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The Colorado Springs Undergraduate Research Forum (CSURF) is a collaborative venture designed to highlight the accomplishments of undergraduate students from *Colorado College*, the *United States Air Force Academy* and the *University of Colorado Colorado Springs*.

In its 11th year, the conference has grown to more than 350 participants and continues to reflect the commitment and dedication of our faculty and staff to our students from all disciplines. Participation in the CSURF is open to currently enrolled undergraduates of CC, USAFA and UCCS. Complete information on the CSURF may be found at www.uccs.edu/csurf .

*Thank You for your continued support of the
Colorado Springs Undergraduate Research Forum.*

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University of Colorado Colorado Springs

**United States Air Force Academy
(2014 Host)**

~ CSURF Steering Committee Members ~

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Associate Professor

Keynote Speaker

9 a.m. ~ Room H-1

DR. ERVIN J. ROKKE



Dr. Ervin Rokke is the senior scholar in residence at the Air Force Academy's center for Character and leadership Development. Before coming to the Academy in 2007, he served as president of Moravian College in Bethlehem, Pa. Dr. Rokke served in the military for 35 years, in operational, diplomatic and academic leadership positions.

At CSURF, Gen. Rokke will be speaking about transforming linear institutions to operate in a nonlinear, highly technical world.

Oral Session I (10-11:20 am)

Awareness and Nature

Room: L-1

~

Awareness

Clayton Delaney Jr.
Claire Rau
Department of Visual and Performing Arts
University of Colorado at Colorado Springs

As busy human beings who tediously run from one task to another, we often become so focused on the world around us that we forget who we are, what we are and how we are. Through my pieces I look to ground the viewer and make them aware of themselves in the space at that current moment.

~

The Black Forest Series: Uniting Natural and Cultural Landscapes

Stephanie Von Fange
Corey Drieth
Department of Visual and Performing Arts
University of Colorado Colorado Springs

My artwork seeks to redefine and re-evaluate societies' relationship to nature. For the past two years I have imprinted freshly cut tree stumps to create post-mortem portraits of individual trees. By changing the context and language surrounding these prints, I have found that they inherit a plethora of themes that overlap, including: place, time, spirituality, memory and identity. My most recent project: linking place to identity through social art practice. This ongoing project addresses and documents a disastrous local experience – the 2013 Black Forest Fire. I am working with families in the Black Forest community to document their property by imprinting specific trees picked by each family member. The prints are white ink on black paper made from the ashes of the tree and each is titled with the name of the family member, the location of the stump and the age of the tree. The resulting pieces embody a memory of place associated with a grave.

This social engagement focuses on cultural and environmental issues – the effect of the fire on the community and the consequent deforestation. Furthermore, it connects individual people to trees and identity to place, creating a collective memorial of the Black Forest Fire that embodies a shared experience between society and nature.

~

From Digital Paintings to Coffee

Elena Clark
Department of Visual and Performing Arts
University of Colorado Colorado Springs

I will be presenting a series of artistic and graphic-design works from a two-year period. Works include *Hands*, which explores the idea of hands being the extension of ourselves and *Fairy Tales*, which is about the progressive movement of female equality in pop culture story telling. Stories in any shape or form have an underlining reflection of the current state of society. By blending comic books and Grimm's fairy tales, the work explores the progression women have made in an effort to achieve equality. My talk will include bodies of work but also individual pieces of art from painting with coffee to digital design that reflect the opportunities that I have gained in my academic career.

Business Management

Room: L-2

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The FloodLift System

Kevin Dolan, Mitchell Kim and Joshua Kreimier
With Maj. Daniel White (Adviser)
Department of Management, United States Air Force Academy

Currently, natural disasters such as floods or hurricanes ravage residential areas that are located in flood zone areas. The only preventive measure that families can take is to put their house on stilts, which reduces the value of the home. The FloodLift system is a synchronized hydraulic lift system installed into the foundation before the home is built. The hydraulic lift system gives homeowners the ability to lift the house up to 12 feet when a flood warning has been announced. Once the danger has passed, the home can be lowered back to the foundation without any damages. This addition to the home will also increase the value of the home. The revenue model consists of licensing use of the patent to builders, the royalty fees and value incentive.

~

AlloSource Production Scheduling

Joseph Gallinatti, Daniel Hamaker, Marian Nicula, and Zachary Saunders

With Maj Jesse Pietz (Adviser)

Department of Management, United States Air Force Academy

AlloSource is a nonprofit company that processes bone and tissue donations into products for the medical industry. Currently, AlloSource operates in a highly resource-constrained environment where the scheduling process is completed by hand just hours prior to the start of a shift. Statistical Management of Analysis for Research and Technology (SMART) Consulting was asked to help improve the schedule-building process. AlloSource seeks to create a daily schedule that is good, but not optimal, and utilizes resources in accordance with pre-determined priorities. In response to this request, SMART Consulting seeks to solve the problem using a system of interacting models. The first is a database which improves the availability and accuracy of information; while the second is a scheduling model (termed the Capacity Model) which aims to improve resource utilization and create good schedules.

~

MYO Meal

Desi Rodriguez

With Maj. Daniel White & Capt. Jason Belvill (Advisers)

Department of Management, United States Air Force Academy

MYO Meal is a hybrid fast-casual restaurant that offers healthy, alternative, quick food service. By combining self-serve yogurt lines and a traditional chef-cooked meal, MYO Meal offers a food experience unlike any other establishment in the industry. By offering the best of both worlds, deciding exactly how you want your dish along with a chef-cooked meat service, MYO Meal offers a diverse service that is innovative, quick and inexpensive. MYO Meal focuses on offering healthy foods, while still having the customer sustain a full and satisfying meal.

Drugs and Disasters

Room: L-3

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Design and Synthesis of a Novel Drug for Human African Trypanosomiasis

Petra Jans

With Dr. Amy Dounay (Adviser)

Colorado College

Human African Trypanosomiasis, also called African sleeping sickness, is a deadly disease that primarily affects the rural populations of sub-Saharan Africa and has very limited treatment options. The disease is caused by a protozoan parasite, *Trypanosoma brucei*, which is transmitted to humans by the tsetse fly. During the first stage of the disease, the parasite inhabits the blood and lymph systems, producing flu-like symptoms; during the second stage, the parasite crosses the blood-brain barrier and causes neurological symptoms, such as sleeping disorders, and eventually, if left untreated, coma and death. The current treatments have several problems: they require difficult administration regimens, making them inaccessible to the majority of people affected by the disease and they are highly toxic. A new, orally active, benzoxaborole drug candidate, SCYX-7158, is currently in clinical trials for HAT treatment, and we have designed a hydroxamic acid drug that we hope will mimic the antiparasitic activity of the benzoxaborole drug. Our preliminary efforts to optimize the 8-step synthesis of our novel drug, starting from the commercially available 4-fluoro-3-nitroaniline, will be described.

~

Early Wildfire Detection

Carter Adams, Michael Morris, Spencer Rutter, Quinn Van Drew

With Lt Col Tim Pettit, Lt Col Jeremy Noel, Capt John Miller (Advisers)

Department of Management, United States Air Force Academy

Throughout history wildfires have been extremely costly to Colorado. Within the past two years alone, wildfires have caused approximately \$500 million of damages in the Colorado Springs area alone. Currently in Colorado Springs, the only wildfire detection available is the citizens of the local area reporting smoke. This is difficult for first responders because it is not an accurate way to pinpoint the location of the fire. There has not been any previous work in Colorado Springs to try to detect the wildfires accurately. On the market today there are products that include technologies such as: optical, infrared and laser. These are recent products and have small amounts of field

testing. Data for this project was collected through various companies on their technologies and how their systems computed the location of the fire. This data was then input into a multi-attribute decision matrix to determine which companies' product offered the best service and whether an investment in early detection outweighs additional suppressions efforts. Results of this scoring matrix will be presented.

~

Analysis and Improvement of Rapid-Form Tornado Damage Modeling

Jonathan Patience

Department of Economics and Geosciences, United States Air Force Academy

With Dr. Nathaniel Heatwole (Adviser)

Center for Risk and Economic Analysis of Terrorism Events (CREATE)

University of Southern California

Currently, tornado damage modeling and prediction is an extremely complex, complicated task. Services such as HAZUS are very powerful, but require a high level of training to use the software. Data about the tornado also might not be available until well after the tornado has hit. Rapid-form modeling is a method that optimizes for simplicity of a model rather than absolute accuracy. By trading some accuracy for simplicity, the model can be more useful in quickly estimating the damage caused by a tornado using data that is available immediately after a tornado hits. Research conducted at USC CREATE last summer showed the potential for rapid-form modeling to be applicable to tornado damage in Oklahoma with a reasonable degree of accuracy, and using only publically accessible data. The purpose of this research project is to expand the scope of the research to include the entire United States, as well as increasing the accuracy of the rapid-form model.

Governance

Room: L-4

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Participation and Legitimacy: Memory, Identity and Power in Collective Action

Jorge Rivera Hernandez

John Gould

Colorado College

This paper argues that the study of successful nonviolent resistance movements can be understood through two fundamental questions, or *problematiques*: (a) the *Participation-Abstention Problematique* and (b) the *Power-Legitimacy Problematique*. The former focuses on the questions regarding the origin, form and quality of the participation in a

movement. The latter focuses on the strategic aspects regarding the balance of power and the sources of legitimacy among the different parties involved. A collective action movement starts with a certain grievance. How and why people decide to act on a particular injustice depends largely on their collective understanding and recollection of the events. In their earliest stages, movements can shape the understanding, or master narrative, of what happened. This provides the population with incentives to act. In the long term, controlling this narrative, which is transformed into collective identity, allows the movement to influence and hold the sources of legitimacy. Ultimately, successful movements are those which are able to mobilize numerous people and effect a change in the balance of power by establishing their legitimacy. In order to assess the validity of these claims, this paper focuses on the nonviolent struggle waged by the Crimean Tatar movement. For decades, and at great individual risk, the Tatars organized and waged nonviolent resistance against the Soviet government, based on their claims to Crimea as their historic homeland. The catalyst of their struggle was what they considered to be an unfair and unfounded deportation. As the years passed, the Soviet version of the Tatar history lost legitimacy, and with it the legitimacy of the government's instructions to repress and marginalize them was also lost. Against all odds, and without resorting to violence, they gained the right to repatriation from the Soviet government in 1989.

~

Doing More With Less: An Assessment of the Royal Air Force's Ability to Meet Challenges in the Near Future

Elliot Bucki

With Dr. John Farquhar (Adviser)
United States Air Force Academy

The Royal Air Force of the United Kingdom is the oldest independent air force in the world. Founded 1 April, 1918, the RAF has an outstanding record of service in many major conflicts. In addition many great air power theorists throughout history have been officers in the RAF and have helped it to grow into the fifth largest air force in the world today and the second largest in NATO. This paper answers the question: Will the RAF be able to respond effectively to the challenges it will face in the next 10 years? Since the end of the Cold War, the RAF has faced massive budget cuts and has had to focus on fighting much smaller and distant conflicts such those in Iraq, Kosovo and Libya. In order to mitigate the impact of these cuts, the RAF has begun to focus its resources on generating a sort of flexibility that can allow for the maximum amount of capabilities for minimum cost. In addition the RAF has begun to work toward building an even stronger relationship with the United States and other allies to supplement its capabilities. Faced with changing national priorities, reduced man power and diminished funding, Britain's Royal Air Force expects to become an "expeditionary air force" as the most cost effective approach for the 2013-2023 decade.

