my early drafts, I only shared the play with a few people to get their feedback about how I could improve the piece. After revising the play and gaining confidence, I was able to organize an open-to-the-public reading where I gathered actors to read the play aloud for the first time in front of an audience. The audience included members of the faculty and students, both undergraduates and graduates. I had a helpful colleague of mine conduct a feedback session directly following the reading, so I could focus on taking in the feedback.

Like most large-scale problems, mental health is not an issue that will be solved with one conversation or discussion. There is no one person who has the answer, and we cannot stop talking about it. So, I will keep talking to people about it and researching more into organizations that specialize in the topic of mental health like ADAA or TWLOHA (To Write Love on Her Arms) and many more. This presentation will include a scene from the play where I will have actors to read the play aloud. I will also have an original song to share accompanied by some choreography that will be used in production as inspiration.

Moving further, I need to finalize a script that can be performed in front of an interested and willing audience. Once that script is finalized, I will share it with a director and producer who will help in guiding the process on the way to performance. First, we will need to pick a space on certain days to perform the piece. We will need to create a budget that allows for designers to get props, create costumes and build set pieces with some creative freedom. We will need to put together a creative team that consists of a choreographer, a dramaturg, an assistant director, and musicians as well as designers for props, costumes, lights and the set. As we start to assemble, we will cast an ensemble of actors to begin the rehearsal process (usually 5-6 weeks to performance). Then, through hard work plus theatre magic, this show will be ready to be presented to an audience at the University of Montana. At some point, the goal is to produce this play to make it available to the rest of America and humanity.

**“Meet Them Where They Are”: Faith-Based and Secular Homeless Outreach Approaches**

**Author(s):** Larissa Fitzpatrick  
**Faculty Mentor:** Daisy Rooks  
**Category:** Social Sciences
Abstract / Artist Statement: Many organizations strive to provide resources for individuals experiencing homelessness both in and outside of shelters. Studies analyzing the effects of religiosity on the practices of homeless shelters show that both faith-based and secular shelters generally offer a variety of services, from the accommodative, such as food and shelter, to the restorative, like housing, substance-use rehabilitation, and spiritual transformation (Snow and Anderson 1987). Although both types of shelters may require clients to participate in the latter to access the former, faith-based shelters often show a belief-based rigidity, with many requiring prayer, sermon attendance, or a proclamation of faith to access meals or lodging (Mulder 2004; Sager 2011). In contrast, very little data exist regarding religious influence on outreach services for individuals living outside the shelter system. Many individuals experiencing homelessness do not, or cannot, access shelter services for a variety of reasons. Some shelters or other organizations use homeless outreach teams to access people living outside of the shelter system. Using qualitative participant observation, I examined the differences in services, approaches, and goals between a faith-based and a secular homeless outreach team. I interviewed staff members and volunteers to reveal the connection between policy and practice. Method triangulation between participant observation, interviews, and policy content analysis allowed me to better understand how outreach teams interpret the organizations’ missions in the field. I found accommodative services provided by both organizations to be very similar, and although restorative services differed slightly, neither team required clients to participate in restorative services to access accommodative ones. Unlike much of the shelter data, religiosity did not show to drastically influence homeless outreach approaches. This research contributes to a gap in research on differences between faith-based and secular homeless outreach approaches.

Isoxazolo[3,4-d]pyridazinones positively modulate the metabotropic glutamate subtypes 2 and 4

Author(s): Christina Gates
Faculty Mentor: Nicholas Natale
Category: STEM (science, technology, engineering, mathematics)

Abstract / Artist Statement: The seven transmembrane(7TM) superfamily, also known as G-protein coupled receptors (GPCR), is one of the largest superfamilies in the human genome. With approximately 30% of marketed drugs targeting the GPCRs, these proteins are among the most successful as therapeutic targets. Within the GPCR receptor family there is a subgroup called the metabotropic glutamate receptors (mGluR). Unlike other GPCRs, mGluRs bind the endogenous ligand glutamate via a large Venus flytrap domain (VFT) to produce a cellular response. There are 8 subtypes within the class of mGluRs (1-8) and are grouped by amino acid sequence similarities Depending on the type of compounds that bind and the mGluR subtype, a different cellular response will result. Compounds that target mGluRs are important for the treatment of a variety of central nervous system (CNS) disorders, as well as cancer. Selectively targeting the VFT domain is difficult due to its high similarity throughout the mGluRs. This difficulty can be overcome by targeting another regulatory region which is located in the 7TM, known as the allosteric site. This presents a more selective target due to less sequence similarity between the mGluR subtypes here, this could lead to fewer off target activity. Our isoxazolo[3,4-d]pyridazinones [3,4-d] compounds were tested and found to have selective activity at mGluR 2 and 4. This selectivity, along with other tests, imply binding may not be at the VFT, but rather at the allosteric site as positive allosteric modulators (PAMs), leading to the selective activity. The mGluR2 subtype is a target for treatment of anxiety and schizophrenia, and successful activation may help to alleviate them. Activation of mGluR4 helps to ease the symptoms of Parkinson’s disease and may even slow progress of the disease. Additionally, both of these receptors have been implicated in the treatment of variety of cancers of the brain and other organs systems, such as glioma, medulloblastoma, or colorectal carcinoma, presenting another target to overcome these diseases. Further modifications of our compounds will be developed to optimize selectivity and activity, by working off a hypothesis based on structural binding to the allosteric site. Our progress on the new synthesis and biological evaluation will be presented here along with future work.
Modeling spatial and temporal variability of sediment balance across a southern California watershed

Author(s): Jordan Gilbert
Faculty Mentor: Andrew Wilcox
Category: STEM (science, technology, engineering, mathematics)

Abstract / Artist Statement: The focus of river restoration and management has shifted from local, sitespecific projects to more holistic watershed-scale management. Consequently, tools that help to provide an understanding of river systems as a whole are necessary for managers. Of particular importance for river management is the concept of sediment balance: the balance between the supply of sediment from the surrounding watershed to the river system, and the ability of the river’s flow regime to transport that sediment. Alteration of either of these components by modification of the river or its surrounding watershed can lead to sediment surplus or sediment deficit, both of which can change the shape and function of a river. River floodplains play an important role in sediment balance, and various mechanisms allow rivers to store sediment, or recruit sediment from floodplains. Existing frameworks for quantifying sediment balance conditions and sediment movement through watersheds are generally applied to large areas and do not provide significant mechanistic information regarding channel-floodplain sediment exchange and transport. Others are detailed numerical models that do provide this information, but require extensive calibration of parameters that are difficult to measure, and can only be applied at individual reach scales. A need exists for a modeling framework that provides some mechanistic information, but can be generalized and readily applied to broader spatial extents. To address this gap, I developed a model that is driven by spatial data that represents actual conditions in real rivers. The model simulates the evolution of sediment balance conditions resulting from flow events in a watershed, accounting for various types of disturbance such as dams, wildfires and impacts from land uses such as agriculture. It also accounts for channel-floodplain sediment exchange, using proxies for mechanisms that are easily obtained from widely available datasets (e.g. digital elevation models). To visualize how sediment balance conditions propagate through river systems in response to flow events, the model can simulate either real (based on river gage data) or hypothetical floods. The model was calibrated using field data collected at various sites in the Santa Clara River (SCR) watershed of Southern California. It was then applied to the SCR to simulate how a flood event during February of 2017 affected sediment balance conditions. This model can serve as a valuable tool in planning and implementing river restoration projects by providing contextual information on specific project sites. By accounting for connectivity and propagation of disturbance throughout the basin, potential impacts to restoration projects and sites can be accounted for, and predictions made about how river structure may change through time.

EFFECTS OF HELMET VENTS ON PERFORMANCE IN SIMULATED WLFF WORKING CONDITIONS

Author(s): Shae Gurney, Katherine Christison
Faculty Mentor: Charles Dumke
Category: STEM (science, technology, engineering, mathematics)

Abstract / Artist Statement: Heat related illness (HRI) is a vital concern to those working in occupations often conducted in the heat. Personal protective equipment (PPE), required by wildland firefighters (WLFF), aggravates these issues due to uncompensable heat gain. Uncompensable heat gain can result in increased incidence of HRI. Helmets are a standard piece of PPE that WLFF’s must wear from the time they leave the trucks at the beginning of their shift until they are safely back in the vehicles. Previous research has demonstrated that the helmet significantly contributes to heat gain. This may negatively affect physical performance of the WLFF.
PURPOSE: The purpose of this study is to determine the impact of the helmet microenvironment on perceived head heat and performance in simulated working conditions while wearing traditional non-vented WLFF helmet (H) compared to a vented helmet (VH).

METHODS: In this randomized crossover design, ten male subjects with a VO2max of 59.8 ± 3.6 ml/kg/min walked for two 180-minute trials (at 3.5 mph, 5% grade) in a heat chamber (35°C and 30% relative humidity). Trials started with a nude body weight measurement following urine collection, then a 10-minute chamber acclimation period in full WLFF gear. The trials involved three intervals of 50 minutes of exercise and 10 minutes of rest, followed by a performance test to exhaustion. A post trial nude body weight and urine sample were also collected. Subjects were provided with 5 ml of water/kg of body weight every 30 minutes. Separated by a two-week washout, subjects repeated the trial with the other helmet. Each trial measured % dehydration, sweat rate, and work performance (PS, PKJ). Peak helmet temperature, perceived head heat (PVAS), helmet humidity (PHH), heart rate, physiological strain index, rating of perceived exertion, core temperature (PTc), and skin temperature were collected during the performance test. Paired sample t-tests compared differences between the H and VH trials.

RESULTS: All 10 subjects were able to finish both trials. Neither sweat rate nor percent dehydration differed between trials. Performance was significantly greater in VH (109.3±8.5 KJ VH vs. 95.9±10.3 KJ H; 703.2 ± 37.5 sec VH vs. 662.7±51.0 sec H). PHH (45.0±1.3% VH vs. 47.3±1.4% H) and PVAS (91.5±9.9 mm VH vs. 108.8±9.2 mm H) were all significant (p < 0.05) between trials. A trend in PTc (38.18±0.10°C VH vs. 38.32±0.11°C H; p≤0.08) existed.

SIGNIFICANCE: This study is one of the first to examine the differences in performance following an extended bout of exercise between non-vented WLFF and vented helmets. These data (PHH, PVAS, PS and PKJ) suggest that a vented helmet could result in an improved helmet microenvironment and greater performance for wildland firefighters. While PTc did not reach significance, a statistical trend suggests that a vented helmet could improve heat dissipation for the body. Thus, the current design of the WLFF helmet may contribute to heat gain, reduced performance, and heat related illnesses for the working WLFF.

Identifying the Capacities for Resilience on the Fairfield Bench, Montana: A Case Study

Author(s): Anne Harney
Faculty Mentor: Neva Hassanein
Category: Social Sciences

Abstract / Artist Statement: Agricultural systems can be understood as social-ecological systems (SES), in which humans and the natural world interact with and influence each other. Elements of SESs, which include ecological, cultural, economic, and governance components, are considered together and integrated as one system rather than simply separate components of the whole. The study of SES focuses on the feedback loops and the synergies among the interacting elements, emphasizing the complexity and non-linear relationships of the system. Research regarding SES has increased over the past several decades as our ecological, political, and economic systems have become more global and more connected.

The concept of resilience within SES has gained considerable attention in recent years. Resilience is generally defined as the system’s ability to absorb and adapt to stressors while still maintaining a similar functioning state. Agricultural systems in the United States are facing major current and future challenges, including climate change, resource availability, economic market instability, and an aging workforce. These challenges could severely impact our food supply and result in far-reaching consequences, such as price increases and food shortages. Because of these major challenges, social-ecological resilience within agricultural systems is a critical concept to study, analyze, and understand.

However, despite the abundance of research on social-ecological resilience, there are relatively few studies that attempt to understand resilience within a particular context. Numerous papers attempt to define or
determine measurement parameters for resilience; however, this fails to recognize the context-specific nature of resilience and instead attempts to apply a rigid framework to resilience research.

My research will fill this gap by providing a place-based case study of resilience in a rural agricultural community in Montana known as the Fairfield Bench. Farmers on the Fairfield Bench mainly grow malt barley for major brewing companies and are facing a number of challenges, including an aging irrigation infrastructure, climate change, unstable markets, and water quality concerns. In this study, I will use a social-ecological systems framework developed by Elinor Ostrom to identify and analyze the multiple interacting variables that exist on the Fairfield Bench. I will identify three key variables that are experiencing challenges or disturbances and use these variables as discussion points in interviews with malt barley farmers. Through these interviews, I will gather qualitative data that will identify the capacities for resilience that exist in this social-ecological system from the perspective of the farmers that live on and work the land. These capacities may include resources, assets, or abilities that the farmers possess that enable them to respond to and persist in the face of disturbances or challenges within the social-ecological system. By taking a place-based and contextual approach, I will explore how resilience on the Fairfield Bench is shaped by the dynamic processes of this agricultural system and extend the existing research that attempts to understand the concept of social-ecological resiliency in practice. In the presentation, a review of the relevant literature and methods for data collection will be presented and discussed.

Computer As Character

Author(s): Kurtis Hassinger
Faculty Mentor: Michael Musick
Category: Visual & Performing Arts

Abstract / Artist Statement: Traditionally, theatre has consisted of performers on a stage telling a story to an audience against the backdrop of lights and sets. This was the accepted mode for most of our performance history and has proven to be a successful method of entertainment for thousands of years. The twentieth and twenty-first centuries, however, have introduced technology that allows both theatre-makers and audiences to experience storytelling in new and innovative ways unimaginable to the performers, designers, and audiences of yesterday.

My area of study in the University of Montana’s College of Visual and Performing Arts focuses on these innovations and asks: how do we story tell when digital media is incorporated into our performance environment? Does the blending of live performance and digital media aid in the storytelling? How does it influence the performance for the actor/audience? What if the actor can interact to the media incorporated?

Working with these questions, I’m currently building a performance piece that incorporates an interface which allows an actor to hold a conversation with a computer. The interface, more commonly known as a ‘chatbot’ works through combining JavaScript, HTML, and an open source coding language called RiveScript to create a program that resembles an Alexa or Siri voice recognition system. However, my concept differs from both examples in that it has been built with the intent that it challenges, through a performative lens, questions of machine as live performer. Daniel Shiffman’s Coding Train tutorials served as inspiration for the project. The performance, itself, consists of the actor asking the computer a series of questions and the computer responding with answers that are sometimes set and predictable but at other times varied and randomized. The purpose of this is to produce a unique scene for the audience and live performer that is at once different each time it is performed yet depends on an unchanging digital system that is not ‘live’ yet fulfills the role of a character. The piece serves as an example of theatre that reflects our current culture and the digital media that fills it as well as our symbiotic relationship with it. The work, under the guidance of Dr. Michael Musick: Associate Professor of Media Arts, is an evolving project of increasingly complex voice recognition patterns that affords a live actor the opportunity to explore a performance arena of increasing digital complexity in the realm of visual arts. The benefit of UM students viewing and interacting with the computer in a conference setting is that they can experience first hand a voice-activated program that performs with them as opposed to serving them in mundane search tasks, thus demonstrating what future interactions and live performances might resemble in the coming decades.
Brief Mindfulness-Based Interventions to Address Individual School Needs

Author(s): Emily Hattouni
Faculty Mentor: Jacqueline Brown
Category: Social Sciences

Abstract / Artist Statement: Overview and Purpose: Mindfulness-based practices have gained popularity since the introduction of mindfulness-based stress reduction (MBSR; Kabat-Zinn, 1994). Over the years, mindfulness has been used with a variety of psychological disorders, such as anxiety and depression (e.g. Desrosiers, Vine, Klemanski, & Nolen-Hoeksema, 2013). Additional research suggests that mindfulness can be used in non-clinical populations to increase psychological well-being (Brown & Ryan, 2003). School-based interventions have shown positive outcomes for elementary-age students, such as decreased depressive symptoms, decreased aggression, greater empathy, and emotional control (Schonert-Reichl, Oberle, Lawlor, Abbott, Thomson, Oberlander, & Diamond, 2015). Kielty, Gillam, Staton, and Curtis (2017) found that classroom-based mindfulness interventions increased the likelihood that children would use mindfulness-based coping strategies (i.e., mindful breathing) when faced with strong feelings. However, schools often report limited time and resources to introduce mindfulness interventions. Thus, brief interventions may be considered for implementation within the schools. Because of the range of applications for mindfulness, the purpose of the current presentation is to present the results of a research study examining a brief (5-minute) intervention of mindfulness. A second goal is to show how the results from the research study can be used to inform school-based mindfulness practice and provide participants with research-based mindfulness strategies that can be easily implemented in schools.

Method: Participants were randomly assigned to receive either a mindfulness intervention, ruminative intervention, or no intervention. Interventions were adapted from Huffziger and Kuehner (2009) and Lyubomirsky, Kasri, and Zehm (2003). Participants were presented a series of 20 statements to read at their own pace, for five minutes. Statements were designed for the induction of a cognitive state, which was either ruminative or mindful in nature. All participants completed a stress-induction, which increased self-reported arousal. Baseline arousal was then compared to arousal levels after the brief intervention period.

Results: To determine if mindfulness and rumination interventions differentially effected emotion regulation, state affect was compared between T1 (pre-stress induction), T2 (post-stress induction), and T3 (post-mindful/rumination intervention). A repeated-measures ANOVA was conducted for the measure of arousal to compare the effect of the interventions. Change in arousal was significantly influenced by intervention group (i.e. mindfulness or rumination), F (2, 63) = 3.92, p < 0.03. Results also revealed that participants who received the mindfulness intervention reported a decrease in arousal from T2 (post-stress induction) to T3 (post-intervention), with an effect size of d = -1.16. The difference in effect size on arousal between the mindfulness intervention and the rumination intervention indicated that mindfulness is more effective at reducing arousal levels. Results suggest that the mindfulness intervention group had a larger effect on change in arousal, and that mindfulness-based interventions are useful to reduce strong emotions. This presentation will highlight the implication of these results for the implementation of effective school-based mindfulness interventions and how these interventions can help reduce arousal levels and promote emotional regulation in school-age children. Additional resources will also be provided to accommodate mindfulness interventions to the specific needs of a school.

Shoulder Strengthening Injury Prevention Program for Collegiate Quarterbacks: A Critically Appraised Paper

Author(s): Tiffany Heeren
Faculty Mentor: Valerie Moody
Category: Social Sciences

Abstract / Artist Statement: Context: Shoulder injuries have a high prevalence in quarterbacks. These injuries typically occur due to the lack of strength of glenohumeral and scapulothoracic stabilization structures. Previous research focuses on post-injury rehabilitation protocols for shoulder injuries. However, there is limited
literature identifying specific strengthening exercises tailored to injury prevention. The purpose of this systematic review is to determine the most effective targeted shoulder strengthening exercises for collegiate quarterbacks established for reducing the incidence of injury.

Methods: PubMed was searched through November 17, 2018 for studies reporting electromyography (EMG) data or injury specific shoulder rehabilitation protocols for overhead athletes. Key words searched were athlete shoulder injury, overhead athlete rehabilitation shoulder, shoulder biomechanics, overhead athlete, and football quarterback. Inclusion criteria included articles with full-text availability in English, published in the last 10 years, and a level of evidence greater than 5. One author screened the results and extracted data for use in this systematic review.

Results: Ten studies with 1649 total patients were included in the review. Four of the 10 studies included were systematic reviews of literature specific to rehabilitation exercises for labrum, rotator cuff, SLAP lesions, and impingement syndrome injuries. Three studies recorded and evaluated the EMG data of % maximal voluntary isometric contractions (%MVIC) in glenohumeral and scapulothoracic musculature during specific shoulder exercises. Three studies of original research examined shoulder rehabilitation exercises for impingement symptoms and SLAP tears. Five strengthening exercises were determined to be ideal in a shoulder strengthening prevention protocol due to highest %MVIC and amount of clinical usage seen in rehabilitation protocols. The exercises included prone shoulder extension, prone shoulder horizontal abduction with external rotation, prone shoulder horizontal abduction at 90 degrees, prone shoulder row with external rotation and side-lying shoulder external rotation.

Conclusion: Shoulder injuries have a higher occurrence rate due to the lack of strength within the stabilizing musculature of the shoulder complex. The vulnerable shoulder positions that quarterbacks use in throwing also increase the rate of injury. Quarterbacks put high, repetitive stresses on their shoulder, requiring unique motions and strength. Strengthening the glenohumeral and scapulothoracic musculature could lead to less prevalence of certain injuries in quarterbacks. Using exercises that focus on both musculature could lead to a decrease quarterback shoulder injuries. The five exercises included have EMG data indicating activation in both glenohumeral and scapulothoracic musculature, as well as literature review of effectiveness in post-injury research.

Hopilavayi Tenses and Interpretations

Author(s): Jarrett Hopewell
Faculty Mentor: Leora Bar-el
Category: Social Sciences

Abstract / Artist Statement: Hopilavayi is a Uto-Aztecan language spoken by about 4,000 people in Northeastern Arizona. According to the Hopi Dictionary Project (1998), Hopilavayi has two overt grammatical tenses: the future tense -ni and the habitual tense -ngwu. The lack of either tense is understood as the covert null tense -Ø that locates events in the non-future time. Much work has been done on Hopilavayi (cf. Whorf, 1938; Voegelin & Voegelin, 1969; Jeanne, 1978; Voegelin & Voegelin and Jeanne, 1979; Kalectaca, 1982; Malotki, 1983; Hill et al., 1998), but none have explicitly analyzed how temporal interpretations might differ from temporal locations encoded in the tense.

In this project I analyze the temporal interpretations and behaviors of each tense in Hopilavayi. I argue that out of the three tenses, only the null tense -Ø exclusively locates time, while the future tense -ni and the habitual tense -ngwu employ aspectual and modal interpretations in addition to temporal location. This research is cushioned within the literature, relying on the multitude of data published. This research is important because it contributes to an understanding of the different temporal categories and their behavior and reopens the discussion of Hopilavayi which has been dormant for over a score. Lastly, this research is intended to analyze Hopilavayi in a respectful manner and not to exotify it (cf. ‘The Hopi Time Controversy’. Also Whorf, 1941; Malotki 1983).

Consider the English sentences in (1) below:
Both sentences are in the present tense, which is signaled by the suffix -s, and both events can hold true at the time of speech (present time). However, sentence (1b) can also hold true before the time of speech because it has the habitual interpretation that the event started in the past and continues now in the present. Thus sentence (1b) could also be written as Jamie always drinks too much coffee and the same interpretation would arise.

Grammatical tense is said to locate an event or state at a time in reference to the time of speech (Smith, 1997). That being said Reichenbach (1947) analyzes that reference time (RT), the time specified by the tense (i.e. past, present, future), does not always align with event time (ET), the time when the event takes/is taking place, or speech time (ST), the time when the sentence is spoken (usually the present). Furthermore Enç (1996) analyzes the temporal interpretation and behavior of the English tenses, arguing that the English ‘future tense’ will carries more than a future time interpretation and has modal behaviors. Thus, tense can encode more than just temporal location.

Referring back to (1) above, assuming the ST is at the present moment in both sentences, the RT is also at the present moment as signaled by -s. Regarding (1a) the ET is also at the present moment. As for (1b), the ET is a continuum starting before and continuing at the ST. We can conclude that the English present tense locates events at the ST, but it can also locate events before the ST and also incorporate habitual interpretations.

Now consider what has just been said, examine the Hopilavayi sentences in (2) below:

(2) a. Mi’ taaqa warikiwta Jeanne (1978; 170)
    mì” taaqa wari-ki-wta
    that man run-ki-IMPRF-Ø
    ‘The man is/was running.’

b. Mi’ taaqa warikiwtani Jeanne (1978; 172)
    mì” taaqa wari-ki-wta-ni
    that man run-ki-IMPRF-FUT
    ‘The man will be running.’

c. Mi’ taaqa warikiwtangwu Jeanne (1978; 174)
    mì” taaqa wari-ki-wta-ngwu
    that man run-ki-IMPRF-HAB
    ‘The man is usually running.’

Sentences in (2) illustrate the interpretations of each tense in simple sentences. (2a) demonstrates that the null tense -Ø employs the RT and ET as being either before or at the ST. (2b) demonstrates that the future tense -ni employs the RT and ET as being after the ST. (2a) demonstrates that the habitual tense -ngwu employs the RT as being at the ST, and the ET as beginning before and continuing at the ST. It seems that the habitual tense -ngwu encodes more than just temporal location. During the presentation I’ll demonstrate how in complex sentences the future tense -ni also encodes more than just temporal location, and that the null tense -Ø is the only one that exclusively locates time.

References


**An Overview of Forensic Trophy Skull Analysis in Montana**

**Author(s):** Katherine Jackson  
**Faculty Mentor:** Kirsten Green Mink  
**Category:** STEM (science, technology, engineering, mathematics)

**Abstract / Artist Statement:** Retaining a skeletal element, especially a skull, whether it be for ancestor veneration, social memory, or as a trophy, is a very common practice throughout human history. Keeping a cranium can reflect a lot of information about cultural beliefs concerning death, war, and victory at specific points in time. It is more common than one might think to come across these "trophy skulls" in archaeological and forensic contexts. Most often, they come to us, as Forensic Anthropologists, through a Medical Examiner’s lab, usually under questionable or unknown circumstances. Forensic Anthropologists specifically apply archaeological methods and techniques to modern, skeletal human remains and forensic casework. This poster reviews three separate cases of “trophy skulls” in Montana, including the findings of the biological profile analyses and the attempts to reconcile police reports and oral histories in order to reconstruct the life histories of the unknown individuals. The biological profile consists of an estimation of sex, age, ancestry, and any observable trauma or pathology. These methods are commonly used by Forensic Anthropologists to aid law enforcement in identification and repatriation. Unfortunately, “trophy skulls” are rarely positively identified due to a lack of provenience and background information, as well as a generally long period of time since death. The term of “trophy skull” is also approached from an anthropological viewpoint and an argument made for changing the terminology associated with these remains in an effort to better describe the likely circumstances of their creation. This review and discussion are important because the concept of “trophy skulls” is not commonly discussed or analyzed, and people are often not aware of the common occurrence of retaining skeletal elements. It is important that people gain a better awareness and understanding of this practice so that it is recognized and reported in the future. It is also important to discuss what happens to these remains once they are recovered, considering that a positive identification is unlikely to occur.

**Initial steps in the development of an autonomous Dissolved Organic Carbons (DOC) Analyzer**

**Author(s):** Alec Johnson  
**Faculty Mentor:** Michael DeGrandpre  
**Category:** STEM (science, technology, engineering, mathematics)
Abstract / Artist Statement: Dissolved Organic Carbons (DOC) are the portion of carbon containing material in waters that have organic carbon incorporated in their structure. It is important to study DOC in aquatic systems for a variety of reasons, including both environmental monitoring as well as waste management. For example, not only can DOC alter aquatic ecosystem chemistry by contributing to acidification of waters, it can also lead to formation of harmful byproducts such as chloroform, or even complex with trace metals in the environment to produce more toxic forms of these metals, including metals such as mercury.

DOC can vary dramatically over time in natural waters and characterizing the patterns and drivers of DOC variability and requires information spanning a wide range of temporal resolution. This is the problem that my current research is trying to address. Although long-term investigations of DOC dynamics are common, studies done at a high temporal resolution are lacking due to the complex logistics and laboratory costs surrounding DOC analysis in remote environments. Currently there are no in-situ instruments that are dedicated to DOC analysis.

Common laboratory methods for quantification of DOC include High Temperature Oxidation/Combustion methods (HTOC), which involves complete oxidation of DOC to CO2 in extreme heat, persulfate oxidation which is a type of chemically-assisted degradation, as well as UV absorption or fluorescence methods. In the HTOC and persulfate methods, the generated CO2 is quantified using infrared absorption. Due to the high energy demand that would require for full degradation of organic matter for an in-situ instrument, my current research has been working with Persulfate oxidation techniques paired with UV-light degradation, an oxidation process which requires less energy, for quantification of DOC.

Using the chemically-catalyzed persulfate method, I have done experiments both trying to achieve complete oxidation for determination of DOC in an energy-efficient method as well as approximating DOC concentrations using oxidation rates, a method which would be even more energy efficient. The project has also been trying to move in the direction of using UV-LEDs as the main source of UV-generated light to be used for degradation. UV-LEDs also have lower energy requirements than traditional sources of UV-light, such as a Mercury-lamp sources. These UV-LEDs have not been on the market for a very long time, and the usefulness of them for DOC quantification has yet to be fully explored.

This presentation will describe current research that I have been working on regarding development of this system and background experimentation, as well as exploring and understanding the data that has come from them. In addition, the presentation will describe possible future directions the project may head in for the full development of a dedicated in-situ DOC-analyzing instrument.

Attributes of a Certified Athletic Trainer, Found Desirable by the Collegiate Athlete

Author(s): Christopher Jones, Moody Valerie
Faculty Mentor: Valerie Moody
Category: Social Sciences

Abstract / Artist Statement: Context: Little research has been done on the attributes desired by collegiate athletes seen to improve their trust in an Athletic Trainer (AT). It is believed that decreased athlete satisfaction, will prevent athletes from reporting injuries to their respective AT. And a lack of trust will impact athlete compliance towards rehabilitation. Attributes desired in our survey will lead to increased athlete satisfaction and trust, resulting in more positive health outcomes due to increase athlete compliance.

Objective: To understand which attributes are found most desirable by collegiate athletes in their AT.

Design: Cross sectional quantitative survey.

Setting: Qualtrics Programming online.

Patients: A convenience sampling technique was used to recruit participants for this study. A total of 99 emails
were sent requesting participation. Forty seven (men=16, women=31) Division I Track and Field athletes completed the survey for a response rate of 47.5%.

Interventions: An electronic survey, the Athletic Trainer Attribute Survey (ATAS) contained 33 five point Likert scale items addressing the importance of AT characteristics, competency, and relatability.

Main Outcome Measures: Cronbach Alpha was used to establish internal consistency of the ATAS as well as each subscale within the ATAS. One-way ANOVAs were run to assess if gender had an influence on the top three attributes in each subscale. Means, standard deviation as well as frequencies and percentages of each attribute were also calculated.

Results: Overall survey internal consistency, Cronbach alpha = 0.934; for the characteristics subscale, Cronbach alpha = 0.940; for the relatability subscale, Cronbach alpha = 0.898; and the competencies subscale was Cronbach alpha= 0.827. The top attributes deemed extremely important in each subcategory were trustworthiness (n=37/43), working knowledge of the athlete’s sport (n=29/43) and injury evaluation/diagnostic skills (n=33/43). One-way ANOVA results reported that female’s valued communication (p=.057), exercising on a regular basis (p=.047), injury prevention (.043) and therapeutic intervention (p=.002) higher than males.

Conclusion: The attributes found to be extremely important (Communication, trustworthiness, working knowledge of sport, injury prevention and therapeutic interventions skills) will increase the satisfaction and trust each athlete has in their AT. If you have the trust of your athlete it will increase the quality of your relationship, resulting in positive health outcomes and easier facilitation of the injury process.

Keywords: athletic training attributes, quality relationship, athletes trust, athletes perceptions

**Historic Costume in Science Fiction and Fantasy Film**

**Author(s):** Jennifer Jones  
**Faculty Mentor:** Alessia Carpoca  
**Category:** Visual & Performing Arts

**Abstract / Artist Statement:** Science Fiction and Fantasy are two genres which have captured the imagination of a generation of audiences. Frequently authors of such works base descriptions of clothing, jewelry, and hair on historical costume, giving readers and viewers a sense of connection to the events in the story. The design of these worn articles often furthers the observer’s perceptions of the characters, telling an unspoken story of who they are as people. Additionally, the choice of garments used in a performance informs the observer of the character’s personality, social status and place in society. This poster will investigate the use of historically based costume in Science Fiction and Fantasy films to contribute to the storytelling of a character.

This poster will review the costumes used in well-known film productions, such as Star Wars, Lord of the Rings, Game of Thrones, Dr. Who and Firefly, to identify elements of costume that have been previously seen in history and the implications the costume pieces have for the character wearing them. For the purposes of clarity, we will only use works of high fantasy and science fiction whose stories or portions of their stories are limited in their outside our current reality. We will investigate commentary from the designers; compare and contrast the designs to period and cultural dress with which they are associated or which they strongly resemble; look at textile and crafts materials that influence the costume’s role in the Science Fiction or Fantasy series: and investigate the uses of these design choices to tell the character’s story.

The goal of this poster is to illuminate key factors that can help designers when faced with abstract concepts often seen in the genres of Science Fiction and Fantasy. This poster would also serve to help viewers better understand and connect to films and television series they enjoy.
EXERCISES WITH THE GREATEST EMG ACTIVATION FOR SCAPULAR STABILIZING MUSCLES: A SYSTEMATIC REVIEW

Author(s): Jessica Keller  
Faculty Mentor: Valerie Moody  
Category: STEM (science, technology, engineering, mathematics)

Abstract / Artist Statement: Purpose: Due to the highly mobile nature of the shoulder joint, decreased muscular endurance, and complex demands of overhead athletics, risk of scapular dysfunction is significantly increased. Therefore, the purpose of this systematic review was to determine the most effective exercises that produce the greatest EMG activation among the scapular stabilizing muscles. Research is limited on scapular stabilizing exercises that produce optimal %MVIC values, and therefore this review aims to create a compilation of the most common and effective exercises clinicians can incorporate into their injury prevention protocols. Methods: A database search was performed using SportDiscus and PubMed October of 2018. Keywords, such as serratus anterior, scapular dyskinesis, Electromyography (EMG) activity, scapulothoracic, scapula upward rotation, and serratus anterior activation, were utilized to identify related articles. Studies were included if they used EMG analysis as their primary measure. Furthermore, studies were included if they discussed %MVIC values, scapular stabilization exercises, and muscle ratios. Of the 2,215 studies screened for inclusion criteria based on title and abstract, 39 articles were screened using a full-text review, and 18 studies qualified for the systematic review. Results: Eighteen controlled laboratory and observational studies, with a mean of 23 subjects per study, were selected for the review. The exercises that produced the greatest %MVIC values for individual scapular stabilizing muscles included side-lying ER with underarm towel, rowing, standing ER at 90° ABD, unilateral shoulder shrug, horizontal ABD (neutral), and an arm raise overhead in line with lower trapezius muscle fibers. Conclusion: This review summarizes the exercises that produce optimal EMG activation of the scapular stabilizing muscles to reduce the risk of injury and correct scapulothoracic and scapulohumeral abnormalities. Future research is warranted to further evaluate muscle activation in the muscles of interest, specifically between pathological and non-pathological shoulders, to identify which exercises are appropriate to implement in an injury prevention program.

High Dimensional Outlier Detection

Author(s): Omid Khormali, Brian Steele  
Faculty Mentor: Brian Steele  
Category: STEM (science, technology, engineering, mathematics)

Abstract / Artist Statement: In statistics and data science, the outliers are the data points that differ greatly from other values in a data set. They are important when looking at the large data set because they can sometimes effect on perceiving the whole data. It is therefore very important to detect and adequately deal with outliers. Recently, in [V. Menon and S. Kalyani, Structured and Unstructured Outlier Identification for Robust PCA: A Non iterative, Parameter free Algorithm, arXiv:1809.04445v1], a novel algorithm for detecting outliers is presented which a) does not require the knowledge of outlier fraction, b) does not require the knowledge of the dimension of the underlying subspace, c) is computationally simple and fast d) can handle structured and unstructured outliers. In this research, we improved this algorithm by reducing its complexity from $O(n^2m)$ to $O((n\log(n))^2m)$ where n is the number of data points and m is the dimension of the space.

The Alphabet Projection of Mass Spectrometry Data

Author(s): Patrick Kreitzberg  
Faculty Mentor: Oliver Serang  
Category: STEM (science, technology, engineering, mathematics)

Abstract / Artist Statement: My presentation will be about finding small molecules in mass spectrometry (MS) data. There is a wide breadth of future applications for this technique but the most impactful may be in drug testing. This method can be used to find what a drug has metabolized into (it could be a harmful poison or a therapeutic chemical) after it has interacted with a patient's physiology. MS is a technique used to find the
mass of objects (e.g. molecules and amino acids) which are too small to be weighed through conventional means. The data is measured in mass vs. intensity; intensity can be thought of as the abundance of the mass in the sample. The data looks like a series of peaks where a peak is present if there is a mass found at that value and the height is proportional to the intensity of that mass. We use the mass difference between peaks to find molecules that are either too small to be found by MS or have disappeared from the sample before the MS process began. We identify a set of the most important mass differentials, which we call an alphabet, that connect many masses in the MS data. There are methods which currently use an already known alphabet to connect a graph, but such an alphabet may be so large as to be unusable for certain data sets such as urine analysis. We are the first to propose a method which finds such an alphabet without any knowledge of the data a priori.

In order to find the most important masses in the MS data we represent the masses as vertices in a graph. We connect the two vertices if there is a mass in the alphabet equal to the difference between the two vertices. The larger the graph it builds the more important the masses in the alphabet are. This comes from the idea that chain reactions are important. If many masses all lose a sugar mass than the sugar must be important to the sample. If those smaller masses then lose a water molecule, water and sugar combined are important. From the MS data millions of mass differentials may be calculated, we project these millions down to the most important ones. Usually we project down to between 32 and 128.

The alphabets from which we build the graphs are determined randomly. Each mass differential is picked by choosing two random masses and taking the difference between them. Then we have a model which calculates what we think the quality of the graph(s) made by the alphabet are. If the quality of a set of graphs produced by one alphabet is better than produced by another, we keep the first. After proposing random masses, building the graphs, and then accepting the best alphabets many times the best alphabet will begin to converge to a final answer, meaning we can not find an alphabet which produces better graphs.

As stated above the most significant application may be in the field of drug testing. But this method can be used anytime you are unsure of what may be contained in a sample. The TSA can use this method to find which potential bomb-making chemicals to look for. This would be done by making a bomb, take MS data then use our method to find which chemicals are prevalent in the sample. Another biological application may be in diagnosis. If we take a urine sample from a patient there may be a molecule which shows up in our alphabet that can determine whether the patient is diabetic, experiencing kidney failure, is pregnant, etc.