~

The Two Bodies of the King Explored

Jessica Adams

Wilson Brissett

Department of English and Fine Arts, United States Air Force Academy

The founding years of the United States of America were filled with thought on how best this country could be established. As a people, Americans invest in their country, cognizant of a larger purpose, and continually question whether that larger purpose is being realized by this government and this people. The Constitution sought to end the cycle of fortune which takes young republics into corrupt adulthood, a cycle alluded to in Washington's "Farewell Address" which emphasizes the value of morality and religion for our young nation's success. Tracing the sentimental goals of our country's founding through its beginnings, onward into Royal Tyler's "The Contrast," pausing in the current time, and looking forward into the future, the question emerges as to whether America has remained true on her course. Is America succeeding in her goal to break free of this wheel of fortune, or is she falling and failing like every other civilization in history? This paper suggests that America has not necessarily broken the Wheel of Fortune, but instead attached this cycle to a positive trajectory. America is linear yet cyclical in nature. There are moments of continuing upwards, but there are also lapses. The mean course of this country is upward and forward, with moments of cyclical faltering along the way.

Social Sciences

Room: L-5

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Daniel Goleman and Emotional Intelligence

Ashley Flanagan

With Kurt Heppard (Adviser)

Department of Management, United States Air Force Academy

Daniel Goleman, psychologist, science journalist, and author, is the century's emotional intelligence guru. His focus concentrates largely on the areas of psychology, education, science, ecological crisis and leadership, which has earned two Pulitzer Prizes. The term emotional intelligence became widely popular with the publication of his book *Emotional Intelligence - Why It Can Matter More than IQ*. His publications have changed the way managers perceive intelligence and the importance of emotional intelligence in the workplace. His findings suggest that people can develop greater awareness and control over their emotions. By applying this type of intelligence to the management sector, managers can revolutionize the way they assess the needs of the organization's stakeholders, implement change and get the most out of their human resources. This

paper highlights the importance of self and social awareness. Furthermore, it offers essential advice on how managers can obtain the most out of their people through the strategic practice of emotional intelligence.

~

**“Already Made a Name for Myself”:
Academic and Professional Women’s Utilization of Impression Management and
Practice Theory through
Retaining their Natal Surnames at Marriage**

Gracie Rennecker
Sarah Hautzinger
Department of Anthropology
Colorado College

For some women in the United States, last-naming practices have progressed from a patronymic system to a non-conventional one. An example of non-traditional last-naming choices is when a woman retains her natal surname at marriage. Women who choose to keep their own names at marriage are often questioned about their reasoning and are sometimes ridiculed for defying the longstanding patronymic system. The questions I seek to answer in this essay are: What are women’s reasons behind keeping their own last names? Do they need a claim to a professional or academic accomplishment to justify their decision? Through the Feminist Last Naming Project, 82 women and one man were interviewed about their last name stories surrounding feminist last-naming practices. I used grounded theory methodology to interpret the data from the interviews and two theories arose: impression management theory and practice theory. Both theories provide a lens to understand women’s academic and professional reasons for keeping their own last names at marriage, as well as the practice of women imparting situational name use in their lives. These women appear to manage the impressions they wish to acquire from different people as well as garner different forms of symbolic capital that reflect the structures under which they live.

~

Cadet Personal Financial Knowledge and Responsibility

Joanne Choi
Joshua Kreimier
Erin Rost
Lt Col Kip Kiefer
Department of Management, United States Air Force Academy

Students at most universities experience financially relevant life lessons such as hunting for an apartment, buying groceries and paying for utilities. Despite these experiences, the New York State Higher Education Services Commission found that students are

woefully ill-prepared for life after college. For instance, 75 percent of students are not ready to deal with the financial challenges ahead of them, and 62 percent of final year students have four credit cards or more and are carrying an average of \$4,100 in debt. Although most United States Air Force Academy cadets graduate with low levels of debt and begin to earn a decent salary immediately after graduation, most cadets never experienced many of the important life lessons learned by other university students. Through a survey of more than 100 senior cadets, we identify 1) what cadets feel they know about personal financial responsibility topics and 2) whether or not they are accurate in their assessment. Results from this survey indicate that cadets are overconfident with regard to their knowledge of personal financial topics. Our study also offers several recommendations for revising the cadet training program by including personal financial responsibility topics in cadet training to better meet cadets' post-USAFA needs.

Performing Arts

Room: L-6

~

Discovering Austrian Identity and Ideology in the Use of the Guitar in the Second Viennese School

Jon Gillin

Colin McAllister

Department of Visual and Performing Arts, University of Colorado Colorado Springs

Just before and just after World War I, large numbers of contemporary composers started writing pieces for the guitar. These are the first major composers to write for the instrument who are not also guitar players. Furthermore, the instrument itself is relegated to relative obscurity in high musical circles for nearly 50 years prior to this explosion in interest in the guitar. But these works propel the guitar into modern music and make it the small ensemble and solo performance instrument it is today. The question remains as to why - after all this time - does a group of composers in Austria take an interest in a parlor instrument that no other non-guitar player had written for before that point in history. This research explores the reasons behind changing attitudes about the guitar as a solo and ensemble instrument and how it relates to shifts in musical ideas and Austrian concepts of identity during this tumultuous time.

~

Taking the Lead: Engaging the 'West' on the Dance Floor

Chelsea B. Brown
Joan E. Ericson (main adviser); Marcia Dobson
Colorado College

The inspiration for my thesis came from two sources: the Japanese film *Shall We Dansu?* and my dancing experiences when I studied abroad in Japan. Of the many forms of dance worldwide from ballet to Bollywood and hip-hop, ballroom dancing fascinates me most. Before leaving the States, I thought it would be nearly impossible to find good social dance scenes, but to my amazement, Japanese dances covered every genre. For almost five months I had minimal physical contact with my host family or Japanese friends, but I could go to a lesson and dance in close embrace with strangers to slow blues tunes. I wondered what made ballroom dancing different. My overarching point is that in Japan, ballroom dancing initially began as a means to facilitate cultural connections between the Japanese upper-class and western elites residing in and visiting Japan; and later in time as a western commodity to be consumed by the emerging middle-class. Despite these uses of ballroom as a hallmark or commodity of the West, it also functioned as a space of liberation from Japanese cultural standards on an individual level, especially for women, and a different manifestation of the Self through the borrowed cultural import of ballroom dancing, simultaneously making ballroom both foreign and domestic.

Poster Session I (11 a.m.-12:30 p.m.)

Room: Falcon Center

~1~

The Role of Top-Down and Bottom-Up Attention Systems on Auditory Attention Capacity

Jason Adams
Brandon Gavett
University of Colorado Colorado Springs

Digit Span is a widely used test of auditory attention span and is an indispensable tool for assessing variables of attention span in neuropsychological evaluations, mental status examinations and educational assessments, for example. Performing the Digit

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Span test requires abilities that factor into auditory attention, such as attention and working memory. Progressive digit presentation is believed to be influenced by top-down auditory attention, favoring participants who are better at planning ahead and anticipating future tasks. In contrast, random digit presentation is believed to be a more pure measure of bottom-up auditory attention. The goal of the current study is to compare the effect of random vs. progressive digit presentation for forward and backward Digit Span in older and younger adults; participants are hypothesized to achieve higher scores on progressive Digit Span. Aging-related declines in Digit Span are expected to be attributable to decreased executive abilities. Participants, including 50 UCCS undergraduates and 50 local adults of ages 50+, complete forward and reverse Digit Span tasks, ordered progressively and randomly. The Brixton Spatial Anticipation Test is used to assess anticipation and the Tower Test to assess planning. Order of test administration is counterbalanced to avoid order effects across study conditions. Undergraduates are recruited from the UCCS SONA system; the adults are recruited from the CU Gerontology Center registry. Mediation analysis is used to examine the relative contributions of planning and anticipation towards differences in progressive and random Digit Span tasks. Data collection for this study is ongoing.

~2~

The Geometry Underlying Electromagnetism

Scott Alsid

Department of Mathematics, United States Air Force Academy

Geometry is often characterized by dragging a vector in as parallel a manner as possible along a closed path, where the curvature is proportional to the angle change after transport around the loop. This is the curvature used in General Relativity. This talk will explain how curvature relates to E&M. In quantum mechanics, the Aharonov-Bohm effect shows us that the vector potential (A) for E&M is more fundamental than the electric and magnetic fields. Here a wave function that travels around both sides of a region with a magnetic field undergoes a phase shift proportional the enclosed magnetic field. The phase angle difference in the Aharonov-Bohm effect is a result of the same type of geometry described by parallel transporting vectors around a loop. In this talk, I will show three superficially different schools for manifesting this geometry to represent E&M. I will describe how to make rigorous the 'rings' used by Brian Green to depict Kaluza-Klein theory. I will describe how to visualize curvature of E&M fields with Grassmanians using a technique developed with Prof Cahill in the 2000s. Last, I will connect these representations to work done at MIT on a hidden spatial geometry of Yang-Mills theory of which E&M is a special case. We will also discuss the relationship between the Grassmanians of elementary electric field arrangements and the spin-less wave function of an electron with regards to a deeper meaning of Gauss's Law.

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~ 3 ~

Integrating ASP-based Planning and Diagnosis with POMDPs for Knowledge Representation and Reasoning for Mobile Robots

Patricia Andrews

Mohan Sridharan

Colorado College and Texas Tech University

Mobile robots operating in real-world domains frequently encounter challenges due to an uncertain and dynamic environment. In order for a robot to successfully accomplish a given task, it must not only generate an effective plan, but also deal with unforeseen changes in the working environment and action outcomes that may be non-deterministic. This project adds navigational planning and diagnostic capabilities to an existing architecture that integrates high-level logical inference with low-level probabilistic decision making. Answer Set Programming, a non-monotonic logic programming paradigm, is used to represent and reason about domain knowledge, while Partially Observable Markov Decision Processes are used to probabilistically model the uncertainty in sensing and acting on robots. This architecture enables robots to represent and reason with incomplete domain knowledge, adapt sensing and acting to the tasks at hand, and revise existing knowledge based on information extracted from sensors and humans. This architecture is evaluated in simulation and implemented on a wheeled robot in an indoor domain.

~ 4 ~

An Assessment of the Effect of Incentives on the Quantity of Ideas Produced by Electronic Brainstorming Groups

Kyle Antoszewski, John Davis, Erin Bleyl, and Will Madsen

With LCDR Brian R. Johnson (Adviser)

Department of Behavioral Sciences and Leadership and Systems Engineering
United States Air Force Academy

This research investigated how people react to incentives in electronic brainstorming sessions. Electronic brainstorming utilizes live chat software on networked computers that brainstormers use to electronically share their ideas. This is as opposed to traditional face-to-face verbal interaction, which has been shown to be a less efficient form of brainstorming. When people brainstorm, there is generally a rise of ideas early on in the session then the quantity of ideas tappers off as the brainstorming session continues. The purpose of this experiment is to investigate whether introducing an incentive would result in a second rise in the quantity ideas after the typical, initial spike, improving the overall quantity of ideas generated. Subjects were placed in groups of three and used a computer terminal to participate in a chat room. All participants experienced one practice condition to get used to the software, followed by an experimental condition where no incentive was introduced. Finally, they were again

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asked to brainstorm and halfway through the session the participants were introduced to a cash incentive. Results indicate that the introduction of the incentive increased the overall quantity of ideas. This information can be extremely useful to brainstorming groups as increasing the number of ideas produced also increases the chance of reaching a creative solution.

~ 5 ~

The Future of Affirmative Action: *Fisher v. University of Texas*

R. Daniel Barbera
Chad Austin
United States Air Force Academy

The University of Texas' admissions process will fail strict scrutiny when re-examined by the District Court in consideration of the guidance provided by the recent Supreme Court decision in *Fisher v. University of Texas*. Affirmative action, one of the most controversial topics in modern politics, was recently reviewed. The previous precedent of *Grutter v. Bollinger* determined that race could be included in admissions processes to achieve a "critical mass" that would serve the compelling interest of better education. This precedent led directly to the *Fisher* case where Abigail Fisher, a Caucasian female, was denied acceptance to the University of Texas despite the fact that less qualified African-Americans were accepted. The court's decision on June 24, 2013, returned the case to the district courts with a clearer definition of the level of scrutiny which the school ought to receive. The opinion stated that the court must appropriately apply strict scrutiny upon the institutions which pursue to use race. They ordered that the university is obligated to show that its plan is narrowly tailored to achieve the compelling interest of diversity as defined in *Bakke*. In consideration of UT's entire admissions process, their use of race in such a small percentage of their admissions process which does not have a significant effect on their total diversity numbers does not justify their use of affirmative action.

~ 6 ~

Theory as a Framework for Crowd Sourcing Research in Technical Communication

Amanda Barker
Michelle Neely
University of Colorado Colorado Springs

A central issue in technical communication is the validity of crowd sourcing as a method for generating knowledge. Commercial industries have already integrated the use of a crowd to gain solutions to particular tasks. As previous research by Brabham has shown, a corporation posts a problem online, numerous individuals provide answers,

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the winners are given some reward, and the company proceeds to manufacture the idea for its own profit. Apart from the business approach to crowd sourcing, few researchers have studied technical communication in regard to this online collaboration. The combination of crowd sourcing and technical communication could result in a system that uses the vast power of the human understanding to discover research concepts more quickly and come to this form of technological revolution. What are the future possibilities for crowd sourcing and technical communication? The purpose of this investigation is to fill that gap through the incorporation of the activity theory; specifically, tool, motives and community.

~ 7 ~

Rural Stereotype Threat: The Relationship with Prejudice Behavior within an In-Group

Melissa L. Barnes
Professor Emily Chan
Colorado College

This study explored the relationship between stereotype threat based on the negative “rural” stereotype and discriminatory behavior against in-group members. Twenty-six participants who self-identify as either currently living in a rural area or who grew up in a rural hometown were recruited to participate in an online study on social perception. For half of the participants, stereotype threat was induced by asking them to identify whether or not their hometown was rural or non-rural. The other half was not asked if they had rural origins. After the threat manipulation, participants completed a test with GRE-type verbal questions and a two-item measure of self-evaluation to assess the effect of stereotype threat. Participants were then randomly assigned to read a job application profile of either a rural or urban job candidate. They then rated the candidate’s competence for the job in three questions (candidate being goal-focused, self-confident and self-aware).

It was hypothesized that stereotype threat would lower the self-evaluation and verbal test performance of the participants (all rural), and that participants under stereotype threat would also underestimate the competence of a threatened in-group member (rural job candidate) compared to someone whose identity was not impacted by stereotype threat (urban candidate). The findings support the multi-threat framework (Shapiro & Neuberg, 2007) which suggests that a stereotype threat can be experienced not only as an individual threat but also as a collective threat.

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Purification and characterization of a starvation-induced cysteine protease in the model organism *Acinetobacter baylyi*

Sarina Bernazzani, Cody Memmel, Phoebe Lostroh and Margaret A. Daugherty
Departments of Chemistry and Biochemistry and Biology
Colorado College

The bacterium *Acinetobacter baylyi* is endemic to soil across the globe, and as such, is constantly exposed to changing conditions and nutrient depleted environments. Lostroh and Voyles identified a starvation-induced operon in *A. baylyi*, containing 30 genes that allow the bacterium to adapt under nutrition-depleted conditions. Among these starvation-induced genes is ACIAD-1960, a putative cysteine protease identified by bioinformatics. At the time no successful purification results for ACIAD-1960 had been obtained. The purpose of this study was to purify ACIAD-1960 to determine if it had cysteine protease activity, and later characterize to find optimal buffer conditions. After secondary purification, SDS-PAGE gel results indicated pure protein, and a later bromopyruvate activity assay showed that the protein was a cysteine protease. The lack of a definite pH curve suggests that an important component of the optimal buffer solution is missing. Future research would necessitate finding the missing constituent of the buffer solution, starting with metal ions such as Mg^{2+} and Ca^{2+} , and then moving on to temperature dependence. The data shows pure protein after initial and secondary purification, and later assays show that the protein of interest is a cysteine protease. Activity assays using reducing agents give a decrease in activity while pH dependence of the protein could not be determined due to inadequate buffer conditions.

~ 9 ~

A Simulation of Traffic in a Roundabout

Matthew Bliley
Lt Col Mario Serna
United States Air Force Academy

The traffic flow of a roundabout can be simulated through simple processes of cellular automaton. We reproduced the findings in *Huang* proving where phase transitions would occur according to certain injection and removal rates. This paper shows that changing the individual driver behavior, by allowing the drivers to continue through the roundabout if the exit is occupied, creates free-flow conditions when there would otherwise be jams; but decreases both the injection rates of the on-ramps as well as the removal rates of the off-ramps.

~ 20 ~

~ 10 ~

**Auction and Game Theory Based Recommendations
for DOD Acquisitions**

Nicholas Boardman, Andrew Cady, Jake Elliott, Parker Quinn
With Maj Nick Mastronardi (Adviser)
United States Air Force Academy

This paper synthesizes auction and game theory literature into specific military acquisition improvement recommendations. We characterize the acquisition environment into distinct categories, present the results of seminal literature that pertains to each category, and translate the literature into recommendations for contracting practitioners. The relevant categories are procurement with unknown cost and no risk, item(s) with known costs and existent but understood stochastic risk, and item(s) with unknown costs and/or unknown stochastic risk. We break out these three categories into sub-categories depending on whether there are one or multiple potential competing vendors, and if multiple by whether we must buy one lot or potentially a schedule of lots from a host of vendors. We conduct a case study demonstrating how we used this contracting approach framework to help inform and develop an optimized competitive bidding environment RFP for the TX, the Air Force's T-38 replacement. Finally, we distill the recommendations from this paper's proposed contracting approach framework into a separate simple practitioner's guide of contracting considerations.

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New Fluorine-Containing Polyarylamines for Organic Electronics

Ford Carty
With Cynthia Corley, Endrit Shurdha and Dr. Scott T. Iacono (Advisers)
Department of Chemistry, United States Air Force Academy

Superior hole-transporting mobility and excellent photoconductive properties of aryl amine-containing polymers place them among the one of the most studied materials for optoelectronic applications. Solution processability; however, is significant limitation to highly arylated polymers particularly for preparing spin cast coatings for multi-layer organic light emitting devices. Strategies in order to improve solubility include installing long hydrocarbon ethers as side groups or introducing heteroatoms in the main chain to improve flexibility. Notably, the preparation of partially fluorinated arylated polymer vastly improves solubility, but has also shown to increase thermal and oxidative stability. In this work, octafluorocyclopentene has been used as a coupling agent to prepare a new class of aryl amine-containing monomers ultimately yielding high molecular weight, optically transparent step-growth polymers. A diverse pool of *N,N*-substituted amine monomers terminally substituted with electrophilic perfluorocyclopentene have been prepared.

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Forensic Applications of Matrix-Assisted Laser Desorption/Ionization Time-of-Flight Mass Spectrometry

Joseph Champaign, Jordan Doorn, Emily Raney
With Lt Col Richard Reich (Adviser)
Department of Chemistry, United States Air Force Academy

Forensic investigations are often dependent on the evidentiary value of limited, trace samples. The analyte of interest is typically embedded in a complex sample matrix in which isolation requires complicated extraction procedures resulting in sample loss. Matrix Assisted Laser Desorption/Ionization Time-of-Flight Mass Spectrometry is a powerful technique, which is well suited for forensic applications. MALDI-TOFMS requires minimal sample preparation afforded by the direct analysis of MALDI, as well as the sensitivity and high chemical specificity of TOFMS. Three forensic applications were investigated to exploit the strengths of MALDI-TOFMS. The first application involves the discrimination of different textile fibers, which may be used to establish a relation between a suspect and a crime scene or victim. The second application involves the characterization and identification of dyes of ball point inks for forensic document examination. Finally, the third application involves the quantitation of post-mortem blood insulin levels for overdose classifications. This work will present the analytical methods developed, the results of the analyses, and illustrate the potential of MALDI-TOFMS for forensic applications.

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Microwave Assisted Fabrication of Carbon Quantum Dot Based Ion Sensors

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Department of Chemistry and Biochemistry, Colorado College

Quantum dots have proven applications in fluorescent labeling and sensing. The toxicity of inorganic semiconductor quantum dots limits their use in biological applications. Quantum materials fabricated from carbon and silicon offer a less toxic alternative. We chose to focus on carbon-based quantum materials. A published, wet chemical method for the fabrication of carbon quantum dots for pH sensing has been modified for microwave assisted synthesis. The synthesis time has been reduced from four hours to fifteen minutes. The carbon quantum dots produced by this modified method have been utilized as platforms for constructing fluorescent sensors for the measurement of pH and magnesium. These fluorescent sensors show a linear response in the range of biologically relevant pH and Mg^{2+} concentration.

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Optimization of Surface Protein Isolation in *Acinetobacter baylyi*

Lynn Doan and Amie Owen
Phoebe Lostroh
Colorado College

Acinetobacter baylyi is a naturally competent gram-negative bacterium, capable of importing exogenous DNA, thus expressing a variety of different genes. The competence machinery in *A. baylyi* is comprised of homologs to the pilus machinery used in twitching motility. Recent research has also shown the proteins involved in twitching motility in *A. baylyi* to be linked to the competence machinery, however, the surface proteins have not yet been characterized (Lieber and Lostroh). Previous attempts at protein isolation resulted in low and inconsistent protein yield. This is the first study to optimize surface protein isolation procedures. The surface proteins were isolated under various conditions and then analyzed using a Bradford protein assay and SDS-PAGE gel electrophoresis. A combination of PBS, NaCl and β -mercaptoethanol was optimal for isolating surface proteins on *A. baylyi*. Also, protein precipitation was not a necessary method in isolating surface proteins. Under the conditions tested, our results were confirmed with Bradford absorption assay and SDS PAGE gels. An optimized protein procedure allows future research in characterizing the relationship between natural competence and twitching genes required for building the respective protein machinery.

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The Effect of Arts Training on Emotions Regulation

Katherine Duker
John Horner
Colorado College

The purpose of the present study was to investigate the relationship between different types of arts training and emotions regulation. McRae (personal communication, October 27, 2013) observed that individuals who identify as artists tend to be better at regulating emotions than non-artists. In addition, previous studies have found that both acting training and creating art have been shown to have a positive effect on emotion regulation in a developmental context. In this study, studio art and acting training were expected to increase the use of adaptive regulation strategies, such as cognitive reappraisal and positive reframing, and decrease the use of maladaptive regulation strategies, such as expressive suppression. Acting training was also expected to improve levels of empathy and theory of mind. Using a quasi-experimental, longitudinal design, participants' emotion regulation strategies were analyzed before and after taking an introductory level art class at a private and a public university. Emotion regulation strategies were identified using 8 scales. There were no statistically significant findings. These lack of results may be due to the low number of participants (n=13), but trends

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were identified within the data that are somewhat consistent with past research. Studio art students tended to decrease their use of both adaptive and maladaptive regulation strategies, and acting students tended to increase their use of adaptive strategies. This research needs to be continued to determine whether these trends hold up with a larger sample size.