Exploring the Effects of Moist Heat Pack Application on Hamstring Flexibility: A pilot project
Author(s): Kaitlin Kroll
Faculty Mentor: Valerie Moody
Category: Social Sciences

Abstract / Artist Statement: Introduction: Moist heat packs are commonly used to increase muscle temperature making it a popular treatment prior to rehabilitation or activity. Research suggests that applying a moist heat pack to skeletal muscle increases local blood flow, decreases muscle spasm, and increases tissue extensibility. However, much of the existing literature has focused on the use of a moist heat pack to facilitate a stretching routine to increase flexibility, and much of the literature reports conflicting findings as to whether flexibility can be influenced by a moist heat pack. Purpose: The purpose of this study was to determine the effectiveness of moist heat pack thermotherapy on hamstring flexibility. Hypothesis: We hypothesize that the application of moist heat packs would increase hamstring flexibility more than the control trial alone. Participants: A non-random sample of ten graduate students from a therapeutic modalities class (8 females and 2 males) participated in this pilot project. Methods: Two trials were conducted for this project: a control trial and moist heat pack trial. Participants’ hamstring flexibility was assessed by performing a single leg raise (SLR) using a standard 12 inch goniometer. Measurements were obtained before and after each trial. For the moist heat pack trial, participants were instructed to lie prone on the table with a moist heat pack applied to the
hamstrings for 20 minutes. In the control trial, participants were then instructed to lie prone on the table for 20 minutes. At least one week passed before participants returned to complete the other trial. Data was analyzed by using SPSS software to run a 2x2 repeated measures ANOVA. Dependent Variables: SLR was the dependent variable in this project. Results: A 2 x 2 repeated measures ANOVA revealed statistical significance (p = 0.024) whereby the moist heat pack trial improved hamstring flexibility from the pre-measure to the post-measure. The moist heat pack trial increased flexibility by 4.8 degrees while the control trial decreased by 1.8 degrees. Conclusion: While the findings of this study are not generalizable, the results suggest that moist heat packs may be effective at lengthening the muscle fibers by relaxing the muscle-tendon unit resulting in increased hamstring flexibility. While this supports some of the existing research, caution should be used making any inferences. There was a large amount of variability in measurements obtained in this pilot group suggesting that a different measurement technique may be warranted when conducting future studies. Word Count: 395

Patient Perspectives of an Intensive Comprehensive Aphasia Program for Stroke Survivors

Author(s): Anya Leyhe, Jenna Griffin, Carolyn Baylor, Kirsten Murray
Faculty Mentor: Catherine Off
Category: STEM (science, technology, engineering, mathematics)

Abstract / Artist Statement: Individuals with aphasia who participate in intensive post-stroke language rehabilitation programs make a variety of significant investments. Investments involve commitment across many domains including: time, finance, family participation, temporary relocation, as well as cognitive, physical, and emotional exertion. While intensive aphasia programs and intensive comprehensive aphasia programs (ICAPs) are becoming increasingly prevalent across health care settings (Rodriguez et al., 2017; Rose, et al 2013), and language-based and psychosocial outcomes are beginning to be reported in the literature (e.g., Babbitt, Worrall, & Cherney, 2015; Hoover, Caplan, Waters, & Carney, 2017), patient perspectives have yet to be explored. As health care moves towards patient centered care (Robinson et al., 2008), persons with aphasia (PWA)’s perspectives of their rehabilitation experience should inform current research and intervention approaches (e.g., Barrett, 2010).

The purpose of this qualitative study is to examine patient perspectives on the experience of participating in an intensive comprehensive aphasia program (ICAP), specifically the Big Sky Aphasia Program (BSAP) at University of Montana. Investigating what it is like for a person with aphasia (PWA) to participate in an ICAP will contribute to the exploration of the worthwhileness of the ICAP model. The primary research question of this study was: “what is it like to be a PWA in an ICAP?”

Investigators conducted nine, face-to-face, semi-structured interviews to collect narrative data from PWA who participated in the BSAP ICAP. The researchers asked the participants to describe their experiences and perspectives of the ICAP All interviews were audiovisually recorded and transcribed from the video recordings. Spoken production was transcribed verbatim and meaningful non-verbal communication (e.g., pointing) was also documented in the transcripts. Both researchers present during interviews took field notes on topics interviewees emphasized as important. Transcripts and field notes will be analyzed to create codes (i.e., phrases with keywords that represent significant concepts in participants’ experiences).

Data will be analyzed for themes and conclusions will be made about participants’ experiences in the BSAP ICAP. Implications of these perspectives for future ICAP implementation and research will be discussed.

References


Death in the Anthropocene: Coping with Loss in the Age of Extinction and Civilizational Collapse

Author(s): Jensen Lillquist
Faculty Mentor: Ashby Kinch
Category: Humanities

Abstract / Artist Statement: The Anthropocene presents significant environmental problems for both humans and nonhumans alike, as both climate change and mass extinction are ongoing phenomena. While mass extinction represents the direct death and loss of multitudes of species, climate change represents the threat of death and loss to human populations. Thus, mass extinction and climate change may be termed the losses of the Anthropocene; much environmental writing voices an unprocessed grief directed towards each of these losses. Yet in order for grief to become mourning—an active response to loss—the loss must be recognized and dealt with. The example set by death practices may provide a path to coping with the losses of the Anthropocene in order to avoid a passive response; it is crucial to bear witness to these losses in order to recognize their stakes and develop cultural practices which allow them to be processed. Conceptualizing the Anthropocene as a project in death allows overwhelming emotion to be replaced by affect.

I develop my argument through a survey of death practices, sociological and psychological analyses’ of the Anthropocene; and literary analysis on several cultural objects which respond to the Anthropocene. Specifically, I analyze The Sixth Extinction by Elizabeth Kolbert, We’re Doomed, Now What by Roy Scranton, Flight Ways by Thom Van Dooren, the Remembrance Day for Lost Species, and the work done by the Dark Mountain Project. These works range from journalistic, to essayistic, to artistic; yet each in some way attempts to grapple with the emotions generated by the Anthropocene.

Loss can and will affect most people who continue to live through the Anthropocene, yet it cannot be allowed to produce a state of emotional and affective paralysis by overwhelming individuals and cultures. Several recent academic works explore the emotional work of the Anthropocene—the grief of the loss of species, loved places, and a sense of security—yet no model has been presented for how we may deal with the strong emotions generated by loss in the Anthropocene, and it is this gap that “Death in the Anthropocene” seeks to fill. The losses of the Anthropocene can be dealt with in the same way that the death of a loved one can be dealt with; through recognition and engaged practices.
Effectiveness of light therapy on superficial healing following cupping induced ecchymosis: A pilot project

Author(s): Hunter Lindsay, Katie Berglund, Alicia Williams, Tessa Gorchesky
Faculty Mentor: Valerie Moody
Category: Social Sciences

Abstract / Artist Statement: Introduction: The idea of using light therapy to heal musculoskeletal, dermatological, and psychological pathologies is still a concept that is emerging in the medical field. Previous research suggests that light therapy will enhance blood flow, decrease pain, and facilitate the injury recovery process. However, much of this research has not been on humans. Purpose: The purpose of this project was to evaluate the effect of two different light therapy techniques on the healing process of ecchymosis induced by cupping. Hypothesis: Our hypothesis was that both techniques of light therapy would promote superficial healing by reducing cupping induced ecchymosis. Participants: A non-random sample of six graduate students from a therapeutic modalities class (3 females and 3 males), participated in this pilot project. Methods: Three trials were conducted for this project: a control trial and light therapy delivered either using light pads or a cluster probe to the quadriceps. The Dynatron Solaris 709 triwave light pad was used to conduct one treatment trial using a red LED with dosage at 6 J/cm² with a power output of 500mW. A Vectra Genisys model 2784 with a 4 LED probe was used for the second trial at 7 J/cm² of energy at a contact area of 7.55 cm². On day one, a cupping treatment was performed to both quadriceps (mid-thigh) to induce ecchymosis. Subsequently, measurements were obtained to mark the diameter of the ecchymosis on the thigh and photographs of the ecchymosis were taken. Participants then underwent a light therapy trial (either pad or probe) on the treatment leg assigned to each type of treatment. The following day, the participants ecchymosis was measured for a change in diameter. Before and after each day, ecchymosis diameter and photographs were obtained. Participants returned the following week to repeat the trial using the other form of light therapy. Data was analyzed by using SPSS software to run a 2x3 repeated measures ANOVA. Dependent Variables: Ecchymosis diameter was the dependent variable in this project. Results: Repeated measures ANOVA revealed no statistical significance between baseline and the first post-treatment measurements between the light pad and probe trials (P = .542). Additionally, there was no statistical significance among control, light pad, and probe between baseline and post-treatment measurements 24 hours after cupping (P = .363). However, a main effect for time was found among all conditions whereas measurements improved regardless of trial (P = .007).

Conclusion: While the findings of this study are not generalizable, the results did not indicate a difference in facilitating reduction of ecchymosis. Regardless of treatment, the ecchymosis resolved in all participants within 24 hours. Additional studies are warranted to determine if a difference exists between techniques of light therapy and their influence on superficial healing. Word Count: 444

Gained in Translation: Storytelling Through Theatrical Innovation

Author(s): Shane Lutz
Faculty Mentor: Bernadette Sweeney
Category: Visual & Performing Arts

Abstract / Artist Statement: As an artist, I am a challenger, a revolutionary, and an explorer - in no particular order. Swedish playwright August Strindberg believed that “society is so horribly regimented” in its obtuse ideas of art, resulting in a drastic stagnation of theatrical innovation. This remains as real today as it did when Strindberg flipped the theatrical tradition on its head in the late 19th Century. I believe that by deconstructing the ideals that have been ingrained into us in terms of what theatre can and cannot be, we can redefine an outdated and inaccessible art form to reach audiences across time and space.

During the Fall Semester of 2018, I began translating Woyzeck, the dark and expressionist play by German playwright Georg Buchner, before I took on directing the production in the spring with a debut in February of 2019. Written almost two-hundred years ago, Buchner calls attention in the inequalities of class and status through archetypal stock characters in a small Bavarian town. Despite its age, Woyzeck remains one of the most popular German plays ever produced with a successful international run in countless styles and artistic
approaches. Its longevity speaks to the work’s ability to communicate the presence of injustice throughout the world in ways that overarchingly relate to all people in all places and all times.

The process of translation from Hoch Deutsch - a complex German dialect more commonly spoken in the Northern part of the country - came with excessive challenges. The German language, while serving as a predecessor of English, boasts a vocabulary with few English equivalents. We have no word for Innerer Shweinehund or Kummerspeck, which translate to “inner pig dog” and “grief bacon” respectively. Additionally, Hoch Deutsch uses filler words such as “doch” that simply do not translate into English grammar. Beyond the dictionaries, textbooks, and native speakers I went to for resources, the most valuable tool at my disposal was adaptation.

Throughout this project, I have explored the relationship between playwriting and directing in order to find the most successful avenue through which to tell a story. Woyzeck is a uniquely German script that enforces distance between the urgency of the piece and American audiences. My adaption of the original material and my work as a director in the rehearsal room focuses on breaking down these barriers, speaking to a place that is immediately here and now. To achieve this, I experimented with new approaches to theatrical innovation, including storytelling through the physicality of the body, evocative imagery, and conventions that serve to upend the expectations of the audience rather than enforce them. This opportunity to playfully test new styles and methods will serve as the foundation for my research as I continue through grad school.

While adaptation allows for greater exploration of method and material, it’s impossible to avoid changes and discrepancies between the new and original texts. After a brief analysis of my approach to building Woyzeck as a playwright and director, recruited actors will perform identical monologues from three separate versions of the play. This performance illustrates not only the different approaches with which Woyzeck communicates, but also highlights the significance of having a new text that can reach audiences on a local and immediate level. A play that addresses inequality across societies should interact directly with the world it’s attempting to change, and this is the first time Woyzeck will do that with American audiences, isolating its scope to the microcosm of Missoula, Montana.

**Employing the art of nanotechnology in wound healing**

**Author(s):** Zahra Mahdieh  
**Faculty Mentor:** Andrij Holian  
**Category:** STEM (science, technology, engineering, mathematics)

**Abstract / Artist Statement:** The current technology for improved wound healing lags behind the needs and requirements for effective wound dressings even the costs already exceed $50 billion annually (just in the US). An optimal wound dressing has to: 1) serve as a protective barrier on the wound to assist the healing process, 2) require minimal changes to reduce pain and potential for infections, and 3) provide a sustained and controlled release of medications to facilitate wound healing. In order to achieve these goals, research is being conducted to improve wound dressing drug delivery. The major challenge with the current wound dressings is a phenomenon called drug burst release. Drug burst release is a rapid initial release of the drug from a wound dressing resulting in delivery of all the medication at once, hence decreasing the efficiency of a single dressing. The objective of my research is to develop technology resulting in a more prolonged delivery of medications in a format that would be suitable for wound dressings. To achieve this goal would require using nanotechnology in the form of a fiber mat containing an inner core with silver nanoparticles within a shell. The silver nanoparticles serve as an effective anti-bacterial agent. It also requires forming pores in the shell when placed on the wound to allow the silver to be released to the wound. (This structure resembles a garden hose that contains water that cannot be released until holes are punched through the surface allowing the water to slowly seep out.) The major challenges to develop this technology are creation of the shell-core structure and ability to form pores.

I have been able to produce a fiber mat and load the silver nanoparticles (diameter ~20 nm) in the core of the fibers. The core-shell structure of individual fibers was visualized by adding fluorescent dye inside the core. The outer diameter of the fibers is about 1400 nm and the inner diameter is about 800 nm. I have been able to
form pores (diameter ~ 170 nm) on the surface of the fibers by using a mixture of a soluble polymer and nanoparticles. The fabricated fiber mat (wound dressing) released 34% of the loaded silver nanoparticles in a period of three days. The obtained results are promising in terms of a prolonged drug release. Furthermore, the antibacterial activity of the fabricated wound dressing was shown to be effective by killing bacteria in less than two hours.

Electrospun fiber mats have a flexible and porous structure with high surface area, which allows for liquid and gas permeability. These characteristics of fiber mats facilitate hemostasis, cell respiration, regulated moisture level, and a suitable bacterial barrier. The resulting wound dressing provides a prolonged drug delivery to the wound site, which decreases the need to frequently change the dressing. Less frequent dressing changes will result in a decrease in patients’ discomfort, care costs, further tissue damage, and the risk of infections.

Funding: P30GM103338.

Parents’ Ability to Identify Concussion Symptoms in Youth Athletes: A Systematic Review

Author(s): Taylor Manning
Faculty Mentor: Valerie Moody
Category: STEM (science, technology, engineering, mathematics)

Abstract / Artist Statement: Purpose: Parents’ of youth athletes often receive very little to no education about sports related concussion (SRC). Due to the lack of education, often times parents are unable to identify concussion related symptoms and do not understand what to do if they suspect a concussion. Determining gaps in parent education on SRC will help us to develop recommendations about methods of delivery of parent education as well as content to include in education which will enhance youth sports safety. The purpose of this systematic review was to determine youth athlete’s parents’ understanding of SRC as well as their ability to identify SRC symptoms. Methods: Two databases, PubMed and SportDiscus, were searched through October 2018 using eight key phrases: youth concussions, parent concussion education, concussion education, concussion programming, concussion policy, concussion identification, concussion management, and parent concussion training. The literature search produced 7382 articles. Duplicates were removed, and 5095 articles remained for review. Articles were screened examining titles, abstracts and full text resulting in 6 articles being included for qualitative synthesis. Specifically, articles reviewed addressed parent’s general knowledge of SRC and ability to identify SRC symptoms. Results: Studies indicated that youth athlete parents are generally aware that a concussion can occur without loss of consciousness (85%), and that their child should not return to play (RTP) on the same day a concussion is sustained (76.5%). Parents are significantly better at identifying physical symptoms of a concussion: such as headache (89.1%), dizziness (95.4%), nausea (85.2%), and vision problems (94.6%) whereas they struggle to identify emotional symptoms (80.6%) and some cognitive symptoms. Conclusion: Parents have decent handle on general knowledge of SRC, as well as being able to identify concussions symptoms. Where parents are lacking knowledge is knowing what to do after their child has sustained a SRC. Parents need to be educated on how to effectively care for their child after a SRC, when and how to seek medical attention and when it is safe their child to RTP. Future research needs to focus on exploring avenues for educating youth parents on SRC, particularly how to care for their child once they have recognized SRC symptoms in their child. As well as educating parents on RTP, specifically when it is safe for their child to RTP.

Total energy intake and self-selected macronutrient distribution during wildland fire suppression

Author(s): Alex Marks
Faculty Mentor: Brent Ruby
Category: STEM (science, technology, engineering, mathematics)

Abstract / Artist Statement: INTRODUCTION: Wildland firefighters (WLFF) are required to work long hours in extreme environments resulting in high daily rates of total energy expenditure (TEE) (Ruby, 2002; Cuddy,
Increasing the number of eating episodes throughout the work shift and/or providing rations that better promote convenient nutrient delivery (Cuddy, 2007; Montain, 2008) has been shown to augment self-selected work output, particularly during the shifts' latter hours (Cuddy, 2007). However, it remains unclear how current feeding strategies of WLFF compare to more frequent nutrient delivery. PURPOSE: The aim of the current study was to determine the self-selected field total energy intake (TEI), composition and patterns of WLFF feeding during wildland fire suppression shifts. METHODS: 86 WLFF (16 female, 70 male; 27.5±6.4 yrs) were deployed to 12 different wildland fire assignments across six regions of the US during the 2018 fire season. Pre- and post-shift food inventories were collected at WLFF basecamp and provided item-specific nutrient content (calories [kcal], CHO, fat, protein). Work shift nutrient consumption (TEI, feeding frequency [total number of and interval between feeding episodes], feeding episodic composition) was monitored in real-time by field researchers on the fireline via observational data capture in mobile tablets. RESULTS: Work shift length averaged 14.0±1.2 hr, with a TEI of 1494.3±592 kcal (51±10, 37±8, 14±4 % for CHO, fat, and protein, respectively). The total number of eating episodes was 4.3±1.7 with an average interval of 117±76 min. Eating episodes averaged 344±307 kcal and included 44±38 g CHO. Using similar intake metrics, TEI was 893±353 and 1356±560 kcal for breakfast and dinner, respectively. CONCLUSION: The present work shift TEI approximates 34% of the TEE compared to our prior doubly labeled water studies (Ruby, 2002; Cuddy 2015). These data also demonstrate that WLFF consumption patterns using current rations may not deliver adequate nutrients for the occupational demands of WLFF. Future work should elucidate the impact of work shift provisions on overall patterns of self-selected work output.

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Effect of Helmets in Reducing the Risk of Concussion in Football: A Systematic Review

Author(s): Conor Marlatt
Faculty Mentor: Valerie Moody
Category: STEM (science, technology, engineering, mathematics)

Abstract / Artist Statement: Context: While the incidence of concussions is on the rise, it is also well known that a large number of concussions go undiagnosed or unreported. With increasing knowledge and focus on the long-term complications following concussions, greater emphasis has been placed on player safety. One particular area of focus in player safety is equipment, more specifically the football helmet. Significant advancements have been made to helmet design over the last decade with the intention to reduce the risk of concussions. The objective for this study was to determine whether there is a football helmet that the NFL or NCAA are using that effectively reduces the risk of concussions. Methods: A systematic review was conducted using PubMed and SPORTDiscus databases using four different keywords. The keywords used the terms; helmets AND concussions, NFL concussions, helmets reducing concussions, and NFL helmets. 835 articles were then screened for use in the systematic review. After reviewing titles, abstracts, full-text and duplicate removal, five studies were included in the systematic review. Results: The main results of this study are that the VSR-4, Revolution, Revolution Speed Classic, and ION 4D performed the best across multiple measures assessed within the reviewed studies. These tests included linear acceleration, angular acceleration, and a severity index score. The helmets that performed the best had lower severity index scores as well as a smaller linear and angular acceleration. Conclusions: It was found that there are certain helmets that performed better during impact tests which may potentially reduce the risk of concussion for football players at the NFL or NCAA Division-1 levels. With that being said, there are no helmets currently on the market that can completely negate the risk of concussion, and more research is warranted and needs to be done to ensure the safety of the athletes. Word Count: 297
Native trees can improve ecological function and increase economic value of exotic plantations: Lessons learned from the Panama Canal Watershed

Author(s): Abigail Marshall
Faculty Mentor: Cara Nelson
Category: STEM (science, technology, engineering, mathematics)

Abstract / Artist Statement: It is well known that tropical forests are being deforested and degraded at accelerated rates to provide food, fiber, and other materials. After clearing, the once highly-productive and biodiverse forests are converted to other non-forest land uses, such as human settlements and cattle grazing. Plantation forestry is thought to offer an ecological-economic “win-win” by providing lumber and income to local communities, while at the same time preserving some of the primary ecological benefits of forests, like wildlife habitat and regulating water. However, if plantations of exotic species grow poorly and fail to deliver economic benefits, then landowners have less incentive to continue growing trees.