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Analysis and Improvement of Airborne Birdstrike Countermeasures

Jack Savage, Dominic Garcia, Jaime Gutierrez, Nicolas Francis, and Jonathan Patience
With Capt Jeffrey Newcamp (Adviser)
Department of Aeronautics, United States Air Force Academy

Bird strikes on aircraft cost the U.S. Air Force about \$32M and an average of 1.3 fatalities annually. However, even after such events, there has not been any major progress in terms of advancements in aircraft safety related to bird strikes. The Airborne Birdstrike Countermeasure program explores measures to help prevent airborne birdstrikes. One system currently in development is an audio-light system which strategically illuminates landing lights while propagating an avian distress call from two speakers placed on an aircraft's fuselage sides. This project explores with systems integrating disciplines to identify an array of variables from multiple disciplines which impact the mission to deter birdstrikes. The project intends to not only create a model for developmental efforts but also to create a sound business plan to project this venture for commercial use.

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Fire Piston Analysis and Instrumentation

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A senior-level mechanical engineering student team in a mechanical instrumentation and measurements course at USAFA was tasked with determining critical parameters for characterization of a fire piston. The intention of this work was to use the student-designed instrumentation system to measure parameters important to characterizing the fire piston to be used as a classroom demonstration and hands-on laboratory experience for polytropic processes in undergraduate thermodynamics. The background research, analysis and theory of operation of the fire piston are presented. The specific key components and instrumentation development process, benefits, as well as difficulties encountered while implementing their designed approach are discussed.

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Vertical Depth Perception Using a Helmet Mounted Display with Displaced Optics

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United States Air Force Academy

The purpose of this research is to understand how changes in helmet-mounted display camera height affect vertical depth perception. There are many benefits to moving the camera away from the eye. By moving HMD cameras above the eye, pilots have an increased field of view, a greater amount of situational awareness, and the ability to put a combiner (mobile Heads-Up Display) in front of their eyes which provides digital data to be displayed to the pilot. Previous research (Browne, 2009; CuQlock-Knopp, 2001; Rash, 2009; Reising, 1994) suggests that as the camera height increases, the vertical depth perception of the user deteriorates, causing the users to feel higher than they actually are. In the experiment, participants were placed in a scissor lift and then donned a HMD. Initially, participants were shown what 15 feet looks like and given training in judging when their vertical height was 15 feet. For the control condition, the participants were asked to estimate when they were at 15 feet with the HMD cameras at eye level. The camera height was then raised to three different levels; one inch, two inches, and three inches. The participants were then asked to estimate when they were at 15 feet, with the experimenters operating the lift. The results of the experiment indicate that there was minimal effect on the participants' perceived vertical height due to vertical adjustment of the HMD cameras. This suggests that raising the optical inputs on HMDs would increase safety for pilots without significantly degrading their ability to judge vertical distances.

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An In-Depth Study of English Majors--Navigation through the English Department and Preparation for a Future Career in English

Allison Hildebrand, Allison Furton
With Michelle Neely (Adviser)
University of Colorado at Colorado Springs

This qualitative and quantitative study provides information about the ways that English majors navigate through writing in the different emphases within the discipline of English (rhetoric and writing, professional technical writing, literature studies, creative writing, and English education). While this data has been collected from various colleges and universities, the main focus of this study centers on the University of Colorado Colorado Springs where the English studies program has been newly implemented. In the current curriculum at UCCS, English majors select an emphasis to study for their

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undergraduate degree within the English Department. Our research seeks to determine whether English majors feel education in their emphasis has prepared them to understand writing techniques across the other emphases. This study was completed through online surveys of English majors at various colleges, and interviews with individuals who are affiliated with the English department of UCCS. This study looks at students' and professors' perceptions of the English department as a cohesive whole, and aims to determine whether students feel prepared to write in all emphases of the English discipline and have gained adequate preparation for a future English career.

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Investigation into the Use of Extremophilic Organisms for Bioenergy Applications

Daniel Hicks

With , Patrick Hallenbeck, Melanie Grogger, Megan Mraz and Donald Veverka
(Advisers)

Department of Biology, United States Air Force Academy

In microbial fuel cells, the redox reactions that generate electricity are performed by living organisms. Identifying microorganisms that thrive in extreme environments and that are able to transfer electrons to or from inorganic electrodes in a MFC may expand the range of conditions in which MFCs can be used, and could also reveal novel electron-transfer mechanisms. To this end, bioprospecting is being conducted in extreme environments (e.g., acid mine drainages, hot springs) to attempt to isolate extremophiles that can be used in MFCs.

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Writing It Off: College Students Using Writing as a Means of Relaxation

Katie Hoehn

With Michelle Neely (Adviser)

Department of English, University of Colorado Colorado Springs

Much research has been conducted to support the idea that writing for fun or for personal reasons can have a positive effect on mood. To explore this notion further, this research project looks into college students' use of writing in the forms of poetry, nonfiction, fiction and journaling as a means of stress relief and relaxation. For this project, I used two research strategies: (1) surveys distributed to college students in two English courses and (2) analyses of published research on the benefits of writing and relaxation. Ultimately, my research project supports the theory that writing for fun, outside of the classroom, can play a role in positively boosting the moods of college students.

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Directional Tactile Alerts to Monitor Multiple RPAS

Allen Frankenberger, Lindsay Johnson, Maxwell Jones, and Elizabeth Taylor
With LCDR Brian R. Johnson (Adviser)
Department of Behavioral Sciences and Leadership, Systems Engineering Program
United States Air Force Academy

The purpose of this research was to investigate how tactile cues can benefit potential operators in situations that place attentional demands on the operator. Previous experiments have shown great promise for potential benefits in the use of tactile vests that vibrate, especially in environments that require a great amount of situational awareness or cannot be assisted with the use of auditory alerts. These are the kind of environments remote piloted aircraft (RPA) operators work in. In a typical experiment, participants sat at a computer terminal and watched three screens. Each screen displayed a prerecorded video of the operation of an RPA. As participants monitored the three RPAs, pre-determined errors occurred and participants made button presses and verbal responses corresponding to each error. Half the participants were randomly assigned to an experimental condition and wore a tactile vest that vibrated to cue participants when an error had occurred. The remaining participants were in a control condition during which they detected errors without the benefit of the tactile cueing. Participants' reaction time and accuracy of error identification was recorded. Results indicate that reaction time was found to be much faster with the tactile vest. Participants also missed fewer errors and had fewer false positives with the vest. With misses taken out of account, the participants took an average of 22 seconds to react to and recognize errors while missing four total errors in 11 trials. In 10 trials, participants without the assistance of the vest missed 10 errors and had an average reaction time of 34 seconds.

Grip-It and Rip-It

Pat Conley, Cody Davis, Ben Kavanay, Tom McKee, and Charles Reichel
With Maj Daniel White and Capt Jason Belvill (Advisers)
Department of Management, United States Air Force Academy

Golf training aids form a very large market around the world, consisting of aids for the beginner golfer all the way to touring professionals. These training aids can be very expensive for the golfer trying to improve their game. Our product, Grip-it and Rip-it, is a training aid designed to self-coach golfers on their swings at a very affordable price. It is an elastic sleeve that fits over the existing grip that allows for easy installment and removal. The idea behind the Grip-it and Rip-it is that the user will form muscle memory using the device, so that upon removal his or her grip is correct. Using different

resources afforded to us by The United States Air Force Academy, we will develop and test initial models of this product in hopes of developing a product to take to market.

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Differences in Run Performance Based on Various Altitudes

Adam Krause, William Lawson,
With Lt Col Michael Zupan, Maj Jason Hofstede and Dr. Brenda Buffington
United States Air Force Academy

The objective of this study is to determine the effect of various simulated altitudes, 7,200 feet (2195 meters; ~21 percent O₂), 6,300 feet (1,920 meters; ~21.5 percent O₂), 5,750 feet (1,753 meters; ~21.9 percent O₂), 5,375 feet (1,638 meters; ~22.2 percent O₂) and 850 feet (259 meters; ~26 percent O₂) on an individual's 1.5 mile (2.41 kilometer) run time. Altitudes were simulated using the Colorado Altitude Training Exercise Room. A significant time difference was observed between 7,200 feet and 850 feet, but when comparing the run times at altitudes of 7,200 feet, 6,300 feet, 5,750 feet, and 5,375 feet, there are no statistically significant time differences. These results suggest that the Air Force's stepwise altitude adjustment for its 1.5 mile fitness test requires adjustment.

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Orbital Debris Remediation

Patrick Lobo, Christopher Keranen, Jason Douglas and Stephaney Saari
With Lt Col Thomas Joslyn (Adviser)
Department of Aerospace Engineering, United States Air Force Academy

Currently, there are hundreds of thousands of orbital debris pieces being tracked daily to avoid the threat of impact with active spacecraft that cost on average \$150 million. With a growing desire to develop an effective, sustainable solution to this issue, there is an untapped market to fulfill this need. In order to meet these requirements and fill this niche in the market, Lieutenant Colonel Joslyn developed StreamStat. StreamStat is a revolutionary spacecraft that utilizes the momentum-transfer of clustered liquid droplets directed at debris that will cause the unwanted debris to lose momentum, deorbit and burn up in the atmosphere. The system is capable of targeting 50 mobile decommissioned satellites with a minimum of 50 percent accuracy. StreamStat meets the sustainable requirement by utilizing mounted solar panels, rechargeable batteries and limited communication to carry out functions giving the system a two-to-three year life span. This project has the potential of targeting dozens of objects while utilizing a single orbit, and a hundred more objects with a controlled orbital transfer capability. This project identifies the small, not fully developed, market of an unfulfilled need of space debris remediation. Using available funds and testing capabilities, we intend to bring this product into modeling, development and ultimately to market.

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Tell Me a Story: Teaching Writing at the Foundational Level

Elisha LoBosco

With Michelle Neely (Adviser)

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As the importance of standardized tests has skyrocketed during the past years, attention has been devoted to increasing student performance during testing levels. However, a critical and often-overlooked area of study is the pre-standardized testing levels: in Colorado, kindergarten through second grade. Teachers at these levels not only have the enormous responsibility of preparing their students for the next grade level, but the additional pressure of preparing students for standardized tests, such as the TCAP, in the next grades. By examining successful assignments and analyzing interviews, this study will provide insight into the experiences of two kindergarten and second grade instructors in teaching writing skills at the foundational level.

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Bluetooth Hacking

Keane Lucas, Chad Speer

With Maj David Caswell, Capt Jason McGinthy (Advisers)

United States Air Force Academy

Bluetooth is a commonly used short-range wireless communications system between many personal electronic devices and peripherals including phones, tablets, cars and other accessories. Bluetooth provides a myriad of services to each of these devices. It is a cheap, power conservative wireless solution to burdensome cables. While almost everyone with a cell phone has a device capable of Bluetooth, few understand how it works or even when it is active. The increasing amount of personal information stored on Bluetooth-capable devices presents a critical security vulnerability should an attacker be able to gain access through the Bluetooth connection. This paper expands on known Bluetooth vulnerabilities create a realistic Bluetooth attack. It then proposes some mitigations for decreasing the vulnerability of Bluetooth.