For example, in the Panama Canal Watershed (PCW), a high-priority conservation area for wildlife connectivity and for maintaining year-round water supply for the Canal, large areas have been converted to plantations of teak (Tectonia grandis), a high-value, exotic timber species. However, poor teak performance and low economic returns on plantations are major factors limiting the upkeep of existing plantations and the establishment of new ones, and in some cases, land-owners are transitioning plantations to cattle ranching despite decades of government- and NGO-led reforestation programs and subsidies.

One strategy for improving the ecological and economic benefits of timber plantations is through enrichment plantings, or the establishment of target species under an existing canopy (in this case, underperforming teak trees). Although past studies have identified promising, high-value native species which may benefit from the partially-shaded establishment conditions of an enrichment planting, there is limited information on how native species perform across a range of microsite conditions and their responses to management practices such as fertilization.

To address this gap, researchers with the Smithsonian Tropical Research Institute have been studying the effectiveness of planting 6 high-value native trees (Byrsonima crassifolia, Dalbergia retusa, Dipteryx oleifera, Hieronyma alchorneoides, Platymiscium pinnatum, and Terminalia amazonia) in the understory of teak plantations. As part of this project, I designed a study to test the environmental factors that influence growth of these native species, in order to assist with the development of appropriate planting guidelines. Specifically, I am interested in the effects of light availability, crowding from teak, microsite productivity and fertilizer inputs on the growth and mortality of study tree species. My initial results suggest that teak plantations can provide a suitable environment for establishment and early growth, but indicate differences among native species which may be related to shade tolerance and associations with below-ground microbial symbionts.

This presentation will provide a brief background on reforestation efforts and timber plantations in the PCW, and discuss preliminary results of the enrichment planting field trial. The management implications of these initial findings will be explored, as well as potential relevance to broader ecological questions surrounding how species functional traits and microbial associations may shape competitive outcomes for abiotic resources, and how/if physiological characteristics predict responses to fertilizer and light.

Whitebark Pine, an elder in peril: a literature review

Author(s): Enzo Paolo Martelli Moya
Faculty Mentor: Cara Nelson
Category: STEM (science, technology, engineering, mathematics)

Abstract / Artist Statement: Whitebark pine (Pinus albicaulis), an ecologically important tree species in high-elevation ecosystems of western North America, is declining across most of its range in North America because of the combined effects of an exotic pathogen (white pine blister rust; Cronartium ribicola) and a native insect (mountain pine beetle; Dendroctonus ponderosae), as well as climate change and its effects on the frequency and severity of wildfire. Concern over the status of whitebark pine has led to its listing under both
the US and Canadian Endangered Species Acts and the adoption of coordinated, trans-boundary restoration strategies, such as the Range-Wide Restoration Strategy and the National Whitebark Pine Restoration Plan. These restoration strategies call for active restoration measures including silvicultural treatments and prescribed burning, among other treatments. Despite widespread agreement on the need to restore and conserve whitebark pine, there is little information on the efficacy of proposed restoration treatments and there is some concern that treatments aimed to concern the species, such as prescribed burning, may in fact have adverse effects. In order to improve restoration strategies for white bark pine, I conducted a literature review on the status of knowledge on the species in general, with a particular focus on restoration. Specifically, I identified all publications listed on Web of Science and grey literature available on AGRICOLA (National Agricultural Library, USDA) from 1950 to 2017 using the search terms whitebark pine and “Pinus albicaulis”. I only reviewed articles that mentioned the species in the abstract or title, or studies in which whitebark pine ecosystems were a main focus (e.g. biotic interaction studies - Nucifraga columbiana, Ursus arctos, Cronartium ribicola, etc).

Although I found that the number of published articles has been increasing over the last 30 years, most studies focused on biotic interactions (27%), pathogens and mountain pine beetle outbreaks; 25%) or mortality, distribution and regeneration dynamics (16%, 19%, 12 % respectively), highlighting interest in understanding the impacts of the main threats to the species. On the other hand, experimental studies focused on the efficacy and effects of restoration practices and management had little research (less than 10% of all articles and only 402 publications. There were also few articles published on the species life history, fire ecology and successional dynamics. My findings indicate a significant gap in information required for effective conservation planning and restoration for whitebark pine. To improve management, there is a need to recognize the value and complexity of alpine ecosystems and to invest in research that aligns with conservation need and that can inform conservation plans, restoration strategies and management practices.

**Intraspecific variation in plant response to drought: assessing the current state of knowledge**

**Author(s):** Mariah McIntosh  
**Faculty Mentor:** Cara Nelson  
**Category:** STEM (science, technology, engineering, mathematics)

**Abstract / Artist Statement:** Because plant growth, fitness, and survival strongly depend on water availability, it is imperative that plants are able to cope with water stress when drought occurs. Therefore, understanding plant adaptation to drought has major implications in basic and applied science, from informing fundamental ecological theory explaining plant distributions and interactions, to predicting and modeling local to global responses to climate change, to implementing effective ecological restoration. Research shows that plants vary greatly in their response to drought, with significant differences in sensitivity to drought and drought coping strategies. However, current work primarily focuses on differences between species or distantly related functional groups (interspecific variation), while little is known about variation in drought response between populations within the same species (intraspecific variation). How this variation is structured between and within species remains a fundamental question in plant ecophysiology. A formal assessment of literature considering intraspecific variation in plant drought adaptation across ecosystems, plant taxa, functional groups, life history strategies, or drought response traits has not yet been made. Therefore, the extent of variation between versus within species is unknown, and the current state of this field may poorly inform applications in ecology, crop science, climate science, ecological restoration, and more.

To characterize what is currently known about within-species variation in drought adaptation, I conducted a literature review assessing intraspecific variation in natural (non-crop) plant populations. Analyzing all publications hosted on Web of Science pertaining to this topic, I asked how intraspecific variation is structured within the literature across ecosystem types, geographical regions, plant taxa, functional groups, life history strategies, and drought response traits. I assessed if and when there are differences between populations of the same species in adaptation to drought, and, in the case of some studies, whether or not this variation is genetic, plastic, or both. I also considered which ecosystem types, geographical regions, plant taxa, functional
groups, drought response traits, and experiment types are most represented in the literature. The results of this review characterize the current state of knowledge of intraspecific variation in plant drought adaptation and identify areas most in need of further research, specifically the need for multi-trait, multi-species, rangewide studies assessing drought adaptation traits. Ultimately, this review will aid in assessing current ecological theory pertaining to plant adaptation to drought and inform applied applications, from predicting forest mortality under climate change, to improving the efficacy of restoration projects in drought-prone areas, to informing future research.

Comparing the Acute Effects of Cryostretching to Traditional Hold-Relax PNF Stretching on Hamstring Flexibility: A pilot project

Author(s): Mckayla McNamara, Brittney Mock, Madelyne Barton
Faculty Mentor: Valerie Moody
Category: Social Sciences

Abstract / Artist Statement: Introduction: Musculotendinous injuries often occur in sporting populations, especially that of hamstring injuries. Additionally, some might say that these injuries are due to lack of hamstring flexibility. Hamstring injuries have been addressed by various forms of preventative stretching such as static, dynamic, ballistic, and proprioceptive neuromuscular facilitation (PNF). Cryostretching has also been used to treat acute muscle strains, increase muscle flexibility, calm muscle spasticity, and treat other non-specific muscle injuries. Although many studies indicate no added benefit of cryostretching on hamstring flexibility, these studies have typically measured distal hamstring extensibility. To our knowledge, the effects of cryostretching have not been assessed focusing on proximal hamstring flexibility. Purpose: Therefore, the purpose of this project was to examine the acute effects of cryostretching on hamstring flexibility using the passive SLR. Hypothesis: We hypothesized that a cryostretching treatment would result in an acute increase in hamstring extensibility more so than traditional PNF Hold-Relax stretching. Participants: A non-random sample of eight graduate students from a therapeutic modalities class (4 females and 4 males), participated in this pilot project. Methods: Two trials were conducted for this project: a cryostretching trial and a PNF Hold-Relax trial. Participants' hamstring flexibility was assessed by performing a single leg raise (SLR) using a standard 12 inch goniometer. Measurements were obtained before and after each trial. For the cryostretching trial, subjects were asked to lie prone on the table while two ice packs were applied to the right hamstring for 15 minutes and secured with flexi-wrap. Immediately following the cryotherapy treatment, a hold-relax PNF technique was used to stretch the hamstring. For the traditional PNF hold-relax stretching trial, subjects were asked to lie supine on the table for 15 minutes. Immediately following, a hold-relax PNF technique was used to stretch the hamstring. At least 5 days passed before participants returned to complete the other trial. Data was analyzed by using SPSS software to run a 2x2 repeated measures ANOVA. Dependent Variables: SLR was the dependent variable in this project. Results: Data analysis revealed no statistical significance (p=0.493) between the cryostretching and hold-relax PNF trials. Hamstring flexibility slightly increased when using the cryostretching technique, whereas, hamstring flexibility with the hold-relax PNF technique diminished. Conclusion: While the findings of this study are not generalizable, the results align with existing research. The large number of resources reporting on cryostretching report minimal impact on muscle extensibility. Cryostretching may be minimally useful for increasing short-term flexibility, but rather may be more useful as a therapeutic intervention in conjunction with rehabilitation and pain management.

The impact of salient naming targets during aphasia therapy

Author(s): Kathy Molesh, Jenna Griffin, Craig McFarland
Faculty Mentor: Catherine Off
Category: STEM (science, technology, engineering, mathematics)

Abstract / Artist Statement: Two to four million Americans are affected by aphasia, an acquired communication disorder caused by brain damage (Simmons-Mackie, 2018). Speech, writing, reading and comprehension may all be affected by aphasia. Aphasia is commonly caused by stroke but brain injuries, cancer and neurologic disorders may also cause aphasia (NIH, 2017). Speech-language pathologists provide
aphasia therapy particularly for aphasia-induced word finding difficulties known as anomia. Because communication is required for many daily activities, aphasia often has a devastating affect on an individual’s quality of life. Therapies that increase independence, and social participation in daily life are needed to increase the quality of life for patients with aphasia.

Currently, behavioral therapies that incorporate neurology and speech-language pathology research are being used to treat aphasia. One area of neurological research that has received little attention is the use of “salience” shown to increase rehabilitation after brain damage (Raymer et al., 2008). Language therapies involving salience rely on stimuli that are important and motivating to an individual. Incorporating salience in aphasia therapies may increase functional outcomes and quality of life.

The following study analyzed the impact of salient stimuli targets on picture naming accuracy for individuals with aphasia-induced anomia.

Two individuals with chronic aphasia and significant anomia who participated in an Intensive Comprehensive Aphasia Program (ICAP) at the University of Montana served as participants for this investigation. Aphasia and anomia severity levels were determined by standardized tests.

Each participant choose 25 “salient” words, which were used to create photographic stimuli for naming sessions. Control photographic stimuli were selected to match the salient targets’ syllable length and frequency.

A single subject research design was implemented to assess the role of saliency during naming therapies. Three baseline-naming probes were given to assess pre-treatment naming accuracy. Three naming probes were given during the treatment phase and three post-intervention probes were given after intervention. All probes and interventions took place over five consecutive weeks of the ICAP. All stimuli were randomly presented during each probe session. Naming responses were scored as correct or incorrect and coded for error type.

Twelve, forty-five minute, evidence-based therapy sessions were implemented by graduate student clinicians under supervision of the researchers. Evidence-based therapeutic approaches were selected for each participant with regard to aphasia type, client goals, and clinical expertise.

Descriptive statistics including means and standard deviations for salient and control stimuli were calculated for each participant for each probe session. Effect sizes were calculated to determine the effect of change for the control and salient stimuli from baseline to post-treatment. Effect sizes for the salient stimuli were large for both participants: P1 (4.04), P2 (4.08). The control stimuli effect size for P1’s was large (2.14) and medium (.64) for P2.

Preliminary analyses suggest that incorporating salient targets in naming therapies increases naming accuracy. Implications for these findings further support the use of person specific, highly motivating, salient stimuli in anomia therapies. Anomia therapies that incorporate salient stimuli may increase functional outcomes and quality of life.

Adaptation Under the Canopy: Cooperative Membership, Certifications, and Coffee Producer Sustainability in Oaxaca, Mexico

Author(s): Meghan Montgomery
Faculty Mentor: Steve Siebert
Category: Social Sciences

Abstract / Artist Statement: The coffee industry has undergone significant transformation over the past two decades, impacting small-scale producers’ livelihoods and the ecosystems that support them. The International Coffee Agreement, which regulated coffee production worldwide, collapsed in the early 1990s, leading to a dramatic price crash and market volatility that continues to affect the industry. Smallholder farmers in Mexico, as elsewhere, responded to the “coffee crisis” through a range of adaptations, including adjusting livelihoods...
strategies, migrating to find work, forming cooperative organizations, and obtaining specialty certifications for their product.

The global market for certified coffee, including Organic, Fair Trade, and Rainforest Alliance, is rapidly expanding in the global market in response to changes in the ecological, economic, and social conditions of production. Certification represents a market-based strategy that claims to benefit producer livelihoods while also safeguarding ecosystem health. Certifications claim to offer producers a stronger position in the chain of production, promising higher prices, trade network access, and specialized training to improve cultivation practices. However, recent research on the long-term benefits of certifications indicates that these programs do not confer advantages universally on producers, and there is a significant lack of understanding about the constraints that small-scale growers face in becoming certified (Mendez et al. 2010).

This research examines a case-study community of smallholder coffee farmers in Oaxaca, Mexico to analyze the dynamics around certifications and growers’ cooperatives, and how effectively these institutions help growers adapt to the coffee crisis. I used a mixed-methods approach, employing ethnographic methods, interviews, a household survey, and on-farm measures of tree abundance and frequency to examine how producers continue to adapt to ongoing market change. This study draws on theories about economic adaptation and livelihoods analysis to document the dynamic strategies that smallholder farmers have utilized to maintain their ways of life in response to coffee market instability. Results indicate that while farmers did experience some benefits from cooperative membership and certifications, they did not perceive an overall improvement in their livelihoods due to cooperative membership or certifications. While farmers have adjusted management practices and livelihoods strategies because of cooperative membership and certification, these changes are more accurately characterized as reactive coping responses, rather than proactive adaptations. Smallholders in the case study community are constrained by financial, educational, and technological resources that limit their ability to implement long-term strategies to reduce vulnerability to future commodity market restructuring. This study indicates that certifications fall short in delivering the benefits that they claim, offering insufficient resources to producers in the face of powerful market forces. Greater attention from the specialty coffee supply chain should be given to support other resource programs and relationships of direct trade with producers is warranted.

Vulnerability of Ponderosa pine needles to hydraulic failure across California

Author(s): Cameron Musser
Faculty Mentor: Anna Sala
Category: STEM (science, technology, engineering, mathematics)

Abstract / Artist Statement: Ponderosa pine (Pinus ponderosa) is an ecologically and economically important species occupying diverse habitats in the western United States. During the 2012-2015 California drought, mortality in ponderosa pine contributed the death of over 100 million trees. Drought-induced hydraulic failure is considered a strong contributing factor to tree mortality, where blockages in the tree’s water transportation system (i.e. embolism) results in decreased water delivery to the canopy. Though most studies focus on woody plant-tissues, needles are a critical point in the hydraulic pathway and often experience the most dangerous pulling forces on water during drought. Characterizing the thresholds vulnerability to drought-induced hydraulic failure and how these thresholds may vary among populations of widespread species is important to determining how species may respond to climate change.

To describe variation in ponderosa needle response to drought, we measured trees from four populations along a rainfall gradient in California. To determine if hydraulic failure in needles is the result of blockages in the water transport system, or the xylem tracheids, versus the tissues surrounding the xylem, we used micro-CT imaging and hydraulics methods to estimate the loss of needles ability to transport water during desiccation. We also measured a suite of anatomical traits associated with drought-tolerance, with the expectation that trees from drier habitats would be more resistant to the effects of drought.
This study is the first of its kind to access the damages of drought using x-ray microtomography across a population’s range. Not only does this method of analysis allow for a more accurate estimation of embolism formation, but it also gives insight into the whole-needle desiccation process.

Micro-CT images showed that needle tracheids were highly resistant to embolism, losing 12% of their functional area at -1.9 MPa. The images also showed deformation and changes in airspace tissues outside of the xylem. Our hydraulics data suggest that the needles as a whole are highly vulnerable (12% loss of ability to move water at -0.15 MPa). We found no significant differences in either inside- vs. outside-xylem vulnerability across the four populations. However, the most southern and driest population had significantly thicker waxy cuticle, smaller mesophyll area, smaller cross-sectional area, and shorter needle lengths.

Our results suggest that ponderosa pine needles show low plasticity for needle vulnerability across its range in California, but morphological and anatomical differences in the southernmost population may help to delay declines in water potential from reaching critical thresholds. Since ponderosa pine needles appear to be similarly vulnerable to drought across its range, it is important to identify locations where abiotic and biotic factors predispose trees to hydraulic failure and mortality.

Biased Drugs: The many ways to turn “on” a receptor
Author(s): Michelle Nemetchek
Faculty Mentor: Travis Hughes
Category: STEM (science, technology, engineering, mathematics)

Abstract / Artist Statement: Type II Diabetes, formerly known as, “adult onset,” diabetes, is a disease that affects almost 10% of Americans and is expected that 40% of Americans will develop Type II Diabetes in their lifetime. Type II differs from Type I diabetes in that it is developed later in life, and though it is heavily dependent on diet and exercise, it also has a large genetic dependence as well. Patients with Type II often produce insulin, but their bodies have become resistant to it, preventing its normal function as a signal to take up glucose from the bloodstream. This ultimately leads to cells becoming starved, and if not treated, can dramatically increase the chances of patients developing heart disease and nerve damage.

A target of many Type II Diabetes drugs currently prescribed in the US is a receptor called PPAR\(\gamma\). These drugs desensitize the body to insulin, allowing it to be recognized as a signal for glucose uptake. Citing side effects like organ failure and weakened bones, other countries have chosen to take these prescription drugs off of the market. In the US, some drugs that target PPAR\(\gamma\); have been taken off the market completely, and others have previously had a “black box” warning of potential side effects. Though some of these drugs are currently prescribed, there is still much room for improvement.

Here, we demonstrate that this receptor could be precisely controlled to turn, “on,” some genes but not others when the receptor is bound to certain drugs. Some drugs control genes by making the receptor interact with the cell’s transcriptional machinery; Other drugs encourage interaction of this receptor with a partner receptor; Still, others may affect the DNA sequences that the receptor recognizes. To establish these drug effects, in vitro protein interaction experiments using fluorescent probes are used to measure interactions between the receptor, transcriptional machinery partners, and DNA. All in all, we see that the binding of certain drugs encourages different interactions between the receptor and these partners. These, “biased,” drugs have the potential to turn on the genes that lead to antidiabetic effects while avoiding the activation of genes that lead to undesirable side effects.

Human vs. Non-human bone: A non-destructive histological method
Author(s): Haley O’Brien
Faculty Mentor: Meradeth Snow
Category: Social Sciences

Abstract / Artist Statement: Purpose: Within biological, anatomical systems, bone is a connective tissue that acts as the main supporting internal structure of the body. It directly reflects the soft tissues (e.g. muscles) that
surround it in what osteologists call “bone morphologies” and is the primary focus of studies in forensic anthropology and zooarchaeology. Within these disciplines, species identification is one of the first steps in the analysis of bone fragments in both forensic and archaeological contexts. This thesis project focuses on the identification of human vs. non-human bone using a novel, non-destructive histological method assuming a qualitative distinction can be found between species using a high-resolution camera microscope.

Methods: Using an AmScope camera microscope, this method is testing for a notable difference in human vs. cow vs. deer endosteal cortical bone without the use of destructive, histological cross-sections. All bones are already fractured, photographed under 100x resolution, and examined for orientation and pattern of vascularization, type of primary bone (e.g. lamellar vs. plexiform), morphological measures of the transition from cortical to cancellous bone, and robusticity of the cortical bone. The non-human species were chosen for their common appearance in potential forensic cases that have come through the University of Montana Forensic Anthropology Lab (UMFAL).