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**Determination of Growth Conditions of *Ralstonia pickettii*,
an Extremophilic Bacterium**

Mary C. McCullers

With Dr. Katherine L. Bates (Adviser)

Department of Biology, United States Air Force Academy

The objective of this research was to determine the growth conditions of a standard strain of the bacterium *Ralstonia pickettii*. Ideal growth conditions were defined using various metals, salts, acids, bases and common disinfectants. *Ralstonia pickettii* grew well in the presence of the metal alloys and often formed biofilms around the metals. A 5M NaCl salt was tested and *R. pickettii* thrived in that halophilic environment. Different molarities of HCl were used to test the lethality of acidic environments. The bacteria grew in the 0.5M environment with a pH of 0.48, but it did not grow as well in the 3M, 6M, and 9M environments, which had -0.07, -0.60, and -1.17 pHs, respectively. Bacterial growth was inhibited in the different molarities of NaOH (1M, 3M, 6M, and 9M). Ethanol, 0.1M CuSO₄, 0.1M FeSO₄, and 0.1M NiSO₄ were tested and proved to be lethal to *R. pickettii*. *Ralstonia pickettii* can be killed using common cleaning products such as bleach and Formula 409 as well. The definition of the halophilic and acidophilic limits of *Ralstonia pickettii* could be useful in controlling a laboratory contamination of this very challenging extremophile.

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**Measuring and Predicting Urban Growth in the Colorado Springs
Metropolitan Area Using Remote Sensing and GIS**

Michael McDonald

Cerian Gibbes

Department of Geography and Environmental Science

University of Colorado Colorado Springs

Urban planning is an area of growing importance. Urban planning determines the amount of sprawl, traffic congestion, environmental damage and other negative effects of urban growth that an area experiences. Additionally, urban planning plays a large role in determining the quality of life experienced by the citizens of the metropolitan area created as a result of that planning. Effective urban planning is dependent upon having accurate, up-to-date and complete information. Measuring and predicting the amount of urban growth experienced by an area is an application of remote sensing in need of further study. The present study will use remotely sensed imagery of the Colorado Springs metropolitan area along with GIS analysis to determine the amount and pattern of growth experienced between 1992 and 2007 and predict the amount of growth for 2007 through 2022. In addition, budget information, specifically infrastructure and

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capital improvement spending for the same time frame, will be analyzed to determine the correlation between past urban growth and spending in these categories. Finally, using the predicted rates of growth in the urban area, the necessary budget changes for infrastructure and capital improvement spending will be determined. The results of this study will provide information to urban planners and other officials responsible for acquiring and allocating resources in the Colorado Springs metropolitan area and a new approach to gathering information to assist future decision-makers.

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Movement Therapy for Parkinson's Disease

Claire McNellan
Kristi Erdal
Colorado College

Current treatment methods for Parkinson's disease, the second most-common neurodegenerative disorder, focus primarily on pharmaceutical approaches. This review examines the extent to which these symptomatic treatments can be replaced or enhanced by movement therapy. In animal models of Parkinson's disease, exercise results in increased dopaminergic activity, beneficial structural changes and diminished immune response. These neural changes are demonstrated behaviorally via motor improvements in both animal models and humans with Parkinson's disease. Dance is one of the most promising movement therapies, likely due in part to activation of the Action Observation Network, external cueing and cognitive engagement. This review concludes that research should continue to develop quantifiable measures of improvements in mobility, dance therapy technique and an understanding of the mechanisms by which both watching and performing dance can lead to neural and behavioral changes.

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How Shame Affects Writing

Taryn Miller
With Michelle Neely (Adviser)
Department of English, University of Colorado Colorado Springs

Shame has a big effect on our lives, yet no one ever wants to talk about it. Brene Brown is one of the most famous shame researchers, defining it as a "fear of disconnection" in her book *I Thought It Was Just Me*. She also discusses how much of shame has to do with our fear of how others perceive us; yet, she does not go into the role that shame plays in writing. This study stems from Brown's observations, but it goes deeper by examining how shame affects writers. The responses were mostly taken from college students at UCCS, with a few participants who have already graduated college. These

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older participants show that shame is universal. The responses showed where shame in writing comes from and common coping techniques students use to handle it. Responses varied from the avoidance of writing to needing to take a break from writing when the shame became overpowering.

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Transitioning Writing Skills from Academia to the Workplace

Maxine Newton

With Michelle Neely (Adviser)

Department of English, University of Colorado Colorado Springs

Quite often, we hear about the debate of whether a college education is a necessity or not. For certain fields, it is absolutely necessary. But for the vast majority who are not working in their specified field, what skills have they attained from college? My research attempted to determine if the writing skills learned in college are essential to being successful in the workplace. Are these skills useful or are new skills required in the workplace? Using interviews, I established whether workers with college degrees feel more comfortable with the writing they must do at work, than those who do not have degrees, or if there is any difference. My questioning focused on how participants used writing during school and how those skills changed in their current careers. The experiences among my participants are very similar and new skills must be learned within the workplace, regardless of a previous education with writing.

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Bipyridine Decorated Fulvenes: New Ligands and Functional Materials for Organic Electronics

Jaewoo Park

With Endrit Shurdha, Scott T. Iacono and Gary J. Balaich (Advisers)

Department of Chemistry, Chemistry Research Center

United States Air Force Academy

David W. Ball

Department of Chemistry, Cleveland State University

The focus of the work is on the selective and stepwise attachment of functional pyridine and bipyridine (bpy) groups at the 1,3, and 6 positions of the pentafulvene core. Reaction of 1,3-diphenylcyclopentadiene with 4-alkynylbenzaldehyde (EtOH/pyrrolidine) gave 1,3-diphenyl-6-(p-alkynylphenyl)fulvene **1** as a dark red solid. Sonagashira coupling of **1** with 5-bromo-2,2'-bipyridine gave the monosubstituted bpy-fulvene compound. Entry into the synthetic strategy for (bis) bpy fulvenes, in which the bpy is directly attached to the fulvene core, has also been developed using 3-Ph and 3-(p-bromo)Ph 2-cyclopentene-1-ones as starting materials. The reactivity of the lithium reagent as well as the Mg and Ca Grignard reagents of 5-bromo-2,2'-bipyridine with the

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3-Ph and 3-(p-bromo)Ph cyclopenteneones will be compared. Reaction of the bpy cyclopentadienes obtained from this strategy with 2,2'-bipyridine-5-carbaldehyde or 2,2'-bipyridine-4-carbaldehyde (EtOH/pyrrolidine) as well as the coordination chemistry and structure property relationships of the resulting new bpy-fulvene compounds will also be presented.

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Effectiveness of Various Colors on Heads Up Displays

John Pierce, Kenneth Appel, Joseph Dunham, and Kaleb Young
With LCDR Brian R. Johnson (Adviser)

Systems Engineering Program, Department of Behavioral Sciences and Leadership
United States Air Force Academy

Current head-up displays use monochromatic green symbology. However, users may benefit from additional color coded symbology because it would decrease response time while increasing comprehension. This research project investigated different colors that can be utilized in aircraft HUDs. Test symbology was displayed on a mock HUD. The symbols were presented using five different colors specifically, cyan, magenta, red, yellow and green. The symbols were displayed on different background images (e.g., clouds, cityscape) and participant's reaction time to the symbols was measured. There were seven test iterations for each color and symbology shape. Reaction time to the symbology will be used to provide quantitative data to indicate what color is easiest to see based on the background image. The subjects were also asked to complete a survey to identify their least and most preferred display combinations. The goal is to find colors other than green to use in HUDs which would improve pilot's cognition and decrease reaction time.

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Metal Sequestration Processes of *Ralstonia pickettii*

John Rosenberg, Sarah Galyon Dorman
With Dr. Katherine Bates (Adviser)

Department of Biology, United States Air Force Academy

A preliminary study was conducted to further understand the effects of *Ralstonia pickettii* on the fatigue life of metal alloys and to determine the qualitative and quantitative aspects of metal-ion sequestration by the bacterium. Two strains of *Ralstonia pickettii* were cultured in media containing Fe^{+2} , Ni^{+2} , and Cu^{+2} , and the amount of ions sequestered by the bacteria were measured via an inductively coupled plasma optical emission spectrometer (ICP-OES). The amount of ions sequestered by the two strains of *R. pickettii* was compared to the amount of ions sequestered by *E. coli* and *E. aerogens* under the same conditions. *Ralstonia pickettii* sequestered Fe^{+2} the

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most at 4.149 ppm, while the amount of sequestered Cu^{+2} and Ni^{+2} was -0.079667 and -0.087807 ppm respectively, subtracted from the standard in the laboratory. The amount of sequestered Fe^{+2} was determined to be statistically significant. Further analysis revealed that Fe^{+2} oxidized in solution and became rust. These observations suggest that *R. pickettii* enhances the fatigue life of alloys by removing rust, or oxidized ions, from the structure more than reduced ions.

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The Tower of London Drexel, Manual VS. Computerized

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The Tower of London Drexel is a problem-solving task, originally designed by Eric Zillmer and William Culbertson (1998), which is intended to measure deficits in executive functioning. The Tower of London Drexel assesses participants' ability to conceptualize change, respond logically and maintain attention, as well as the ability to generate and select alternative means of problem solving. Executive functioning is localized in the frontal lobes and therefore deficits in functioning when completing the TOLDX can reveal abnormalities in frontal lobe function. The TOLDX manual consists of two boards, one for the examiner and one for the participant. The examiner creates a variety of patterns using three different colored beads (red, blue and green) and the participant recreates the pattern on their own board. The goal of TOLDX is to complete the puzzle in as few moves as possible, while following each rule, such as stacking only the amount of beads that can fit on a peg and not picking up more than one bead at a time and without exceeding two minutes or 20 moves. The examiner records the number of moves made, the time spent planning before the first move is made, the total time taken to solve the puzzle, as well as any time or move violations. I will present correlations comparing the manual version of TOLDX with the computerized version to assess the differences in participants' performance. While both versions assess the same aspects of planning, either one could be affected by a number of variables, such as mental flexibility and attention span, and therefore not accurately measure a deficit that the other version might.

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The Effects of Prenatal Stress and FGFR2 on Anxiety and Locomotion and the GABAergic System in the Hippocampus

Abigail Sawyer
Lori Driscoll
Colorado College

Prenatal stress influences the development of neurotransmitter systems and biases neural systems toward the expression of developmental and adulthood psychiatric

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disorders. The GABAergic system, the main inhibitory neurotransmitter system in the brain, is impacted by PS, particularly in the hippocampus; it is through this interaction that PS may modulate psychiatric outcomes. Fibroblast growth factor receptor 2 (FGFR2) controls a wide variety of functions throughout the lifespan, and could be the mediator between PS and its effects on the GABAergic system. The study examined PS mice with a knockout of the FGFR2 gene to explore the interaction of these factors on anxiety and locomotion. PS animals were more anxious than non-stressed animals, and non-stressed animals were more impacted by the anxiogenic effect of the FGFR2 manipulation than PS animals. In the locomotion test, NS animals were unaffected by the FGFR2 manipulation, but PS animals were hyperactive with the FGFR2 KO. The current study shows some inconsistencies with past literature and future work must be done to clarify the relationship between PS, FGFR2 and the GABAergic system. This study does emphasize the complex nature of the interaction between environmental influences and genetic deficits, and offers one model for the development of certain psychiatric disorders.

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**The Effects of Lipases on Influenza Activity: A Potential Explanation
for the Disease Process in Waterfowl**

Justin C. Scheidt

With Lt Col Marcus D. King (Adviser)

Department of Biology, United States Air Force Academy

This study aims to identify and to characterize the interaction of secreted bacterial lipases with influenza virus to determine if lipolytic destruction of the virions limits the extent of influenza A infections in waterfowl. Currently, 20 species of bacteria have been identified as potential lipase-secreting candidates for investigation. Ongoing research is being conducted to create a more reliable and less expensive means to identify lipase-secreting bacteria. In addition, we are developing a lipase-targeting zymogram to characterize the enzymes so that we may understand their effects, not only on the virus, but also on the host cells. Through a better understanding of the microbial ecology associated with the avian enteric environment, with special consideration given to the interactions between avian influenza and other members of the microflora, new prevention and treatment methods may be developed.

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Expert vs Novice Eye Patterns in Operation of Raven Remote Piloted Aircraft

Jonathan Schneider, Matt Croghan, Grant Urbon, Garrett Manley, Barrett Stehr
With LCDR Brian Johnson (Adviser)
Department of Behavioral Science, Systems Engineering Program
United States Air Force Academy

The experiment investigated how eye-tracking patterns differ between expert and novice operators of a remote piloted aircraft. Previous research has shown that experts have more defined eye patterns in manned flight (Kasarkis et al.,2001). However, a comparison has not been analyzed with RPAs. Participants operated the RQ-11B Raven on a controlled mission profile, while being monitored by the EyeTech Digital Systems TM3 eye tracking device. Various elements of the mission such as banking were monitored extensively for eye movement differences between experts and novices. Specifically, eye tracking data such as saccades and dwell time were monitored during in flight procedures. Any observed differences in eye movement between experts and novices can help with future training of RPA operators.

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Synthesis and Characterization of Mixed Metal Oxide Aero and Xerogels

Matthew S. Schneider
With Dr. Margaret H. Rakowsky (Adviser)
Department of Chemistry, United States Air Force Academy

High surface area metal oxide gels are a new and rapidly expanding field of research. Possible future areas of application for high surface area metal oxide gels include: heterogeneous catalysts, photoelectric cells, gas storage and separation. Here, we created mixed metal oxide aerogels and xerogels using epoxides in sol-gel synthesis. Metals used in gel synthesis were Al, Ce and Pr. Gel porosities and structure were characterized using scanning electron microscope and powder x-ray diffraction.

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Biocultural and Genetic Factors used in Osteoporosis Risk Assessment

Claire Smith
Dr. Krista Fish (Adviser)
Colorado College

Previous studies suggest that patterns of bone loss and incidence of fragility fractures observed in age-related and post-menopausal osteoporosis today were not evident in

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ancient human populations. It is hypothesized that this change is related to less demanding physical labor in modern, more technologically advanced societies, resulting in less robust skeletons. Additional studies emphasize the importance of acquiring maximal bone mineral density through modifiable behavioral practices during childhood and adolescence in order to help prevent geriatric onset of osteoporosis. The purpose of this study is to examine the biocultural and genetic risk factors medical professionals consider when assessing osteoporosis risk and to evaluate if the appropriate age demographic is targeted for osteoporosis education. Thirty-three medical professionals participated in a structured survey consisting of 20 questions regarding critical risk factors for determining osteoporosis risk. Survey results indicate that diet, vitamin D intake, physical activity level, history of low BMI, and cigarette smoking status are among the most important developmental factors considered when evaluating patient risk. Professionals emphasize that the interplay between these modifiable factors significantly influences individual risk. A patient's age, sex and past medical history are also important, albeit non-modifiable, factors. Results suggest that medical professionals adequately educate young female patients about osteoporosis risk and bone health. Examining the factors that contribute to the incidence of osteoporosis in modern human populations is crucial for understanding and preventing this debilitating disease.

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Population Differentiation in *Impatiens capensis* at the Southern Range Limit

Holly Swedlund
Shane Heschel
Colorado College

As a consequence of climate change, plants will experience altered environments which will result in novel stresses for plant populations. Drought tolerance and avoidance are important mechanisms to study the capacity for plants to persist in novel environments. Drought avoidance involves growing and reproducing before the onset of the drought. In contrast, plants that exhibit drought tolerance tend to produce offspring later in the season and make physiological adjustments to tolerate stress. The ability of wetland annual *Impatiens capensis* to avoid or tolerate stress provides a model for examining how plants might deal with novel stresses. *I. capensis* is sensitive to soil moisture levels due to its lack of significant cambium, a thick cuticle and significant prop roots. Different populations of *I. capensis* inhabit various environments including the Rocky Mountains, the Midwest, and the east-coast of the United States. Each population exhibits distinct physiological and morphological traits that allow for the species to persist in these particular environments. A previous study examined the stress response of *I. capensis* from three different regions in the United States and found that different regional populations have each evolved differently and utilize unique strategies to survive in drought conditions. Our study examined the stress response of *I. capensis* from three individual sites in the southern portion of the *I. capensis* range. Based on the unique responses observed in the plants from sites classified as pond, clearing or woods, our

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findings provide evidence that the adaptive strategies these plants utilize to survive not only differ depending on the specific region they inhabit, but also differ depending on their specific habitat within that region. Its ability to make specific morphological and physiological adjustments for particular habitats suggest that *I. capensis* is a highly adaptive species and is capable of surviving across a variety of geographic and environmental conditions.

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College vs. Real World: Taking a Look at How Writing Changes after Graduation

Taylor Valachovic and Lindsey Jobe

With Michelle Neely (Adviser)

Department of English, University of Colorado Colorado Springs

As students attend college at the undergraduate and graduate level, writing becomes a major part of their lives because they receive numerous writing assignments, but not everyone in college writes to the same degree in and out of school. The research team asserts that this is because the requirements of writing in a work setting are less than that of a college setting. The study we developed focuses on the importance undergraduate students and those who have graduated college place on personal writing (fictional, poetic, journal writing, etc.) and professional writing (reports, persuasive, research writing, etc.). We will utilize interviews and surveys collected from current and former college students to determine how frequently undergraduates and graduates write personally and professionally.

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On-Line Writing: A Look at the Habits and Motivations of Writers in an Interest Sharing Online Forum

Terrence Vaughan

With Michelle Neely (Adviser)

Department of English, University of Colorado Colorado Springs

This study looks at the motivation and posting habits of people who post regularly in online interest-sharing forums. Focusing on several forums with a common subject and membership numbers ranging from the tens of thousands to more than 200,000, the study recruited subjects who are members of a forum and post on a regular basis. In this study, I attempt to analyze the writers' habits and motivations by correlating multiple factors such as education levels, posting frequencies, their self-image within the forum, and their perception of how others in the forum view them.

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Secure Enclaves - Enabled Technologies

Derek Sandblom, William Vine and Benjamin Vowell

With Maj Nick Mastronardi (Adviser)

Department of Management, United States Air Force Academy

In today's increasingly digital world, more and more sensitive information is stored electronically, and more and more often this information comes under attack. With the continual evolution of offensive attack techniques, the need for more impressive defensive counter-measures is becoming apparent. As the requisite to fill this capability gap grows, so does the opportunity for businesses. Replacing the need for a counter-measure, recent developments in micro-processor technology have created a veritable impenetrable fortress to be placed inside modern day computer systems. The answer lies in Secure Enclaves - Enabled Technology, a software company that utilizes Intel Labs' revolutionary Software Guard Extensions technology. Instead of relying on encryption and software, this technology is hardware-based, and is so secure that an NSA Red Team could not crack it. This technology has tremendous application to both government and private organizations concerned about security. For completing a proof of concept case with the Department of Veterans' Affairs, Secure Enclaves - Enabled Technologies will receive \$500,000 that it will channel into the development of a commercially available security software package.

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Synthesis and Characterization of Carbon Aerogels

Adam Walker

With Dr. Margaret Rakowsky (Adviser)

Department of Chemistry, United States Air Force Academy

Carbon aerogels have useful properties including high porosities, surface areas and pore volumes. Carbon aerogels can have exciting properties when infiltrated with other compounds. The absorption of materials into carbon based aerogels has already been accomplished with MgH_2 . The focus of this study was primarily on tailoring the properties of the aerogel to maximize the amount of wetting or infiltration that can occur. This testing involved various changes to the synthesis to optimize surface area or adsorptions. The basic steps of synthesis were the curing of the resorcinol formaldehyde gel, drying, pyrolysis or carbonization which was done at high temperature and finally activation. The last two steps in synthesis were the focus of the study. The carbonization had the greatest effect on the density and pore characteristics while the activation step was tailored to change the functionality of the aerogel to make infiltration with other materials possible.

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An Analysis of the FalconSAT-6 Structural Engineering Model

Meredith Wilmer

With Lt Col David Barnhart (Adviser)

Department of Astronautics, United States Air Force Academy

The FalconSAT-6 (FS-6) Program at the United States Air Force Academy (USAFA) is a capstone class for cadets where they work together with faculty to form an integrated aerospace company to pursue the design, build, test and fly aspects of a space system, as well as taking care of the planning, scheduling, training for, and executing real world satellite operations. The Mechanical Team was tasked with completing the System Engineering Model 2 (SEM-2) Vibration Test. The purpose of the SEM-2 test was to qualify the structural design of FalconSAT-6. SEM-2 consists of a flight-like structure with engineering development unit components and mass simulators to represent avionics parts, designed and built to have the key characteristics of the structural and avionics configuration of the flight model. The SEM-2 structure was fabricated and assembled using flight processes and materials, designed to match the flight model in form, fit, and function. During the test, low level sine vibration sweeps were used to characterize structural response. Strength testing was conducted via sine burst loading. The structure was subjected to a random vibration environment to demonstrate the fatigue life of the vehicle structure. The qualification-level, sine-burst, static loads test was successfully performed in each axis.

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Outside Tradition: A Study of Non-traditional Adult Students of the English Major

Nicole Winter

With Michelle Neely (Adviser)

Department of English, University of Colorado Colorado Springs

This study explores the experiences of non-traditional students who, as defined by the National Center for Education Statistics, include students who have not immediately continued their education after high school graduation, attend college only part time, work full time (35 hours or more per week), are financially independent, have children or dependents, are single parents, have GEDs rather than high school diplomas. The focus of this research will specifically involve returning adult learners within the English major at UCCS. This study aims to learn the ways in which this growing group of students attempts to pursue their undergraduate degree while also meeting the responsibilities of full-time work, running a household and rearing children. The study will also seek to discuss the scope in which their professional and personal lives influence their ability to participate in the classroom.

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We Are Noise

Brent Wollman
Jane Rigler

Department of Visual and Performing Arts, University of Colorado at Colorado Springs

Our mind's machinations rattle relentlessly, tangled in self-indulgent vices: recognition, success, control, dominance. Systems grind against each other, tragically unaware, damaging the whole. We live as a beautiful cavalcade of interruptions, treacherous and sublime. Embodying so much noise, peace becomes a fleeting refuge. This project is an immersive live electronic music concert involving original compositions and a small ensemble of performers. The show features a narrative that abstractly portrays a character's scuffles with self-destructive tendencies. Imagine the grumble of timeless warfare in the distance. Melodic shape shifters unfold from bomb shell shadows. Even in the lull, instinct continually voices its beguiling calls, and the human spirit dances with the beast, no longer content to be devoured. We will immerse ourselves into the noise of our fears and desires. How else can we learn to tame them?