Originality: Current methods for human vs. non-human taxa identification include morphological, genetic, and histological analyses to determine forensic significance and assess what is present in an assemblage. These established techniques rely on the presence of mostly complete morphological features or destructive analyses to attempt to identify the species of origin and are impractical for use in most forensic and archaeological contexts where highly fragmented bones are the norm. This study attempts to develop a new methodology for use in contexts where these other methods are not possible or available.

Significance: The results of this study could provide an accessible, affordable, and fast identification method which, in turn, could save time and resources if non-human determinations are made early in a forensic investigation. By applying this at a crime lab, someone without extensive histological knowledge in osteology could look for quantitative and basic morphological features to establish forensic significance of remains. In an archaeological context, this method could be useful for similar cost, non-destructive, and efficiency reasons with the additional caveat that most faunal fragments found are regularly too small for taxonomic or element identification beyond possible long bone shaft fragments. This would additionally help give archaeologists and biological anthropologists a method for human vs. non-human taxonomic identification in known archaeological sites that is respectful to tribal beliefs on how to handle the deceased.

Homomorphisms and cores of random digraphs

Author(s): Esmaeil Parsa
Faculty Mentor: P. Mark Kayll
Category: STEM (science, technology, engineering, mathematics)

Abstract / Artist Statement: An acyclic coloring of the vertices of a digraph D is an assignment of different colors to the vertices of D such that the vertices of the same color induce an acyclic subdigraph of D. If an acyclic coloring of D uses k distinct colors, it is called an acyclic k-coloring of D. The minimum number k for which there is an acyclic k-coloring of D is called the acyclic chromatic number of D. It is easy to see that the acyclic chromatic number of D is equal to k if and only if we can define a mapping f from V(D) to V(K_k) such that f maps an arc either to a vertex or to an arc of K_k with direction preserved and the inverse image of every vertex of K_k induces an acyclic subdigraph of D. A mapping f:V(D)\rightarrow V(C) with the forementioned properties is called an acyclic homomorphism of D to C. If there is an acyclic homomorphism of D to C, we say D is C-colorable. A one-one and onto homomorphism is called an isomorphism and an isomorphism of D to itself is called an automorphism. A digraph D is called a core if the only homomorphism of D to itself is an automorphism. Complete digraphs are examples of cores.

Cores play a very important role in the study of digraph homomorphisms. A very first question about cores is that "how big is the set of core digraphs?". In this talk we want to prove that asymptotically almost surely every random digraph is a core. Loosely speaking this means that if we have a bag containing all digraphs on n vertices and we randomly choose a digraph from the bag, the probability that the outcome is a core digraph tends to 1 as n goes to infinity.
Musical Theatre School Tour: Inspiring Students to Explore History in Their Own Backyards

Author(s): Aimee Paxton, Jadd Davis
Faculty Mentor: Bernadette Sweeney
Category: Visual & Performing Arts

Abstract / Artist Statement: Theatre for Young Audiences (or TYA) is an artistic medium wherein adult actors present theatrical works geared for young people. It is important to distinguish that TYA is for children, rather than by children. Musical theatre uses a multitude of storytelling devices: script, lyrics, music and choreography. By employing such a multi-pronged approach, a TYA musical can thus reach children of differing sensibilities.

In our research we have found that the model of a TYA school tour provides access to students, particularly in rural areas, who seldom experience live theatre. Bringing the show to the schools is important, rather than forcing students to come to a physical theatre, where access may be impossible or impractical.

We have spent years working at the premiere TYA establishments in the Northwest and draw heavily from the philosophies espoused by flagship entities such as Seattle Children’s Theatre. We have tested the model with Coeur d’Alene Summer Theatre’s “CST on the Road”, which we helped inaugurate in 2015. It is our goal to spread TYA theatre throughout the Northwest (and create an imitable model for other geographies) rooted in a sense of place. In our research, we have found that young people respond favorably to material about those places with which they are familiar, deriving greater value from their immediate locale. Our research aims to create an ever-growing catalogue of TYA musicals with specific historical and geographical contexts, while deepening our own skills as complete theatre-makers.

To this end, we have written the original touring musical, Gray Thunder, which centers on the historical figure of Mable Gray. In 1902, Gray became the first Official Fire Lookout in Western America (atop Bertha Hill, formerly known as Thunder Mountain, in Central Idaho). Mable Gray is an excellent subject for a historical musical because not much is known about her personal life. Thus, as writers we can fictionalize her relationships while addressing documented contextual facts about her life, creating a rich story to accompany the history lesson.

This medium offers an opportunity to encourage positive value structures, as students build empathy with the characters they see portrayed. In Gray Thunder and past work we introduce themes of kindness and compassion, anti-bullying, the value of nature, and what it means to be a family. Of particular note in Gray Thunder is the fact that the protagonist is a woman whose work was of considerable value in a culture dominated by men. It is important that young children of all gender identities hear stories from the past that are not simply from the male perspective.

Creating a historical musical requires months of research and constant collaboration, culminating in rehearsal and finally performance. Gray Thunder is about to begin rehearsals and will premiere on tour in Northern Idaho this winter.

This presentation will consist of a brief performance from the musical, accompanied by visual aids of the script in various stages of development, responses collected from students and teachers, and a vision for future TYA opportunities in the greater Missoula area.
Psychological Abuse in Romantic Relationships and Associated Mental Health Concerns

Author(s): Jessica Peatee
Faculty Mentor: Christine Fiore
Category: Social Sciences

Abstract / Artist Statement: Intimate partner violence (IPV) continues to be a prevalent health concern, as recent estimates from the National Intimate Partner and Sexual Violence Survey (NISVS) found that 37.3% of women and 30.9% of men in the United States have experienced sexual violence, physical violence, or stalking by an intimate partner at some point in their lifetime (Smith, Chen, Basile, Gilbert, Merrick, Patel, Walling, & Jain, 2017). While all forms of IPV surveyed occurred at strikingly high rates, the most common form of IPV likely to be experienced over the course of one’s lifetime was psychological aggression, with nearly half of all women (47.1%) and half of all men (47.3%) reporting having experienced at least one psychologically aggressive behavior by an intimate partner (Smith et al., 2017). Many researchers hypothesize that experiencing psychological abuse in a romantic relationship may be more common than experiencing other forms of IPV because psychological abuse often co-occurs with the presence of physical violence in a relationship and may be likely to occur on its own (Follingstad & Rogers, 2014; Hennings & Klesges, 2003). The experience of psychological abuse in a romantic partnership has been associated with problematic health concerns such as depression, anxiety, and somatic complaints (Rogers & Follingstad, 2014). Due to its high comorbidity with other forms of relationship violence, few empirical studies have examined the impact of psychological abuse alone (without co-occurring physical or sexual abuse) in a romantic relationship on an individual’s health. This presentation will summarize results from a recent study aimed at examining how psychological abuse alone in a romantic relationship was related to an individual’s current mental health symptoms (e.g., depression, anxiety, and posttraumatic stress) and how this relationship may differ from other experiences of relationship violence.

A sample of 331 college students attending a Northwestern university were invited to complete self-report measures in which they answered questions about their abuse experiences in their “most problematic” romantic relationships and described their current depression, anxiety, and posttraumatic stress symptoms. A comparison of rates of psychological abuse (88.5%), physical abuse (38%) and sexual abuse (44%) in this sample indicated that college students were more likely to endorse experiencing psychological abuse in their most problematic romantic relationship than other forms of IPV. Analysis of this sample revealed that those who experienced psychological abuse alone in their most problematic romantic relationship reported significantly greater symptoms of depression, anxiety, and posttraumatic stress than those who denied experiencing abuse in their most problematic romantic relationship, while those who experienced multiple forms of abuse (e.g., psychological abuse and physical/sexual abuse) reported the highest levels of mental health symptoms. This presentation will include a discussion of how these results evoke a need to develop and evaluate interventions that are sensitive to the experience of psychological abuse in an intimate partnership as a means of reducing problematic mental health concerns and/or reducing the likelihood of further victimization. Additionally, these results may be helpful in identifying individuals who would benefit from preventative or early intervention strategies.

Investigating the size, distribution, and associations of contaminants in the
Upper Clark Fork River, Montana

Author(s): Kaitlin Perkins, Manuel Montaño
Faculty Mentor: Ben Colman
Category: STEM (science, technology, engineering, mathematics)

Abstract / Artist Statement: Mine waste and the metal contaminants it releases are common globally and can have negative effects on aquatic ecosystems, resulting in decreased abundance and diversity of invertebrates and fish. Contaminants have historically been thought to enter aquatic food webs in the “dissolved” fraction, which is operationally defined as anything passing through a filter of a given size (e.g., 700 nm). However, this
definition of dissolved may be inaccurate for three reasons: 1) it lumps small particles in the 1 – 700 nm size range with truly dissolved solutes (< 1 nm); 2) for some elements, these submicron particles (colloids) may be their dominant form; and 3) work on manufactured particles in this size range has shown that organisms like algae and filter feeders can accumulate these colloids, and may thus colloids may drive exposure to the rest of the food web. For elements like iron, which may be found as colloids, the iron itself may not be toxic, but it can serve as a vector of other toxins by sorbing arsenic, copper, and lead and thereby indirectly drive their accumulation by organisms. The goal of this study was to examine the distribution of elements across the continuum of particle sizes in the mine waste contaminated Upper Clark Fork River, Montana. We collected water samples from twenty-two sites in the summer 2018 during base flow conditions, with sites distributed between the Clark Fork’s headwaters by Warm Springs to where the river enters Missoula. Samples were analyzed using single particle inductively coupled plasma time-of-flight mass spectrometry, which measures the elemental composition of individual particles, in this case in the 1-1000 nm size range. The most abundant particles that we observed were iron, followed by manganese, which had sizes in the lower end of the colloidal size range. Manganese, zinc, and copper were all commonly associated with iron particles, suggesting that iron may indeed be serving as a vector for these elements in this ecosystem. These data begin to illuminate the potential importance of submicron particles in both the transport of contaminants in mining contaminated rivers, as well as in driving exposure to organisms.

The Musical Collaboration of Tennessee Williams, Elia Kazan, Alex North in a Street Car Named Desire

Author(s): Peter Philips  
Faculty Mentor: Bernadette Sweeney  
Category: Visual & Performing Arts

Abstract / Artist Statement: In his Notebook Tennessee Williams wrote:

The experimental dramatist must find a method of presenting his passion in an articulate manner… my form is poetic [therefore]…a nonrealistic form must be chosen…[what] I call sculptural drama.

Sculptural drama, Williams’s hypothesis of “plastic theater,” implied the use of all stage resources, to generate a theatrical experience greater than realism. Only by using “other” transformative shapes could poetic imagination define truth, life, or reality.

My work aims to demonstrate music as a universal source of poetic truth. Williams, from his earliest writings, recognized the poetic expressionistic purity of music. Similar expressions are found in the philosophic writings of Schopenhauer, Nietzsche, Wagner. Through critical analysis of musical interludes in Williams’s plays and film adaptation, I demonstrate an ontological and aesthetic connection of Williams with these theoreticians.

For A Streetcar Named Desire and other Williams plays, scholar’s Nancy Tischler, Annette Davison, Brenda Murphy, C.W.E Bigsby and others have described the collaborative relationship between Williams, film director Elia Kazan, and music composer Alex North. A similar collaborative artistic philosophy of aesthetic artists remains undefined.

Alex North’s film score for Streetcar is considered a cinematic masterpiece. The collaborative team was familiar with New Orleans and the blues and jazz for which the city was famous. Williams had lived in the Vieux Carre frequenting many jazz clubs. Kazan filmed Panic in the Streets in New Orleans, North referred to jazz as “emotionally lowdown Basin Street blues—sad, glad, mad New Orleans jazz in terms of human beings.”

Kazan agreed with Williams choice of the blues as it relates to the protagonist Blanche’s “lonely abandoned soul.” In the film score, clarinet, drums, piano, and trumpet played arrangements of well-established standards. The blues/jazz music appeared to originate from the neighboring Four Duces bar, giving credence to scenic objectivity. The ghostly dance, the Varsouviana, played at the Blue Moon Casino the night Blanche’s husband died, was used for subjective effect, heard only by Blanche at moments of emotional crisis at mention of her late husband. Jazz elements emphasized a strong connection with Stanley, particularly in three scenes. Two
scenes suggested the importance of sex in Stanley and Stella’s relationship. The rape scene underscored the potential for sexual violence when desire is unrestrained by morality.

Tennessee William’s comprehension of the power of music is underscored by Alex North’s score which emphasizes William’s tragic and ambivalent characterizations of his protagonist anti-heroes. William’s anti-hero is embodied in Jungian psychology where the classic ideals of nobility, courage, and goodness are a priori within the individual collective unconscious. Schopenhauer sought to demonstrate the a priori nature of causality. Nietzsche termed music a primary expression of the essence of everything. Wagner’s Gesamtkunstwerk sought to unite the arts; music and fiction, dance and gesture. Williams included music to create atmosphere and define character throughout his entire literary canon. Is music, defined as “the purest form of art that embodied the Will itself,” the aesthetic philosophic connection of great artists?

Recreation Impacts: A Case Study of the Sawtooth Wilderness

Author(s): Chelsea Phillipe
Faculty Mentor: Elizabeth Metcalf
Category: Social Sciences

Abstract / Artist Statement: Outdoor recreation provides an opportunity for people to connect with nature, improve mental and physical health, and to support local economies. The Outdoor Industry Association reported 13.6 million recreationists in 2017 (1.3 million more than 2016) equating to nearly half of the US population participating in outdoor activities. Federal land managers utilize education, regulation, and law enforcement to protect our natural resources from negative impacts – including those from recreation and tourism. However, there is limited evidence about the effectiveness of these strategies (e.g. Leave No Trace) over long time frames. One area of particular concern is federally designated Wilderness where there is a tension between preservation and human use. By exploring emerging and existing trends in wilderness recreation federal land managers may better develop policy for sustainable tourism and recreation.

The Sawtooth Wilderness in central Idaho provides a unique case study to explore effectiveness of intervention strategies aimed at reducing negative recreation impacts. Record keeping from campsite monitoring, beginning in the 1990s, locates and measures recreation-related impacts on the ground. Twenty years of required wilderness permits, necessary for both day and overnight use, provides insight into user trends; where visitors go, how long they stay, and modes of travel. Supplementary educational reports from the Wildlands Education Plan, interviews with locals and education practitioners, along with educator numbers from the national Leave No Trace campaign provide insight into wilderness education efforts. The Theory of Planned Behavior guides this research to build a better appreciation of user trends, impacts, and education.

The Sawtooth Wilderness Case Study is timely as it focuses on a wilderness at a pivotal turning point in its management and regulation policies. Its location in central Idaho provides a buffered distance from high use and impacts, but as the surrounding communities grow, so do their impacts. In 2017 the United States Census Bureau announced Idaho as the fastest-growing state in the nation, while its capital Boise, was named Forbes Magazine No. 2 spot for young professionals. As new Boise residents discover unique opportunities to escape day-to-day stresses in the serene mountain landscapes of the Sawtooths their impacts will likely compound with existing users. Land managers are challenged to balance these recreation impacts while safeguarding wilderness to maintain pristine and wild conditions.

Preliminary data analysis suggests that use is concentrated in a few select campsite areas and that user trends have changed over the last few decades. Initial Key Informant interviews indicate that the Sawtooth Wildlands Education Plan has been successful in reducing recreation impacts including those at campsites.
Mapping Ideologies: Place Names in Glacier National Park

Author(s): Kaitlin Pipitone
Faculty Mentor: Leora Bar-el
Category: Social Sciences

Abstract / Artist Statement: The present-day place names of Glacier National Park largely reflect a history that excludes the long-time native residents of the region. This project aims to expose the language ideologies that emerge in documentary sources regarding current and historic place names of Glacier National Park. By examining various documentary sources through the theoretical lens of language ideologies, I propose that authors’ language ideologies are constructed through the three semiotic processes identified by Irvine & Gal (2000): iconization, fractal recursivity, and erasure.

Beyond their mere referential function of distinguishing one place from another, place names evoke a wide range of associations (Barber & Berdan 1998, Basso 1996). Though place names form a near-universal linguistic category (in that all communities name places), place-naming conventions vary cross-linguistically (Basso 1996; Burenhult and Levinson 2008). Different communities name topographic features in ways that reflect their own cultural values (Burenhult & Levinson 2008). Consequently, Indigenous and Euro-American place-naming traditions differ greatly from each other; it has been suggested Indigenous people rarely named places for people, as is commonplace in the Euro-American tradition (Afable & Beeler 1996, Barber & Berdan 1998, Cowell & Moss, Sr. 2003, Feipel 1925).

After outlining relevant circumstances surrounding the establishment of the park, I present data from a selection of documentary sources related to place names in Glacier National Park. In differentiating between place names and place-naming conventions, the authors' language ideologies, or “beliefs and attitudes about language” (Field & Kroskrity 2009: 4) including “beliefs about the superiority or inferiority of specific languages” (Field & Kroskrity 2009: 11), often seek to rationalize the choice of Euro-American place names over indigenous place names. Through iconization, a linguistic form becomes linked to the people who use it; through fractal recursivity, an opposition at one level (for example, a social level) may be projected onto a linguistic level; and through erasure, linguistic forms or the people who use them are rendered nonexistent when they do not conform with an individual's ideology (Irvine & Gal 2000).

The theoretical framework of Irvine & Gal (2000) succeeds in isolating these “beliefs and feelings about language” (Field & Kroskrity 2009: 4) and the processes that authors use to construct these beliefs and feelings. This research extends the application of Irvine and Gal's language ideology framework by providing the theoretical groundwork for approaching language ideologies as they emerge in place names studies. Specifically, this conceptual framework could serve as a means of identifying what ideologies motivated the official changing or creation of place names due to the establishment of national parks in the United States. As discussions about changing place names or restoring indigenous names happen regularly in both the national and local arena, this type of research could contextualize and impact these discussions by recognizing the motivations, attitudes, and effects of choosing one place name over another (Davis 2015, Gopnik 2015, Heygi 2018, Lessard 2015).

References


Ancient DNA Extraction and Analysis of Bone Samples from Orton Quarry Ossuary.