~50~

Potential Mechanisms of Avian Influenza A Virus Persistence as a Contributing Factor to Human Adaptation

Matthew B. H. Williams
Marcus D. King
United States Air Force Academy

The objective of this research was to identify protease-secreting bacteria in the intestinal microflora of the Northern Bobwhite Quail (*Colinus virginianus*) in order to understand the effects that the secreted enzymes have on the hemagglutinin proteins of the Avian Influenza A (H7N9) virus. To date, 39 isolates from 5 bacterial species have exhibited proteolytic activity. A thorough characterization of respective isolate protease HA0 hydrolysis products as well as other resident activities (e.g. lipase) is ongoing such that the role of these respective contributors in virus activation/inactivation can be firmly established. These activities may reflect ecological and host environments in which these viruses persist and replicate, and the activities may also be a contributing factor in the ability of new viruses to transmit or adapt to new species, to include humans. A thorough understanding of protease found in natural sites of infection is necessary to derive insight into mechanisms of pathogenicity, mechanisms of perpetuation, and ease of cross-species transmissibility.

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Oral Session II

(1-2 pm)

Exploration of Narrative

Room: L-1

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Satisfaction, Shame

Rebecca Hamilton

Claire Rau

Department of Visual and Performing Arts, University of Colorado Colorado Springs

While it may seem as though there is a gaping dichotomy between the feelings that one has in regard to satisfaction and shame; the two go hand in hand. Consumerism, sexuality, career, personal and social mores, and many other topics battle this separation. My work during the past three years has examined and discussed the fluidity of gaining satisfaction in a given situation and then feeling guilt -- either simultaneously, immediately or during a longer period of time.

~

Daoist Themes in Malick's *The Tree of Life*

Jack Johnson

With Professor Robert von Dassanowsky (Adviser)

Department of Visual and Performing Arts, University of Colorado at Colorado Springs

In this paper, I discuss implicit and explicit Daoist themes in the film *The Tree of Life* (USA 2011) by examining the biography of director Terence Malick and presenting Daoism and the Daoist concerns raised by visual symbol and narrative. The film's themes of cosmos, nature and grace are explored and analogized along the Daoist concept of yin and yang. I apply this cosmology to the formalism of the film — its story unfolding against the backdrop of the universe's beginning and ending, and the Daoist reasoning behind the presentation of the O'Brian family, whose lives are chronicled in the interval cosmic time. Ultimately, I consider my analysis of the film in light of other non-Daoist readings of Malick's work.

~

Puerto Rican Representation in West Side Story

John Garrett

Bill Bannister

University of Colorado Colorado Springs

My senior thesis will raise the question of whether the producers of the film West Side Story could represent the Puerto Rican voice and culture more authentically, if given the chance within the United States of the 1950s. My thesis will explain the creators of West Side Story reduced the authentic Puerto Rican voice and experience to that of the generic immigrant experience of the 1950s, solidifying negative stereotypes of Puerto Rican culture. The argument is the West Side Story creators reproduced depictions of Puerto Ricans as immigrants which mirrored images, popular of the sociological and ethnographic literature studies since published in 1950s and 1960s. Nonetheless, West Side Story did depict aspects of Puerto Rican American lives which validated some of their social realities. My historiography covers three specific culture genres of Hollywood, common American academic and sociological essays and books and popular culture, all within the specified time of United States society in the 1950s and early 1960s.

Airdrops

Room: L-2

~

Sub-size Specimen Fracture Toughness Analysis of 7050-T7451

Ralph Bush and Michael Lee

Department of Mechanical Engineering, United States Air Force Academy

Subsize compact tension 7050-T7451 fracture toughness specimens were tested using a method proposed by Haynes and Gangloff and based on ASTM Standard Test Method E1820. This test method utilizes potential drop probes to detect the initial crack advance in advances as small as 27m in conjunction with an elastic-plastic data analysis procedure. Test specimens with a W dimension of 1.5" and thicknesses of 0.25" were used to verify the usefulness of this test method in comparison to ASTM E399. Measurements from this study were compared to plane strain fracture toughness

values of 7050-T7451 plate using ASTM E399. It is shown that the results of this study are within 2% of the values generated with more accepted test practices. The variation in fracture toughness with respect to position throughout the plate matched results from a previous study by DeJong.

~

Precision Airdrop Instrumentation Development

Jacob Ceynar, Jared Greene
With Lt Col Richard Buckley (Adviser)
Department of Mechanical Engineering, United States Air Force Academy

As part of a larger program to improve the reliability and accuracy of high-altitude air drop missions, extensive modeling is being done to improve the release point prediction to include the inclusion parachute deformation and stratified wind predictions. In order to validate modeling of bundles free falling and under parachute canopy, a high accuracy, low-cost data acquisition system is needed to record data during actual airdrop tests. An Arduino-based system was developed that incorporates GPS based time, position, velocity data, temperature, barometric altitude, and accelerometer data. The system has gone through two design iterations and has successfully been implemented on both a skydiver and an airdrop bundle. A user interface is also used to visualize the data.

~

Precision Airdrop

Jeremy Butler, Craig Phelan, Zebulon Kimball, Cameron Igawa, David Moore,
Connor Higgins, Joseph Abakunda, Arthur Williams
With Lt Col Jeremy Noel, Lt Col Timothy Pettit (Advisers)
Department of Operations Research, United States Air Force Academy

The military can use airdrops to deliver supplies to ground troops at an exact location and time, in a process called Joint Precision Airdrop System. The cost of such an act is not sustainable, however. Precision Airdrop Capstone will therefore provide insight for alternatives to JPADS which will achieve similar accuracy with decreased cost. The first aspect is performing cost-benefit analysis on different mission profiles. We will augment a template from which planners can make decisions on the most efficient methods of airdrop resupply given mission-specific precision requirements. The second aspect is validating or refuting a current airdrop assumption that the SC_d coefficient remains constant throughout the parachute's flight. S is the area of the parachute and C_d is a coefficient representing the parachute's porosity. We will assess this assumption through scaled airdrop tests using data acquisition units and cameras to correlate

changes in wind with changes in the shape of the parachute. The results and findings have not come to fruition yet as testing for the project was done on 18, 19, and 20 February in Eloy, Arizona. As soon as the data is recovered in a suitable form, assessment with our pre-built model will begin.

Energy and Awareness

Room: L-3

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Geometric Flywheel Optimization for Grid-Scale Energy Storage

Dustin Wallace

With Maj Cody Rasmussen; Capt Michael Richards (Advisers)
United States Air Force Academy

The viability and utility of condition-dependent renewable energy sources such as wind and solar are largely dependent on the ability to store excess energy harvested at off-peak hours to match supplies with demands placed upon the grid. While numerous technologies for providing this capacity across the various forms of energy are in development and use, one promising method is to store the energy in kinetic form by utilizing large flywheels. Thick-walled cylindrical flywheels currently provide almost all grid-scale kinetic storage, so an investigation was launched into the stress-limited geometric optimization of a rim-and-spoke configuration on the basis of specific usable energy density. Early calculations on such a configuration showed the theoretical ability to compete with commercially operational flywheel systems by achieving a specific usable energy density on the same order of magnitude. With no method to account for manufacturing and operational costs however, economic viability predictions remain outside the scope of this study, largely reducing the investigation to an academic exercise focused on developing valuable research skills for future implementation.

~

Investigation of Manganese and Iron in Groundwater surrounding Shuree Ponds in the Valle Vidal Unit of the Carson National Forest

Christopher A. Morales

With Thomas J. Phelan (Adviser)
United States Air Force Academy

The United States Forest Service Southwestern Region has been responsible for a diesel fuel contamination site in the Carson National Forest since 1990. The Forest Service has been unable to achieve site closure due to levels of dissolved iron and manganese historically higher than New Mexico groundwater standards. This presentation details the development of a site conceptual model designed to aid the

Forest Service in their understanding of elevated iron and manganese concentrations and help develop a remedial action plan for future work at the site. During the summer of 2013 water and soil samples were collected from the site and analyzed to determine the source of elevated manganese and iron concentrations in groundwater. The results indicate that the levels of iron in groundwater no longer exceed state regulatory levels and only one monitoring well out of five has elevated levels of manganese. Further analysis of the site conditions and data suggest that reducing conditions due to anaerobic biodegradation of trace amounts of fuel hydrocarbons are responsible for the elevated levels of dissolved manganese. Implications of this finding as well as recommendations for future site activities are presented as well.

~

Sustainability Conversations

Felicia Dupont, Del Greywolf, Laura Parsons, Sam Twynam, Linda Watts
Department of Anthropology, University of Colorado Colorado Springs

Our group conducted interviews with people from various backgrounds which exposed divergent viewpoints and perceptions. These individuals also showed very different levels of awareness regarding natural resources, alternative energy, natural foods and GMO's, sustainability and other environmental issues. Using NVIVO 10 Ethnographic discourse Analysis Software has allowed us to map a range of perspectives and uncovered a discourse chasm regarding sustainability and natural resources. Is there a bridge as well?

Race in America

Room: L-4

~

An Examination of the Watts Riot

Nano Dolce
Christina Jimenez
Department of History, University of Colorado Colorado Springs

The topic for my senior thesis paper revolves around the events of the Watts Riot. In terms of race relations in this country, few events have provided such profound legacies and symbolized so much more than the actual event. The Watts Riot virtually ended the

era of pacifistic, peaceful protests to discrimination and ushered in the era of militant, violent action to produce stronger results for the black community. After the fire died down from the weeklong episode, many Americans viewed it as simply another race riot. However, a few scholars asserted that the riot demonstrated more elements associated with class struggle than racial discontent. Through my paper, I will attempt to show that the socio-economic factors in Watts are compelling and possibly the most dominant factor that precipitated this sad chapter in American history.

~

Louis Armstrong: A Revolutionary for the Civil Rights Movement?

Anna Rozsa
Christina Jimenez

Department of History, University of Colorado Colorado Springs

Louis Armstrong was an innovator in American music with his ability to play the trumpet on a scale that no one else could quite copy. He was also an actor, entertainer, singer and a goodwill ambassador for the United States. Americans, both blacks and whites, loved Louis Armstrong and he became one of the most popular black artists of his time. Armstrong subtly, and later actively, used his influence as America's musical hero to speak out for civil rights. He simultaneously broke down barriers of racism by introducing jazz to mainstream America. Armstrong transitioned from a well-known jazz artist to an advocate for civil rights because he spoke out directly against the actions the United States government took in enforcing racial inequality during the civil rights movement.

~

Significance of Art during the Chicano Movement in Denver, Colorado

Maria Cordova
Christina Jimenez

University of Colorado Colorado Springs

Art expressed the communal struggle of La Raza (Chicanos/Mexican-Americans) during the Chicano Movement of the 1960s and 1970s. Art, including poems, songs, stories and murals allowed history and culture to be preserved and transmitted to future generations. These different art forms created during the Chicano movement acted as a catalyst to unite the Mexican-Americans in the fight against injustice. Chicanos faced severe restrictions within the public school system. Chicanos were forbidden to speak Spanish in school. Chicano studies were not recognized or taught. Many Chicano students were limited to classes they could enroll in and ended up in the industrial arts. These educational limits extended into employment opportunities resulting in agricultural and industrial jobs that offered diminutive gains. Through visual, fine,

musical, and written art Chicanos created a voice that demanded cultural respect, an inclusive educational experience and better job opportunities.