Author(s): Paige Plattner
Faculty Mentor: Meradeth Snow
Category: Social Sciences

Abstract / Artist Statement: The field of molecular anthropology, specifically the focus of ancient DNA analysis of human specimens, affords the opportunity to obtain background information and relationship of specimens and artifacts that may have been otherwise forgotten. The Orton Quarry (36ER243) site is an example of how genetic analysis can restore archeological context to otherwise disassociated remains. The Orton Quarry site is a Late Prehistoric mass grave of human remains along the coast of Lake Erie in Northeastern Pennsylvania. In March 1991, heavy-equipment operators accidentally exposed and destroyed approximately two-thirds of the original ossuary, leaving only the eastern third intact before archeologists arrived. In the time since the excavation very little has been published on the Orton Quarry site, its importance, or its original inhabitants. One of the primary objectives of this project is to expand upon the few publications of the site and add anthropological insight for the region. By extracting and analyzing the mitochondrial DNA using the Dabney et al. (2013) protocol, and the established standards for degraded DNA contamination avoidance, we have obtained valuable data on the site’s genetic ancestry. Ancient DNA from the seven samples was isolated and the whole mitogenome was sequenced. Haplogroups will be assigned and the resulting sequences compared to a relevant dataset from the surrounding region to gauge population relatedness and shared derived mutations, as seen in Pfeiffer et al. (2014). Despite the small sample size, comparing the data from these individuals through haplogroup and haplotype data from the Great Lakes region will prove to be valuable by establishing the maternal relationship between the individuals interned at the site, as well as with the region as a whole. This research has the potential to expand our knowledge of the Orton Quarry Ossuary, the genetic data for the Great Lakes region as well as grow our genetic understanding of ancient mitochondrial DNA in North America.
Depressive Symptoms and Protective Factors: A Qualitative Study of Native American Older Adults and Elderly

Author(s): Kristen Pyke
Faculty Mentor: Gyda Swaney
Category: Social Sciences

Abstract / Artist Statement: Literature Review. Research of depression in Native American older adults and elderly has been limited. The research that has been done has typically fallen into three domains: exploring the frequency of depression (Carleton et al., 2013), identifying or developing culturally competent measurement tools (Ackerson, Dick, Manson, & Beals, 2018), and determining the protective factors that reduce the effects of depressions. More specifically, Kaufman et al. (2013) found that spirituality was beneficial in reducing depression; however, this varied by tribe within their sample. Whitbeck et al. (2002) found that perceived social support among elderly Native Americans was a protective factor for the individuals displaying depressive symptoms. Method. This study is a secondary analysis of a qualitative data set of a larger community-based participatory research study which focused on stressors and coping in older adult and elderly Native Americans in the northwest (Wallace & Swaney, Resiliency in Native American Older Adults, 2006). This study examined 11 archival interviews (8 female and 3 male) with older adult and elderly Native Americans. The participants ranged in age from 50-79 years with a mean age of 62 years. The interviews were analyzed by a team of Native American researchers using a qualitative methodology, i.e., Grounded Theory. The analysis involved coding the interviews and identifying words and phrases that answered the four research questions. My research questions were: a) Do Native American older adults and elderly discuss symptoms of depression? b) If so, how do they discuss symptoms of depression? c) Additionally, if they report experiencing symptoms of depression do they report experiencing suicidal thoughts? d) If they report depressive symptoms, including suicidal thoughts, do they also identify any protective factors that may reduce the effects of depressive symptoms? Results. In this sample of NA older adults and elderly, the participants reported symptoms of depression including: depressed mood, fatigue, difficulty sleeping, suicidal ideation, trouble concentrating, and overeating. For example, the participants reported “feeling sad,” “feeling lonely,” and “crying for no reason,” which are indicative of a depressed mood. Participants also discussed having had thoughts of suicide and having made a suicide attempt. This sample of Native American older adults and elderly identified protective factors including: culture, family, friends, laughter, nature, spiritual beliefs, receiving and providing support, and values. Contextual events emerged as an important theme; participants reported attending boarding school, histories of sexual and physical abuse, divorce, and addictions. Discussion. We learned that these Native American participants described depressive symptoms that map right onto how the DSM-5 defines and described symptoms of depression. John (2004) reported that Native American populations may discuss more somatic symptoms of depression compared to the general population. Within this group of Native American participants, they discussed feeling down and having a depressed mood over more somatic symptoms. Chapleski et al. (2004) found that stressful life events have an impact on depression symptoms. The Native American participants within this study expressed how their stressful life events negatively impacted their mood. They discussed how their mood was impacted by their experience of stressful life events and how they utilized different protective factors to their advantage in overcoming their stressful life events.

Using RNA Sequencing to Observe Biased Agonism in PPAR&gamma;

Author(s): Mariah Rayl
Faculty Mentor: Travis Hughes
Category: STEM (science, technology, engineering, mathematics)

Abstract / Artist Statement: Diabetes currently affects 9.4% of the United States’ population, costing approximately $245 billion dollars both direct and indirect costs. Additionally, 33.9% of the population has prediabetes which can progress to diabetes without adequate preventative measures. Between 90% and 95% of the diabetes cases are specifically type two diabetes (T2D). A major hallmark of T2D is that it reduces the cellular response to insulin. Due to the increasing prevalence of T2D in the United States, medications such as rosiglitazone and pioglitazone have become increasingly important in order to manage the condition, but
like many other medications, they come with side effects. Ideally, the downstream effects of medication can be controlled by creating medications that have less side effects.

Rosiglitazone and pioglitazone are FDA approved drugs used for insulin sensitization in T2D and act through binding of peroxisome proliferator-activated receptor \( \gamma \) (PPAR\( \gamma \)). PPAR\( \gamma \) changes cellular transcription based on which type of drug binds to it. When agonists bind, PPAR\( \gamma \); activity increases and when antagonists bind, PPAR\( \gamma \); activity decreases. Unfortunately, PPAR\( \gamma \) affects a wide range of biological processes so drug treatment causes a wide range of side effects. These side effects include organ failure, weight gain, fluid retention, bone fractures, and more.

The classic model of PPAR\( \gamma \); implies that when PPAR\( \gamma \); is treated with an agonist, it recruits a coactivator protein thereby activating transcription, but when treated with an antagonist, PPAR\( \gamma \); recruits a corepressor protein thereby repressing transcription. More recent data indicates that slight structural changes in PPAR\( \gamma \); due to drug treatment affect the affinity for various coactivators in more ways than two, making the classic model inadequate. We propose a model of biased agonism in which differential recruitment of coactivators lead to differential sets of genes transcribed. If the gene sets can be determined and drugs can be designed to better select one gene set over another, side effects may be reduced or eliminated by exploiting a drug’s bias toward a certain gene set.

Because PPAR\( \gamma \); directly affects transcription, we developed an mRNA sequencing experiment in order to determine exactly which genes PPAR\( \gamma \); binding drugs affect in isolated human adipose cells. We observed that the drug GW1929 affects these cells differently than the drug rosiglitazone even though they are both agonists. GW1929 could be displaying biased agonism in that it preferentially recruits one coactivator over others and leads to a distinct transcriptional pattern that is not observed in the other drugs.

**Leveraging machine learning algorithms and remotely sensed data to inform timber harvest on Montana State Trust Lands**

**Author(s):** Ryan Rock  
**Faculty Mentor:** Anna Klene  
**Category:** STEM (science, technology, engineering, mathematics)

**Abstract / Artist Statement:** The Montana Department of Natural Resources (DNRC) sets harvest thresholds on state-owned forest lands using field data collected by technicians and contractors. Primarily, these thresholds rely on estimates of the size of trees (stand size class), the density of trees (total stocking density), and the dominant species (forest type). Collecting this data is expensive and time-consuming, especially when applied to all 780,000 acres of forested trust lands the DNRC manages. Remotely sensed data and machine learning algorithms offer an opportunity to reduce the amount of field data collected by predicting forest characteristics using spectral information. Random forest is a common machine learning algorithm that predicts outcomes based upon a set of training data. These results predict the category of class membership of a pixel and are compared to independent data to gauge the model’s success. In this case, field plot data collected in the summer of 2018 were used to train random forest algorithms to predicted forest characteristics for ~12,000 acres near the Stillwater State Forest, which was recently acquired by the state. Predictors for the random forest can be derived from aerial imagery, so several data sources were compared to see which predicted the most accurate results. A first set were derived from NAIP 2018 4-band (R, G, B, NIR) imagery at a resolution of 1 meter. Another set were derived from the European Space Agency’s Sentinel-2 satellite, which has 13 bands (3 of which are specifically designed to map vegetation) but at a coarser spatial resolution (10-20 m). Sentinel-2 also captures images approximately every 2 weeks, in contrast to the bi-annual NAIP collection. Several spectral data from Sentinel-2 will be used to build random forest models to discover which band combinations reduces classification errors. Using random forest models to estimate forest metrics is not a new approach, but it is a new process for the DNRC. If reliable estimates of harvest thresholds can be produced with minimal field data, the agency could eliminate the need to hire contractors for data collection, reducing costs and improving profits which supply state revenue. The final product of this study will not only...
inform forest management on the study area but will provide the MT DNRC with the tools to apply this method statewide.

Understanding the Factors that Influence University Environment: Gender Differences in Perceptions of Female and Male STEM Graduate Students.

Author(s): Rachel Schafer
Faculty Mentor: Dusten Hollist
Category: Social Sciences

Abstract / Artist Statement: Female students on college campuses outnumber male students, yet male students still outnumber female students in STEM related fields. This study compares differences between how male and female students perceive their university environment and the impact of cultural congruity, academic perceptions, faculty interactions, peer interactions and mentor interactions on their perceptions. This research examines those factors that influence how graduate students in STEM fields (science, technology, engineering, and math) perceive their university environment. University Environment is a scale measuring attitudes about the availability of campus services, the willingness of campus faculty and staff to provide assistance, the level of personalized attention received, and comfort levels on campus. Data for the project comes from a survey of 4,012 STEM graduate students from 13 universities. The findings inform current understanding about perceptions of female and male STEM graduate students.

Neurocognitive Test Scores on Athletes Diagnosed with ADHD and Their Return to Play Following Sport Related Concussion: A Systematic Review

Author(s): Nate Schieffert
Faculty Mentor: Valerie Moody
Category: Social Sciences

Abstract / Artist Statement: Context: Attention deficit hyperactivity disorder (ADHD) and sport related concussion (SRC) share many of the same symptoms which can be exacerbated when the two are combined together. There are currently no clinical guidelines in the treatment for concussed ADHD athletes. Current research has analyzed the comparison of neurocognitive test scores between ADHD and non-ADHD athletes. The objective of this review was to determine whether neurocognitive test scores can be used in the development of clinical guidelines when recovering from a SRC in an ADHD athletic population.

Methods: A comprehensive search of PubMed and SPORTDiscus was performed. Studies used were conducted up through October 31st, 2018. Studies were selected that examined neurocognitive test scores between ADHD and non-ADHD athletes. Keywords included concussion and ADHD or attention deficit hyperactivity disorder; concussion and learning disorder; mTBI and ADHD; Sport related concussion (SRC); Post concussive symptoms; Return to play (RTP) and ADHD.

Results: A total of 8 studies met the inclusion criteria. A total of 1,080 ADHD subjects and 5,712 non-ADHD subjects were included in this review. It was found that athletes with ADHD demonstrated lower neurocognitive test scores using the ImPACT (Immediate Post-Concussion Assessment Cognitive Test) when compared to non-ADHD athletes in all test categories at both baseline and post-injury. One study showed that ADHD athletes had an increased recovery time of an average of 3 days when compared to non-ADHD athletes (16.5 days to 13.5 days, respectively) in return to baseline neurocognitive test scores.

Conclusion: This systematic review suggests that ADHD subjects take longer to recover and demonstrate lower neurocognitive test scores both at baseline and post-injury. Normative values for neurocognitive test scores must be established for an ADHD population to better understand the impact of ADHD on post-concussion symptoms. The preliminary findings indicate that much yet has to be discovered in order to develop clinical guidelines for clinicians to follow with the diagnosis, rehabilitation, and return to play for ADHD athletes diagnosed with concussion.
Tree spatial patterns modulate peak snow accumulation and snow disappearance

Author(s): Eryn Schneider, Andrew Larson, David Affleck
Faculty Mentor: Andrew Larson
Category: STEM (science, technology, engineering, mathematics)

Abstract / Artist Statement: Forests and snow covered regions frequently co-occur across the northern hemisphere. In these environments, forests are structurally and spatially complex mosaics of tree neighborhoods that are intrinsically linked to ecosystem functions. Tree and canopy structures influence snow accumulation and disappearance processes through interception and radiation attenuation. However, it is unclear to what extent if spatial heterogeneity within the forest canopy induces heterogeneity in snow accumulation and persistence. Using a forest-based approach, we identified and tested the differential effects of within-forest neighborhoods on snow processes. Neighborhood types included individual ponderosa pine (Pinus ponderosa), Douglas-fir (Pseudotsuga menziesii) and western larch (Larix occidentalis) trees, tree clumps, openings, and regeneration patches. Neighborhoods were identified within a mixed-conifer forest and paired with intensive measurements of snow accumulation (density and depth) and persistence. Overall, neighborhood type and year had a significant effect on accumulation and snow disappearance. Openings were significantly different from clumps and individuals, always accumulating more snow. Openings retained snow significantly later than clumps but were not significantly different from individuals. Within the individual tree neighborhood, a nested species effect indicated no differences in accumulation but significant differences in disappearance between deciduous and evergreen conifers, with snow persisting longer beneath deciduous western larch. Our results suggest that canopy interception is the primary mechanism driving the accumulation phase, while snow disappearance patterns are a consequence of increased longwave radiation. Reducing canopy interception and longwave radiation by creating widely spaced single trees and small openings will increase snow depth and duration and thus water yield, while maintaining a heterogeneous canopy structure that includes tree clumps can be used to meet multiple objectives including diverse wildlife habitat, timing of green-up, and plant biodiversity.

Mano a mano en la lucha intergaláctica / Hand in Hand in the Intergalactic Fight: Braided Images in El Eternauta

Author(s): Abby Seethoff, Maria Bustos-Fernandez
Faculty Mentor: Maria Bustos Fernandez
Category: Humanities

Abstract / Artist Statement: El Eternauta, an Argentinian science fiction graphic novel written in the 1950s by Hector Germán Oesterheld and illustrated by Francisco Solano López, tells the story of a man named Juan Salvo who, along with his friends, must fight to survive a radioactive snow and an extraterrestrial invasion of Buenos Aires in the 1960s. Due to the increasingly political tone of the remake (1969) and sequel (1975) to El Eternauta, as well as the life path of Oesterheld, who joined the leftist militia los Montoneros and was disappeared by the Argentinian dictatorship, critical readings of this text often interpret the fictitious resistance to the alien invasion as a symbol of the radical insurrection of the 1970s (despite the possible anachronism of that timeline with regard to the first Eternauta). The focus on the author and the narrative has resulted in dearth of scholarship examining the tremendous work of Solano López. This project approaches the relationship between image and text by using Thierry Groenstein’s theory of braiding, which is a kind of visual motif that links a series of repeated images throughout a graphic novel. Each term in a series echoes the preceding ones, creating a citational effect that enriches the story with an additional layer of meaning. In El Eternauta, the braiding of various characters’ hands produces two visual theses: one, that hands, useful in life and a distinct loss in death, are a metonym for the body, a resource as fundamental to the resistance, solidarity and humanity as the mind; and two, hands are a way to understand our humanity as a link not only among ourselves but to all citizens of the universe.
Development and application of an in-situ alkalinity sensor

Author(s): Qipei Shangguan, Cory Beatty, Chun-ze Lai, Jim Beck, Reggie Spaulding, David Podrasky, Greg Leary
Faculty Mentor: Michael DeGrandpre
Category: STEM (science, technology, engineering, mathematics)

Abstract / Artist Statement: Total Alkalinity (AT) in aquatic environments is an extremely useful parameter in identifying and assessing both physical and biogeochemical processes, such as water mixing and dissolution/precipitation of calcium carbonate minerals. AT is also one of the most commonly measured parameters to characterize the inorganic carbon cycle. Determination of AT typically involves a titration where acid is added to a water sample and the resulting pH is measured using a pH electrode. Each analysis typically takes ~15 minutes or less. Large-scale research programs require large investment of capital and labor to produce enough AT data, which severely limits our observational ability.

Continuous AT monitoring from moorings, autonomous floats or other platforms can produce high-resolution AT data with reduced cost, time and manpower. SAMI-alk (Submersible Autonomous Moored Instrument for alkalinity) is a robust sensor, developed in our lab, which is capable of performing in-situ measurements hourly over a one month period. This sensor utilizes a novel tracer monitored titration method where a colorimetric pH indicator quantifies both pH and relative volumes of sample and titrant, circumventing the need for gravimetric and volumetric measurements. SAMI-alk can be now deployed in various aquatic environments (ocean, river, etc) through adjusting the ionic strength of the titrant.

The SAMI-alk was mounted on a buoy from June 3-22, 2013 on the northeast coast of Oahu, Hawaii. A total of 340 SAMI-alk measurements were made during this period. These AT data, which displayed strong diel cycles with high temporal resolution, greatly improved our understanding of the dynamics of coral productivity (published in Environ. Sci. Technol., 2014, 48 (16), pp 9573–9581). The SAMI-alk was also deployed in the Clark Fork River at Galen Rd, Montana from October 26 to November 05, 2017. A total of 115 measurements were made (unpublished data), which revealed that riverine AT had strong correlations with conductivity. More quality assessment of these data is ongoing.

Our current work focuses on extending the deployment length, which primarily includes testing of titrant stability, reduction in size and reagent consumption, and improvement on long-term measurement reproducibility. As SAMI-alk becomes more available to researchers in related fields, it will advance our knowledge of AT variability and anthropogenic effects on our natural environment.

Tracing Narratives: Biographies of Niitsitapi Moccasins

Author(s): Michaela Shifley
Faculty Mentor: Kelly Dixon
Category: Social Sciences

Abstract / Artist Statement: Footwear is a part of the human experience. Shoes, and moccasins more specifically, at their fundamental level, are about the relationships that form between humans and the ground that they walk on. They are representative of how humans move and interact with and within the world, and thus, moccasins’ study is critical to moving us towards an understanding of our relationships with each other and the world around us. Currently, there is more Plains Indian footwear in museum collections across the world than any other Plains Indian artifact. Yet, despite their overwhelming commonness in museum collections, as well as the significant cultural importance of footwear in general, no systematic, museum-based, object-centered anthropological investigation of Plains Indian moccasins has ever been conducted.

Past studies of Native American moccasins have focused almost exclusively on the distribution of styles and designs across the United States, and have limited objects to being simply markers of traditions, rather than considering that careful examinations of their materials could empower the artifacts to speak for themselves. None of these previous studies have considered economic or environmental influences as possible contributing factors to moccasin production, nor do many of them address wider analytical concepts, such as
ideology or trader-Indian relations. In effect, moccasins have been fitted into pre-existing theories, but have never been mobilized through research to tell their own stories and therefore, to be catalysts for much-needed new theoretical frameworks that could give insight into how Plains Indians valued and understood these objects. My research aims to rectify this silence surrounding Northern Plains moccasins in the anthropological literature by utilizing the museum collections of six institutions to investigate how Niitsitapi (Blackfoot Confederacy) moccasins’ biographies have been shaped by the interactions of people, places, materials, and environments.

Because Indigenous concerns are inherently of anthropological concern, this dissertation relies on theoretical discourses that emphasize Indigenous understandings of the world. Through ethnographic interviews with contemporary Niitsitapi artists, businesspeople, and knowledge-holders, this work provides an opportunity for anthropology to incorporate Niitsitapi expertise and traditional knowledge into its understandings of material culture, and may provide an avenue for forming cross-cultural, interdisciplinary partnerships that can contribute to understandings of the roles moccasins played – and continue to play – in everyday Niitsitpai life. I use the object biography and the chaînes opératoires(or “operational sequences”) approaches, which are anthropological methods that both emphasize ‘helping objects to speak’ by following their biographies, a theory that has yet to be applied to Plains Indian material culture. These frames will highlight Blackfoot constructs of value by helping the researcher to hear the stories that moccasins have to tell. These methods will be supplemented by interrogating other lines of evidence, such as archival materials (e.g. photos, trade records and inventories) and museum collections records.

In asking and investigating these questions, my research will inform discussions of Plains Indian material culture and economic change on the North American Plains, as well as contribute new theoretical insights to the field of anthropology and beyond.

**Associations between meaningful activity and social closeness with well-being for persons with disabilities**

**Author(s):** Ari Silverman, Jennifer Waltz, Bryce Ward, Craig Ravesloot  
**Faculty Mentor:** Jennifer Waltz  
**Category:** Social Sciences

**Abstract / Artist Statement:** Persons with disabilities (PWD) experience high rates of physical and mental challenges, high levels of depression and suicidality, and are considered a health disparity population. PWD often lack opportunities to fully participate in meaningful experiences in their communities, resulting in feelings of social isolation or loneliness. Improving well-being is paramount to enhancing the health status of PWD. Two approaches that have demonstrated promise in increasing long-term well-being in the general population are 1) engagement in meaningful activity and 2) experiences of social closeness. This study examined whether these two approaches were associated with greater immediate well-being for PWD and those without disabilities.

Meaningful activities have been defined as subjective experiences that provide an opportunity for completion of important tasks, and foster a sense of feeling valued, in-control, and socially connected with others. To understand the role of meaningful activity in well-being, we asked the question: is participation in meaningful activities associated with greater well-being? Social closeness is a person’s perception of their degree of embeddedness in a social network. We analyzed the link between social closeness and well-being by asking the question: is participation in activities with socially close others (operationalized as family members, household members, or friends) associated with greater well-being? Finally, we ascertained what particular activities and which types of relationships were related with the greatest happiness and meaning.

To answer our questions, we used data from the 2010, 2012, and 2013 Well-Being Module of the American Time Use Survey (ATUS) conducted by the Bureau of Labor Statistics. Data were collected using a version of the Daily Reconstruction Method, which demonstrates strong validity for determining variations in affective state during the course of a normal day. Participants (PWD = 4,079, persons without disabilities = 30,486) included a large and representative sample of the non-institutionalized U.S. population age 15+. Predictor
variables were the meaningfulness of the activity and the presence of various types of relationship categories during the activity. Outcome variables were assessed by a 7-point likert scale, and included 1) happiness and 2) the average of the negative well-being scales of pain, sadness, stress, and fatigue. Meaningfulness was used as an outcome variable to determine which relationships and activities were most meaningful.

To our knowledge, this study is the first of its kind to demonstrate that meaningful activities are associated with greater immediate happiness and less negative well-being for PWD and persons without disabilities. PWD especially benefit from activities that foster a sense of mastery, such as household activities, and that strengthen self-efficacy, such as participation in government services and civic obligations. Importantly, our findings are the first to indicate the value of being with socially close others regardless of the extent of interpersonal interaction. Merely being in the presence of socially close others is associated with greater immediate happiness.

Our findings highlight the utility of incorporating ample opportunities for social closeness and meaningful activities that allow for mastery and self-efficacy in interventions aimed at improving well-being for PWD. Increasing daily experiences of social closeness and meaning may result in improved health outcomes and greater quality of life for this marginalized population.

Language Education and Intangible Heritage: The Dangers of Cultural Incompetence

Author(s): Rebekah Skoog
Faculty Mentor: G.G. Weix
Category: Social Sciences

Abstract / Artist Statement: The discussion surrounding heritage management: who should regulate what is considered heritage and what isn’t, has been a growing discussion in the field of Anthropology and academia. As the awareness of our colonial past becomes more evident in what has and has not been preserved, Harrison, Brown, and Fairclough tackle the socio-political conflicts surrounding heritage sites and museums. While these scholars direct the conversation from local, to state, and international policies and protocols, they also focus the discussion on the legal, political, and socio-economic arena. That being said, heritage management can deal in the the tangible and intangible. Intangibility of heritage, are the aspects of knowledge and skills that can be transmitted through generations. As such, in American culture, institutionalized education can be a type of museum for intangible heritage. This begs the question: are teachers a kind of heritage manager that should be under more scrutiny? As language is a form of intangible heritage, and language teachers aim to bring their students to an understanding of another culture, education and language learning could be an important unexplored role in the public’s understanding of heritage. Moreover, the American Council for Teachers of Foreign Language (ACTFL) has been encouraging teachers to bring intercultural competency, into the classroom, for the last decade. Additionally, in the United States there is a push to keep students engaged in the classroom which can emulate what Harrison might call the “disneyland” effect on heritage or a type of touristic, experiential interaction with heritage. The question then is has this focus on engagement and push for intercultural competency caused a misrepresentation of culture? If so, how might this actually be a detriment to what one understands of another culture? Using perspectives on pragmatism from Noriko Ishihara and on worldview and teacher bias from Marianne Celce-Murcia, this paper argues that through the same assumptions that lead to universal heritage and heritage tourism, the language classroom can simplify intangible cultural heritage in a way that can be counterproductive to understanding another culture.
Tribal Water Rights and Water Conflicts in Montana

Author(s): Kristin Sleeper  
Faculty Mentor: Brian Chaffin  
Category: STEM (science, technology, engineering, mathematics)

Abstract / Artist Statement: Access to water defines the arid American West and water management is an explicit effort to balance competing water uses. Differing water uses highlights the complexities in water management, and water conflicts will only increase as the climate continues to change. In Montana, the potential for decreasing mountain snowpack and thus less reliable irrigation capacity and river flows during the late summer months could have devastating economic, environmental, and cultural consequences. The need for water rights holders to have certainty about the quantities of water that will be legally available from year-to-year is clear. However, to have certainty, tribal and non-tribal, state-based water rights need to be integrated to ensure administration and enforcement are accurate and equitable.

Tribal water rights are rooted in indigenous sovereignty as well as treaties between Indian Tribes and the U.S. federal government. The case of Winters v. United States (1908) formally recognized tribal water rights, where the Supreme Court ruled that when the federal government set aside land for the Fort Belknap Indian Reservation, it impliedly reserved sufficient water from the Milk River to fulfill the purpose of the reservation. Tribal water rights, which are federal reserved rights, sit in tension with the basic principles of western water law. The legal doctrine of prior appropriation defines state-based water rights, where first in time is first in right, and the date of initial water use determines the superior right.

In 1979 Montana began a general stream adjudication to quantify all water rights, which ignited conflict and management impasses from both Tribes and existing non-tribal, state-based water rights holders due to the clash of appropriated rights, federal reserved rights, and values for water use. The state established the Reserved Water Rights Compact Commission to negotiate Tribal water rights and avoid the looming threat of litigation. However, despite the success of the commission, current research and judicial opinions suggest that difficult and persistent questions remain regarding how to quantify tribal water rights and how to integrate tribal compact rights and non-tribal, state-based water rights.

To assess where the current water governance system breaks down and leaves questions related to the integration of tribal compact rights and state-based water rights, this presentation will summarize the findings from a series of key informant interviews conducted with tribal lawyers, state administrators, legislators, lobbyists, hydrologists, landowners, and irrigators from across Montana. In addition, this presentation will describe recommendations for policymakers about the best ways to address water conflicts going forward. The results of this work are relevant to water users, the State of Montana’s Water Policy Interim Committee, as well as to Tribal Nations facing similar situations in Montana and beyond.

Learning from Stone: Using Lithic Artifacts to Explore the Transmission of Culture at Bridge River, British Columbia

Author(s): Anne Smyrl  
Faculty Mentor: Anna Prentiss  
Category: Social Sciences

Abstract / Artist Statement: Inherent in all tool-making traditions is the necessity of passing along required knowledge, both technological and cultural. This is an uncontroversial statement, but a difficult premise to study archaeologically due to the intangibility of the transmission process. Lithic, or stone, tools provide a useful angle from which to approach cultural transmission, as they leave distinct archaeological traces and require specific cultural knowledge to produce. The Bridge River site, a mostly pre-contact pithouse village in British Columbia, has yielded a collection of stone projectile points, which range from expertly crafted to crude and unfinished. Using these projectile points, this project seeks to piece together the process by which novice toolmakers were taught to knap.
Using the existing literature surrounding the process of learning to knap, a series of diagnostic qualities of novice lithic artifacts can be drawn up and established. Based on technological traits, these diagnostics can be applied to any lithic assemblage as a starting point for determining the possible presence of novice knappers. The Bridge River assemblage yielded several projectile points with several hallmarks of inexperienced crafters, as well as a larger number of points lacking those hallmarks, suggesting that crafters of multiple skill levels knapped together. The assemblage was then put into a larger context by comparing it to ethnographic depictions of the St’at’imc, who built the village and lived there until its abandonment in the fur trade era, and by looking at the broader literature of craft learning. From these lines of evidence, a theory of social cultural transmission is being built, one which suggests an informal, perhaps observation-based method of learning to knap, rather than a structured apprenticeship or classroom system.

The Bridge River project as a whole has focused on large-scale issues of temporal cultural change and population shifts. By focusing on individual instances of cultural transmission, this analysis brings a different angle to the project as a whole. Although this is not the first analysis of this type done, the study of craft learning through artifact analysis is still relatively small, and this study is the first of its kind on the Bridge River assemblage. Furthermore, this study draws from ideas of locating the individual within the archaeological record and of considering the intangible qualities of culture when analyzing archaeological sites and data. The past was lived just as holistically as the present, and this project is part of an emerging push to use the past’s recoverable data to hypothesize about its intangible – and therefore unrecoverable – components.

Exploring knowledge in periods of drought: Understanding how producers use, exchange, and regard local and expert knowledge

Author(s): Adam Snitker
Faculty Mentor: Laurie Yung
Category: Social Sciences

Abstract / Artist Statement: Scientists from universities, government agencies, and private industries research to find new information, products, and practices that support agriculture production. Often, institutionally sponsored knowledge, also known as expert knowledge, is crafted to be universally implemented into any operation. Meanwhile, farmers and ranchers draw on experiences on their own farms and ranches, often referred to as local knowledge, to inform current agricultural decisions (Kloppenburg, 1991; Lyon et al., 2011; Goulet, 2013). Expert knowledge positions agriculture producers as recipients of knowledge, meanwhile, local knowledge identifies producers as knowledge generators (Kloppenburg, 1991, Hassenein, 1999). In periods of increasing climate variability, relevant and useful knowledge can be critical to developing a resilient agricultural operation. The 2017 Montana Climate Assessment suggests that drought like conditions may occur more frequently in the future, which could be challenging for Montana farmers and ranchers. Therefore, Montana agriculture producers will need to develop new strategies, generate new knowledge, and adapt to changing conditions. This study attempts to understand how expert and local knowledges are used, exchanged, and perceived by Montana agricultural producers in periods of drought. To investigate this question, five focus groups composed of Montana agricultural producers were conducted in different communities across the state. A purposive sample was developed to include diverse operation types: dryland farms, irrigated farms, and ranches. Thirty-four individuals participated in the focus groups. Participants were asked about what information they used to make decisions in periods of drought, where they receive such information, and how they perceive that information. A qualitative analysis, where the researcher identifies common themes in the data to understand similar and different perspectives across all groups, has been adopted for this study. While there has been extensive literature detailing use and perception of different types of knowledge relevant to agriculture, there is little or no research that attempts to understand what types of knowledge are useful and how those different types of knowledge are perceived by Montana agriculture producers in periods of drought. Potential benefits of this study could include action by agricultural institutions, such as universities, government agencies, and private industries, to adjust their research to better align with the information identified by agriculture producers as useful. Additionally, non-research public service organizations, such as the Natural Resources Conservation Service, Extension Service, and United States
Department of Agriculture, can evaluate and organize existing programs to better support the generation and exchange of useful knowledge as identified by agriculture producers.

**Sister Cities**

**Author(s):** Alyson Spery  
**Faculty Mentor:** Michael Murphy  
**Category:** Visual & Performing Arts

**Abstract / Artist Statement:** In the early ‘90s, a man from Tlaxcala, Mexico traveled to a Wyoming dude ranch for work. Though he followed a long lineage of migratory workers, he marked the first Tlaxcalan to arrive in Jackson Hole. But he was not the last.

Today, 30% of residents in Teton County, Wyoming are of Mexican descent, and the majority of them hail from Tlaxcala state. While the Teton County School District reports over 40% of their students speak Spanish as their first language, general enrollment at the primary school in San Simeon, Tlaxcala has dropped in half. Meanwhile, all around Tlaxcala, the construction of new homes (built with money made in the US) marks the promise to return to Mexico.

Although we are a country founded by immigrants, Americans talk about immigration (especially from Mexico) with a growing sense of fear: the fear of “criminals”, “rapists”, and “drug dealers”. Americans must get to know their Mexican neighbors. We need to see each other, eye to eye.

With a team of filmmakers and educators, our grassroots organization (Eye to Eye Media) will teach documentary storytelling skills through instruction and mentorship so these communities can take cameras in their own hands in order to tell their own stories, through their own lens. Spanning more than two years, our flagship community media project entitled Sister Cities, will produce a canon of films from Mexicans living on both sides of the border by spending one year, on location, in each place: Jackson Hole, WY and Tlaxcala, MX. This two-year project culminates with screenings in both countries as well as a web-based platform to host the entire collection.

No documentary on immigration is as ambitious or as authentic as Sister Cities because these films are not about, but by the immigrants themselves. And now, more than ever, we need to hear these stories. As racial tensions heighten in the US over immigration, Sister Cities provides an avenue for a vulnerable population to take ownership over their own representation. Each story contributes to creating a multi-faceted (and multi-faced) narrative about the immigrant experience in America today.

Sample narratives include the Garcia family, who work in Jackson so they can afford to build a house in Mexico. Now that it’s built, they must decide between renting and raising their four children in Jackson or returning to Mexico for good. Though the kids were born in the US, their parents, once they cross the US border, can never go back to the place they’ve called home for almost 20 years. Then there is Ivan who has never felt the sense of belonging to any specific place. He emigrated at nine years old with his parents, and although he has US residency, he will never visit Mexico. Since his family in Tlaxcala lives like their above the law, the danger is too great for him to return even to see his last living grandparent. Back in San Simeon, the elderly doña Maria is supported by the remittances from her four children who all live in Jackson. Without their financial support she would be homeless, yet without their physical support she is left to care for herself by herself. These are just a few of the stories from the sister cities.

Since studying documentary filmmaking, I spent the past two years producing immigration stories driven by the participants themselves: from Renga for the West (premiered at 2018 Big Sky Documentary Film Festival) and Bon Polis: Immigration Lovestories (currently in production). Through these experiences, I learned the importance of owning and directing your own story, especially for otherwise underrepresented people. In October of 2018, I visited Tlaxcala to successfully garner the support of the local community in San Simeon to launch the second phase of this project in 2020. Currently, in Jackson, I am establishing local partnerships and recruiting participants to launch production in May of 2019.
The real humanitarian crisis at our border is the loss of humanity. We no longer see the people entering the US as anyone like us. Many contemporary documentary films address this issue, but none allow the subjects to direct the films themselves. If Americans want to understand immigration, we need to see it through the perspective of those that experience it. Films are our most powerful communication tool. By compiling compelling stories into self-directed films, Sister Cities reshapes the public narrative so we begin to see each other eye to eye.

An investigation into wheat's vulnerability in the western U.S.

Author(s): Brian Stampe
Faculty Mentor: Marco Maneta
Category: STEM (science, technology, engineering, mathematics)

Abstract / Artist Statement: As both world population grows and diets change, global food demand is expected to double by 2050. However, as regional climates shift, changes in average weather conditions will likely have significant consequences for croplands. Thus constraining the impact the climate has on croplands is an essential task of the 21st century.

Heat and drought metrics have already been correlated with county level wheat yield data and suggest vulnerabilities to both high temperatures and lack of rainfall. Mechanistic models also suggest vulnerabilities to lack of moisture and high temperatures. Most of the empirical studies utilize county or larger scaled data. However, field scale yield data is becoming more popular because of potential spatial heterogeneity across county scales. A likely trade off is that it may be harder to extrapolate to larger (i.e. country, continental, or global) scales. Here, we utilize a remote sensing metric, Normalized Difference Vegetation Index (in lieu of yield data), which quantifies how much green light the satellite receives. We use Landsat’s 30m resolution, thereby keeping similar resolution to field scale studies but being able to sample anywhere across the globe. We hypothesize that wheat in the 21st century grown in the western U.S. is primarily constrained by lack of water, both the supply and demand. And as such, we utilize metrics such as vapor pressure deficit and cumulative dry days to pull out more nuanced effects weather may have on wheat’s greenness. Furthermore, we hypothesize that not all wheat growing regions will have the same sensitivity to changes in meteorological variables. Thus, we utilize a self organizing map and k means approach to cluster agro-climatological regions and compare their relative meteorological sensitives. We find that North Eastern North Dakota is rather resilient to changes in water supply and demand and that Eastern Montana is much more vulnerable. We also find that areas with lots of irrigation (i.e. Western WA, South East Idaho) are somewhat buffered from drought, but by no means completely. These findings can offer nuance to discussions on farmer adaptation, water resource planning, and help further constrain mechanistic crop models.

State Sanctioned Cultural Heritage and Maya Self-Determination

Author(s): Rachel Steffen
Faculty Mentor: John Douglas
Category: Social Sciences

Abstract / Artist Statement: As a diverse young nation, postcolonial Belize has been forging its national identity to ensure unity amongst its multi-ethnic citizenry. Belize uses and commodifies Maya heritage as a tool for mobilizing a shared national identity and increasing their economic prosperity through tourism. This has caused the state to create cultural resource management laws and practices that have placed limitations on the indigenous Maya population’s access to the archaeological sites of their ancestors. The Maya are often seen only as citizens of the state, and not as those belonging to sovereign entity. Due to this, Maya peoples have to pay to access their own pre-Columbian cultural heritage sites, just like anyone else, as all archaeological sites are property of the government. Fueled by the burgeoning global economy of heritage tourism the question of indigenous ownership of ancestral sites is complicated by the massive amount of foreign exchange flowing into the country because of those sites. Examining a case study from the southern
Toledo district, shows that Maya populations are challenging the state for the right own and freely access their archaeological sites. This case study engages the complexity of issues of when indigenous heritage clashes with national identity and interests. The outcome has the possibility of changing heritage management practices in Belize.

**Participating in the Organization Narrative: An Examination of Myth in ACLU Membership Emails**

**Author(s):** Katjana Stutzer  
**Faculty Mentor:** Joel Iverson  
**Category:** Social Sciences

**Abstract / Artist Statement:** After the 2016 presidential election, the American Civil Liberties Union (ACLU) was among a number of advocacy focused nonprofit organizations that experienced a surge in donations. Nonprofit advocacy organizations play an important role in informing and engaging the public, and setting agendas for what issues become prominent and are deemed important in American public life. From its position as a powerful and well-established organization, analyzing how the ACLU communicates to members about the civil liberties conflicts within the current administration is a fruitful exploration of potentially effective organizational communication, as well as an important insight into a key political influencer in the United States. It was found that ACLU email communications to members function persuasively because they are consistent with the overarching hero myth narrative of the organization.

The literature demonstrates that narratives are key components of communication. According to the narrative paradigm, humans understand reality through communicating stories that make sense to them and support their experiences. Organizations also use stories to similarly understand and communicate their work. The most persuasive stories are those that ring true to most people. Myths are stories that follow accepted archetypal structures that almost everyone is familiar with (e.g., good wins over evil, hard work pays off). A narrative analysis of the plot, characters, and settings was used to analyze eleven ACLU emails sent to members in regards to the Justice Kavanaugh confirmation hearings and contrasted with the “About” section of the ACLU website. It was found that in both the “About” information and the set of emails the ACLU uses the hero myth, where the organization is engaged in a just battle for what is good, in this case liberty and freedom. It was found that the emails engage members by persuasively inviting them to cast themselves as characters in the hero myth along side the organization and take action offline (by donating money or calling their elected officials) in the same way that their characters jump into the excitement of the fight. ACLU member emails persuaded supporters to view their action as meaningful through inviting them to see themselves in the hero myth.

This research helps to fill a gap in the organization communication literature regarding narratives used externally in member communications. Not only is a narrative analysis a unique approach when applied to external communications, but it also provides a deeper understanding of how organizational narratives can function persuasively. This research also helps to provide more information about the communication strategies of ACLU and similar organizations, which are also underrepresented in the literature. Advocacy nonprofits in general but especially the ACLU play a powerful role in American politics and public life. So notably, the way they frame issues has a broader impact on public understanding of current events. The ACLU reinforces broad cultural narratives, like the hero myth, by drawing on those stories in their member communications, contributing to the understanding of issues of justice and the legal system as a battle scene or a fight, or a struggle between good and evil. This analysis is important because the ACLU is an influential actor in communicating the stories that citizens believe, both in the sense of myths and current events.
A Novel Method of Measuring ENM Induced Lipid Disruption in Macrophages and Model Membranes Systems

Author(s): Matthew Sydor, Donald Anderson, Harmen Steele, J.B. Alexander Ross
Faculty Mentor: Andrij Holian
Category: STEM (science, technology, engineering, mathematics)

Abstract / Artist Statement: The expanded use of nanotechnology has led to increased production and use of engineered nanomaterials (ENM), resulting in an increased risk of human exposure. Human exposure to ENM has the potential to cause chronic inflammatory diseases. ENM generated occupationally can be airborne and are taken-up by immune cells (macrophages) in the lung, where the ENM accumulate in phagolysosome organelles. Some ENM have been shown to cause damage to phagolysosomes, resulting in phagolysosomal membrane permeability (LMP). LMP leads to the release of degradative enzymes into the cytosol, leading to release of inflammatory cytokines and cell death. This suggests that ENM may interact directly with the lipid membrane of the phagolysosomes, disrupting their normal state, resulting in LMP. The way in which various ENM disrupt lipid membranes, is not fully understood. Time-resolved fluorescence anisotropy measurements, using suitable lipid probes, can measure changes in membrane characteristics, such as lipid order (Lo) and disorder (Ld). Additionally, macrophage-like THP-1 cells, which stably express a YFP-ASC protein can be used to determine inflammasome formation, an immediate downstream event of LMP leading to inflammation. In this work, THP-1 cells and 100 nm liposomes made of POPC (1-palmitoyl-2-oleoyl-glycero-3-phosphocholine) and DOPS (1,2-dioleoyl-sn-glycero-3-phospho-L-serine) were used as model systems determine interaction with ENM. Both models were exposed to 12.5 to 100 µg/ml of titanium dioxide (TiO2), zinc oxide (ZnO) nanospheres. Fluorescence membrane probe Di-4-ANEPPDHQ and a time-resolved fluorometer were used to determine the changes in lipid Lo/Ld of the liposomes. Inflammasome formation (measured as visable specks in THP-1 cells) were quantified using a laser scanning cytometer. THP-1 cells exposed to 100 µg/ml TiO2 for 4 hr had a significant increase (11%) in speck formation. There was no significant continued increase in speck formation at 100 µg/ml TiO2 between 4 and 24 hr. After 24 h the 50 µg/ml dose of TiO2 increased to nearly the same level as the 4 hr 100 µg/ml. ZnO (a more toxic ENM) exposed THP-1 had a significant increase in speck formation at 50 µg/ml after 4 hr (14%) and at 25 and 50 µg/ml after 24 hr, 25% and 45%, respectively. While both TiO2 and ZnO seemed to cause inflammasome formation, resulting from LMP, ZnO was confirmed to be more potent than TiO2. POPC liposomes exposed to 100 µg/ml TiO2 had a decrease in lipid order, but no significant change was observed using DOPS liposomes. ZnO exposure (100 µg/ml) to DOPS liposomes also showed a decrease in lipid order, but again there was no change using POPC liposomes. These results indicate that while both materials may be disrupting lipid membranes, the target lipids are different.

Aggressive Osteoblastoma of the Acetabulum in an 18-Year-Old Female Volleyball Player

Author(s): Tayleigh Talmadge
Faculty Mentor: Valerie Moody
Category: Social Sciences

Abstract / Artist Statement: Background: The subject was an 18-year-old female volleyball player with an osteoblastoma of the acetabulum of the hip. She had a chief complaint of deep, aching pain from her outer right hip to upper groin. Despite conservative treatment, the frequency and severity of pain progressively worsened over the course of a year and a half. The subject’s primary care provider believed her pain was caused by a stress fracture in the lower spine, so further imaging was requested.

Differential Diagnosis: Differential diagnoses for the subject’s hip pain include a labral tear, femoroacetabular impingement, dysplasia, athletic pubalgia, acetabular fracture, hernia, soft tissue involvement.

Treatment: The radiologist discovered a 4.8x2.4x4.2 cm lesion in the medial right acetabulum, with internal high attenuation foci suggestive of calcium or chondroid matrix with abnormally increased radiotracer uptake. The lesion had completely eroded through the acetabulum, leaving the patient at risk for pathologic fracture.
The subject underwent three biopsies, one drill biopsy and two open biopsies. Following the second open biopsy, the osteoblastoma was labeled as benign. The subject underwent a surgical resection and open reduction internal fixation (ORIF) to remove the osteoblastoma from her acetabulum. The athlete’s rehabilitation protocol has been guided largely by existing protocols from hip labral repair and ACL-reconstruction. Due to the uniqueness of the case, her surgeon did not have a predicted time for her to return to play.

Uniqueness: Osteoblastomas represent about 0.8% of all bone tumors and are more commonly seen in male adolescents. Osteoblastomas in the region of the hip are extremely rare, accounting for 3-8.8% of all osteoblastomas, especially an aggressive osteoblastoma of the acetabulum. The physical presentation of an aggressive osteoblastoma of the hip includes limited ROM, chronic pain, night pain, radiating pain, pain aggravated by weight bearing or walking, and pain alleviated by analgesic drugs. The clinical findings of an osteoblastoma may present similarly to other sport-related injuries, but a non-specific mechanism of injury is a red flag for clinicians to note. There is no specific osteoblastoma rehabilitation protocol, so the clinician is challenged to develop an individualized plan of care for the patient. However, literature infers that rehabilitation should be guided according to an acetabular fracture. There is no developed patient-rated outcome (PRO) for individuals following a surgical resection and ORIF, so clinicians should utilize a general hip PRO to track patient progress throughout rehabilitation.

Conclusion: An aggressive osteoblastoma of the acetabulum is a rare, unlikely pathology to encounter in a young, active population. It is important that clinicians working with this population recognize the signs and symptoms of an osteoblastoma, so they know when to refer for further evaluation. Diagnosing any hip pathology, whether it be sport-related or non-sport-related, requires a thorough patient history and objective assessment. For athletes suffering of worsening hip pain despite conservative treatment, an osteoblastoma should be treated as a differential diagnosis. Since current literature is lacking in return-to-play outcomes following a surgical resection of an aggressive osteoblastoma, the clinician is responsible for developing an individualized plan of care for an athlete.

Investigating the Use of Environmental Chemical Tracer Concentrations to Reduce the Uncertainty of Modeled Groundwater Flow and Transport in a Fractured Rock System

Author(s): Nicholas Thiros
Faculty Mentor: Payton Gardner
Category: STEM (science, technology, engineering, mathematics)

Abstract / Artist Statement: Groundwater flow and transport within fractured rock systems has important implications for evaluating available subsurface water resources, the design of nuclear waste disposal systems, and identifying the role of groundwater in mountainous regions. The relative amount of water moving through a fractured zone compared to the surrounding rock matrix is often unknown. A principal uncertainty in simulating groundwater flow and solute transport within fractured rock is the characterization and explicit expression of the effective fracture parameters. Hydrogeologists have extensively utilized ‘apparent’ groundwater mean ages derived from environmental chemical tracer data to constrain subsurface flow and transport models. However, deriving a groundwater mean age from environmental tracer concentrations is ambiguous and uncertain. In this study we develop a 3D groundwater flow and solute transport simulation of the Bedrichov Tunnel in the Czech Republic to directly investigate the utility in utilizing environmental tracer concentrations, rather than inferred groundwater mean age, to constrain estimates of effective fractured rock parameters. The Bedrichov Tunnel simulation is on a portion of the tunnel that contains a single major fracture that has associated fracture discharge, stable isotope, and tritium measurements that span multiple years. Fracture and distributed tunnel discharge measurements, apparent ages of fracture discharge derived from environmental tracers, and the multiple environmental tracer concentrations are used to constrain the range of effective fracture and solid matrix parameters that control flow and transport to the Bedrichov Tunnel. We investigate the differences in estimated effective fracture parameter uncertainties when using environmental tracer concentrations and mean groundwater age to separately constrain the Bedrichov Tunnel groundwater
flow and solute transport model. It is hypothesized that higher parameter uncertainties will be associated when groundwater age is utilized due to the bias and uncertainties associated with inferring a mean groundwater age from environmental tracers. This work will provide information on methods to assimilate and evaluate the information content of environmental tracer data in groundwater flow and transport models that can facilitate more accurate predictions of future subsurface hydrology conditions.

American Automation Tax Policy
Author(s): Joshua Thornton
Faculty Mentor: Pippa Browde
Category: Humanities

Abstract / Artist Statement: Automation increases production and reduces labor costs, while disrupting industry and employment. Will automation have a substantial long-term negative effect on America’s tax system and human labor market? This paper argues that the Tax Cuts and Jobs Act of 2017 implicitly endorses hiring human labor over automation. First, a brief background of automation is detailed. Second, an analysis of basic tax policy concepts, such as neutrality, efficiency, equity, and simplicity are applied to a specific provision of the Tax Cuts and Jobs Act of 2017. Finally, this paper concludes that the Tax Cuts and Jobs Act of 2017 can assist a transition from reliance on an income tax base to one that focuses heavily on business investments and capital gains.

Qualities of Athletic Training Students that Collegiate Athletes Find Desirable
Author(s): MaKenna Turk
Faculty Mentor: Valerie Moody
Category: Social Sciences

Abstract / Artist Statement: Title: The CAATE, BOC and NATA all guide the development of athletic training students (ATS) to meet the minimum requirements necessary to be effective competent Athletic Trainers (AT). However, the BOC states that obtaining certification doesn’t guarantee quality and professional success of an AT. In order to better develop quality ATS prepared for the workplace, an understanding of what qualities are valued by patients is warranted. While much of the literature has focused on desirable qualities of practicing athletic trainers, little research has specifically focused on the ATS. Purpose: The purpose of this study was to assess qualities in ATS desired by collegiate athletes in hopes of guiding ATS future education and professional development. Methods: A convenience sampling technique was used to recruit of 26 participants from a Division I Women’s soccer team. Eleven out of 26 participants completed the survey for a response rate of 42%. The Athletic Training Student Quality Survey (ATSQS) is an electronic 24 five-point Likert scaled survey. The survey was developed using Qualtrics and was sent out to subjects via their university emails. Participants were given 10 days to complete the survey. Cronbach’s alpha was used as a reliability coefficient for the ATSQS. Means and standard deviations for each item on the Likert-scale were calculated. Total response percentages were also calculated for each item on the Likert-scale. Results: Cronbach’s alpha was used as the reliability coefficient in this study and was calculated as 0.944 for the ATSQS. Most qualities had mean scores above four (Very important) and the overall mean score across all items was 4.23. The six highest scored qualities included helpful, trustworthy, punctual, consistent, high ethical standards, and admits mistakes. Conclusion: The most desirable qualities in order are helpful, trustworthy, punctual, consistent, high ethical standards and admits mistakes. Practicing as a clinician goes beyond the skills learned in a textbook. Possessing qualities and characteristics that are valued by the patient may enhance communication and interactions that are key in providing patient care. In athletic training, it seems natural that the best way to further develop these qualities in ATS is through clinical education. Clinical education provides ATS the opportunity to learn how to build professional relationships as well as vital communication and people skills in a healthcare setting. Originality: There is currently no literature that exists in athletic training looking at qualities of ATS desired by patients. All AT literature assesses qualities desired by ATs or ATS by fellow clinicians or educators. Significance: Obtaining information from this project has potential to shape the development of ATS in clinical education. By improving this development, ATS will be better set up for success as young
professionals in AT and can increase the quality of health care provided by young professional ATs and ATS in clinical education.

The Artist
Author(s): Stephanie Whitney
Faculty Mentor: Micheal Musick
Category: Visual & Performing Arts

Abstract / Artist Statement: Music has been ingrained in human culture for thousands of years. It is tied into many facets of life. We use it to teach, to heal, to tell stories, and even to pass on history. It has the unique capacity to embody emotion and memory on a personal and universal level. Because of this there is no way to give a direct definition of the meaning of music. With this thought in mind, I asked myself if there is a way to capture what our brain goes through while listening to a song?

Within my work as a media artist I began to build a code in processing that could do just that. The Artist Is a series of still images that is created by utilizing brainwaves of subjects while they listen to a specific song chosen by me. Each image represents a small piece of that person’s memory and feelings that come up when they listen to that song. I wanted this to be shown in the image so I made the objects that the spikes in brainwaves produce small yet deep and complex on a vast canvas. But when all the objects come together it seems as though you are looking in on something much larger than just an image. In order for this to work I had to relinquish control over how each piece would turn out and let the brainwaves speak for themselves. Because of this they are all vastly different and each one stands out on its own even though each one is run through the same code.

The ideal space for me to present this piece would be a ten by five foot area. I will also need a TV to project on and will be providing the computer, software, and headset. The best way for me to show my piece would be to do a live presentation and allow people to participate and create the art as well as be able to view the still images that are created.

Worldviews: Discerning and Measuring the Dimensions that Make Up Our Most Fundamental Beliefs
Author(s): Shailee Woodard
Faculty Mentor: Rachel Severson
Category: Social Sciences

Abstract / Artist Statement: This research sought to develop a comprehensive worldview measure. A worldview is a set of core beliefs, values, and attitudes about the nature of the universe and humanity, one’s place in the universe and in their social context, and how one should live their life. Humans are predisposed to have a worldview, as it is a result of human nature and necessary for human functioning, particularly interacting with others and finding meaning and purpose in one’s life (Kearney, 1984; Nilsson, 2014). Worldviews have immense potential for contributions to the field of psychology. For example, worldviews provide possible explanations of human behavior and valuable insights into tensions between societal groups. While worldviews show great theoretical and empirical promise, critical gaps remain in our knowledge. One reason for the scarcity of research on worldview development is the lack of a robust worldview measure. The current research sought to fill this gap by developing a comprehensive worldview measure.

To do so, two studies were conducted. The first study derived a workable number of items (questions) from five existing worldview measures, and the second study used those items to produce a comprehensive worldview measure. In Study 1, five existing worldview measures (160 items) were administered to 171 undergraduate students. Items were analyzed using Exploratory Factor Analysis (EFA), a statistical procedure used to identify a smaller set of underlying variables (i.e., factors) from a larger set of variables (in this case, the 160 questionnaire items). Using standard criteria for item reduction (e.g., redundant or uncorrelated items), the items were reduced to 77. The item reduction was necessary given that the statistical techniques required in Study 2 necessitate 5-10 participants per item.
Study 2 sought to identify the underlying factors (or groupings of the items) in order to ensure the new measure maintained a meaningful breadth while eliminating any further redundant or extraneous items. Participants (N = 772) were recruited through Amazon Mechanical Turk (MTurk), an online platform where individuals are paid (in this case $.50) to complete small tasks. MTurk was chosen for two reasons: (1) large sample size (at least 770 participants) necessary for the analyses and (2) greater demographic variability to increase generalizability of the results. An EFA was run on half of these participants using the same criteria from Study 1 to reduce items. This process resulted in 52 items which formed six factors: Factor 1, benevolence and optimism; Factor 2, religiosity; Factor 3, hard work and respect for authority; Factor 4, illusion of free will; Factor 5, Eastern-based spirituality; and Factor 6, importance of money and self. The six factors were then analyzed using Confirmatory Factor Analysis (CFA) to see how the six-factor model fit the remaining half of participants. Although there was high consistency between the factor structures in Study 1 and 2, the six-factor structure did not meet the high standards of the CFA. Therefore, improvements to the new measure, such as adding new items to the questionnaire, will be employed to further refine this new comprehensive worldview measure.

Examining Injury Trends in High School, Collegiate, and Professional Rodeo: A Systematic Review

Author(s): Elly Wright
Faculty Mentor: Valerie Moody
Category: STEM (science, technology, engineering, mathematics)

Abstract / Artist Statement: Rodeo is an intense, fast paced sport with a high injury prevalence. It is separated into rough stock events (bareback riding, saddle bronc riding, bull riding) and timed events (steer wrestling, team roping, tie down roping, goat tying, barrel racing), with research suggesting bull riding is the most dangerous event on earth. The added component of livestock creates a large amount of unpredictability that can contribute to injury occurrence. Even with such a high prevalence for injury, rodeo is vastly under researched with most existing studies focused on injury epidemiology. Current research focuses on one level of competition and has not been synthesized to examine injury trends between various levels of competition. This systematic review was conducted to examine injury trends across all levels of rodeo competition to further the understanding of the sport. A database search was conducted using PubMed and SportDiscus through October 2018. A keyword search was completed using seven key words: rodeo injury, rodeo, rodeo injury epidemiology, bull riding injury, college rodeo, professional rodeo, and high school rodeo. Studies were selected based on inclusion of injury data at any level of competition. Studies were eliminated based on title irrelevance, no authors listed, no inclusion of injury data, and full text unavailability. The initial database search produced 1,109 articles. After applying exclusion criteria, 11 articles were selected for this systematic review. Variables examined were injury frequency and rate, anatomical location, injury type, and event occurrence. This systematic review was unique because it compiled data from multiple levels or rodeo competition. By combining data from high school, collegiate, and professional levels of competition, more comprehensive conclusions were drawn related to injuries in the sport of rodeo. The conclusions drawn can then be applied to clinical practice and help medical providers like athletic trainers, physical therapists, physicians, etc. be better prepared to treat athletes at all levels of rodeo competition. A few of the findings from the review include professional rodeo athletes are at higher risk of injury when compared to high school level of competition, with rough stock athletes being at higher risk compared to timed events. Rodeo athletes from all events are highly susceptible to extremity injuries that are conducive to implementation of injury prevention strategies. Future research is needed to explore injury prevention strategies and the most effective ways to integrate them into rodeo. In a sport like rodeo with such a high prevalence for injury, providing the highest quality care is of utmost importance to help keep athletes in competition. The information collected in this systematic review provides a clearer picture of injury in rodeo.
Decreasing error associated with calculations of freshwater pCO2 using more accurate pH measurements

Author(s): Fischer Young, Michael DeGrandpre, Cory Beatty, Maury Valett
Faculty Mentor: Michael DeGrandpre
Category: STEM (science, technology, engineering, mathematics)

Abstract / Artist Statement: As atmospheric CO2 continues to rise, understanding how CO2 cycles through the environment is of continuing importance. Although terrestrial and oceanic CO2 dynamics have been studied for decades, freshwater CO2 dynamics have not been studied as intensively. Increasing CO2 partial pressure (pCO2) in freshwaters indicates that increasing atmospheric CO2 is impacting freshwaters as well. However, calculating freshwater pCO2 accurately is not well established. Thus, it is necessary to establish an accurate method for calculating freshwater pCO2 to understand how increasing atmospheric CO2 is impacting freshwater systems.

Due to error in the pH measurement, large overestimations in pCO2 calculations have been demonstrated by previous studies. This study will examine methods to minimize the error from pH and total alkalinity and thus provide more accurate and precise calculated pCO2 values. A laboratory controlled mixing tank with a pCO2 infrared analyzer will act as the true value used for comparisons of this study. pH will be determined spectrophotometrically using purified meta-cresol purple as the indicator. This method is extremely popular for ocean water analysis and has been adapted for freshwater analysis for this study. In addition, glass pH electrode measurements were also taken in order to compare the error associated with each method when calculating pCO2. An edited MATLAB version of CO2sys, a carbonate system modelling tool, that includes a correction for freshwater ionic strength will be utilized for the indirect calculations. Preliminary findings indicate that using the ionic strength correction for freshwater and spectrophotometric pH instead of a glass pH electrode resulted in more accurate and precise pCO2 calculations. The spectrophotometric pH pCO2 values gave a reproducibility of ±10 μatm whereas the glass pH electrode pCO2 values gave a reproducibility of ±100 μatm for multiple samples. It is increasingly important to be able to obtain accurate and precise freshwater pCO2 values in order to designate a freshwater system as either a sink or a source of pCO2 to the atmosphere. Freshwater pCO2 is a small but important key to providing accurate global carbon budgets. It is the goal of this study to improve the accuracy and precision of calculating pCO2 of freshwater systems using pH data and to determine the importance freshwater systems have in global carbon budgets.

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