Aircraft, Math and Space

Room: L-5

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Flight Line of the Future - Using 3-D Printing for Aircraft Battle Damage Repair

Rachel Stecher, Deborah Kim, Gavin Owens and Hache Stossmeister
With Lt Col Tim Pettit (Adviser)
Department of Management, United States Air Force Academy

Grounded aircraft in the combat zone cost the Air Force money and mission capability. Current Aircraft Battle Damage Repair techniques are slow, inexact, costly and labor intensive. The Flight Line of the Future project evaluates the application of 3-D printing technology in deployed locations to reduce aircraft downtime and hasten repairs of aircraft battle damage. Currently, deployed engineers address battle damage by performing temporary fixes in order to increase availability of airpower in the short-term. Cost and time are critical components in the analysis of how to integrate 3-D printing techniques into current Air Battle Damage Repair capabilities. 3-D printing represents swift fabrication of custom parts for individual aircraft. With the application of 3-D printing in deployed locations, battle damage engineers and depot engineers could benefit from increased availability of combat power, decreased operational costs and improved quality of life.

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Characterizing the Cyclic Groups by Subgroup Indexes

Victoria Slattum
Greg Oman
University of Colorado at Colorado Springs

In this note, we prove that an arbitrary group G is cyclic if and only if distinct subgroups of G have distinct indexes in G .

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Control Strategies for Debris Avoidance in Spacecraft Formation Flight

Mike Grimmer
With Lt Col David Richie (Adviser)
United States Air Force Academy

As of 2014, there are 17,000 trackable objects orbiting Earth larger than a coffee cup, with NASA estimations around 500,000 pieces of debris of all sizes, ranging from a paint fleck to the ISS. All of these objects pose potential threats to satellite constellations; the problem is further exacerbated when formation flying spacecraft are involved. Recent studies in spacecraft performance have lauded the advantages of formation flying, including increased flexibility, lower cost, more versatility with launch vehicles and graceful degradation via distributed functionality. This paper will investigate active disturbance rejection control and how this robust control method can be applied to better formation flying spacecraft in regards to debris avoidance. Through active disturbance rejection control, the complex mathematics surrounding maneuvers in formation can be simplified to better counter adverse disturbance torques from space debris. It will minimize the difference between the desired system state and error derived from the perpetual disturbance torques acting on the spacecraft. These control strategies can be applied to the Air Force Academy's future FalconSAT missions (in both ESPA-class and CubeSAT-class configurations) and can be further incorporated into testing programs like MIT's SPHERES project.

Management and Government

Room: L-6

~

Colorado Springs Police Department Criminal Activity Tracking System

Joel Cramer, Evan Gros, and Royce Schertz

With Maj Jesse Pietz (Adviser)

Department of Management, United States Air Force Academy, CO 80840

Predictive and intelligence-led policing uses smaller police forces to protect and serve larger populations and is without a doubt the way of the future. The real problem of intelligent policing is linking useful data analysis to effective methods of policing. Last year a group of USAFA cadets created the Repeat Offender Model as a tool for the Colorado Springs Police Department. ROM uses an actively updated system, called

Law Enforcement Records Management System to operate within CSPD. For this project, a dataset of more than a million data points, provided by CSPD, will be used to simulate LERMS. Based on these data, we update and improve ROM in order to make it more effective and useful for CSPD. Major improvements to this model include a data scrubbing system, an automatically updating incarceration data so that incarcerated individuals are accounted for in the model, and integrating juvenile and adult records of the same individuals.

~

Playing Fair: An Analysis of Social Class Disparities in Accessibility to and Quality of Denver Playgrounds

Lauren Dinsmore
Gail Murphy-Geiss
Colorado College

This thesis is as an exploratory study of some of the environmental justice issues at work in the built environment of Denver, using data available through the county of Denver. This research provides insight into the complex interplay between access to and quality of playgrounds. Using GIS and STATA, analysis was conducted on playground accessibility, playground quality and Census tract demographics. Poverty was the only indicator of playground accessibility and poverty was the only demographic variable associated with quality of playgrounds. Quality findings reveal the county of Denver has provided equitable safety and condition features across the board to neighborhoods, but a larger poverty effect is at work regarding the cleanliness and overall quality of playgrounds.

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Colorado Springs Airport Ridership Analysis

Kassie Gurnell, Helen Jantscher, Hannah Peterson, and Anthony Riel
With Maj Jesse Pietz (Adviser)
Department of Management, United States Air Force Academy

Colorado Springs Airpor has been suffering from a trend of losing customers to Denver International Airport . This negative trend along with recently losing one of the bigger airlines that flew into COS has been highly unfavorable for the airport in its regional market. Many travelers living close to COS are choosing to drive the extra distance to fly out of DEN. In this project, we analyze data collected on United States Air Force Academy travelers and develop a Multi-Attribute Decision Making model in order to gain insight on the factors that are most important to USAFA travelers when selecting a departure airport. We expect that our analysis will help COS gain more customers and become more competitive in the airport market.

Poster Session II

(2-3:30 pm)

Room: Falcon Center

~ 1 ~

The Effect of Audio, Visual and Heat Stimuli on Pilots

Blake R. Abrecht
With Capt. Jeffrey Newcamp
Department of Aeronautics, United States Air Force Academy

This experiment tested the potential effects of audio, visual and heat stimuli and how these stimuli affect pilots during high cognitive workload (critical) phases of flight. This research began in response to the development of a system designed to prevent airborne birdstrikes for the United States Air Force. The experiment tested pilots flying a Calspan 4000 flight simulator while performing tracking tasks and secondary cognitive tasks with external stimuli present. The external stimuli included a 90 dB goose distress call and a 600 watt aircraft landing light flashing at 0.75 Hz positioned five feet in front of the pilot at a 45 degree angle that increased surface temperature by 11 degrees Fahrenheit during the 90-second test period. All pilots had a minimum of 10 logged flight hours in varying aircraft and participated in two trials with the external stimulus present and two control trials without the stimulus present. The results of this study indicate that with this specific combination of audio, visual and heat stimuli present, pilots' tracking task performance remained relatively unchanged. However, pilots' secondary cognitive task performance decreased with the presence of these external stimuli. Because of the drastic difference in experimental conditions versus actual flight conditions, it can be concluded that this combination of stimuli is safe to utilize in any anti-birdstrike system intended to be implemented on an aircraft.

~ 2 ~

Prevalence and Ecology of *Ralstonia pickettii* Contamination in the Mechanical Engineering Laboratory at the U.S. Air Force Academy

R. Daniel Barbera, Sarah E. Galyon Dorman
With Katherine L. Bates (Adviser)
Department of Biology, United States Air Force Academy

The goal of this research is to locate the source of *Ralstonia pickettii*, a bacterial contamination found in the U.S. Air Force Academy Mechanical Engineering Laboratory, in order to prevent its harmful effects on future engineering experiments. Specific areas of the laboratory were sampled in an attempt to locate the source(s) of *R.*

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pickettii. Selection of sampling locations considered *R. pickettii*'s affinity for salt, acidity and metal. Upon sample collection, individual species were cultured and isolated using common TSA agar. Gram-negative colonies were analyzed using a VITEK microbial identification system, attempting to confirm the identity of the bacteria as *R. pickettii*. Identification of the contamination source will present the opportunity to eradicate the undesirable bacteria from the laboratory so that future engineering experiments may continue without the anti-corrosive properties of *R. pickettii*.

~ 3 ~

Comparative Study of Chlorogenic Acid Concentrations in Foods: Fresh Fruit, Canned Fruit, Fruit Juices and Coffee

Santiago Bukovsky-Reyes

Katherine E. Buxton, Janel E. Owens

Department of Chemistry and Biochemistry, University of Colorado Colorado Springs

Chlorogenic acid is a secondary plant metabolite with purported health benefits. The objective of this study was to compare foods prepared with five extraction protocols prior to instrumental analysis by high performance liquid chromatography with diode array detection. It was determined that microwave-assisted extraction (MAE; 5 min, 80 °C, methanol/water solvent mix at pH 2.5) was optimal for extracting CGA from solid foods (canned fruits, green coffee beans, fresh fruits) while using a dilute and filter approach was useful for beverages (juices, cider, brewed coffee). Concentrations of CGA in beverages ranged from 7.6 µg/mL (peach cider) to 61.8 µg/mL (peach nectar). Solid foods prepared by MAE had CGA concentrations ranging from 6.9 µg/g (fresh peaches) to 34.8 mg/g (green coffee beans). A stability study was completed to demonstrate that CGA was stable in methanol or fruit juice during 11 days.

~ 4 ~

Controlling Competing Organic Reactions

Chris Butler

Dr. Allen Schoffstall

Department of Chemistry and Biochemistry, University of Colorado Colorado Springs

The multistep synthesis of 3-(4-methoxyphenyl)-propynoic acid from p-methoxy cinnamic acid has proven to be very difficult due to the strong activation energy of the methoxy substituent. First a Sn2 dibromination across the cinnamic bond must occur. Many procedures found in the literature yielded products not only brominated across the cinnamic bond but bromination would also readily occur across the phenyl ring as well. Many parameters of the reaction had to be augmented including brominating agent, solvent, temperature, and time for the reaction to take place. Once this product was achieved in excellent yields, the next step would involve an E2 followed by an E1 reaction to remove both bromines from the cinnamic bond in order to produce a triple bond alkyneic acid. This also proved to be difficult; the elimination with a strong base would produce a terminal bromoalkene void of the carboxylic acid. The main

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parameters that had to be changed in this case were temperature of the hydration of the carboxylate salt and the strength of the hydrochloric acid used. Once the desired product was achieved, it could now be used in a regio selective 1,2,3-triazole copper catalyzed cyclo-addition synthesis.

~ 5 ~

**The Effect of Diminished *MLCK* Expression in Response to
PRR15 Knock-Down**

Samuel N. Coen

With Lt Col Ryan W. Maresh (Adviser)

Department of Biology, United States Air Force Academy

The objective of this study was to evaluate the expression of *Myosin light-chain kinase (MLCK)* following the knock-down of the gene *PRR15*. *PRR15* plays an important role in mammalian development by controlling downstream genes such as *MLCK*, for which abnormal expression is associated with various adult pathologies. Using real-time PCR, *PRR15* knock down cells were compared to control cells with normal functioning *PRR15*. Elucidating the relationship between gene expression and placental insufficiency will facilitate understanding of how the fetal environment influences the onset of certain diseases in adulthood.

~ 6 ~

**Thermodynamic examination of the ion effect and cellular
crowding on nucleic acids**

Hallie Comfort, Neena Grover

Department of Chemistry and Biochemistry, Colorado College

Ions play essential roles in forming functional RNA structures and can act as nucleophiles to facilitate RNA catalytic reactions. Under physiological conditions, RNA folding requires relevant ions such as potassium and magnesium. Nearly 30 percent of the cellular volume is occupied by ions and macromolecules. Cellular crowding affects the stability of nucleic acids by changing the availability of ions and water (excluded volume effect). To mimic cellular conditions, polyethylene glycol (PEG) is used as a "crowder." RNA folding experiments on Group I introns in the presence of PEG show formation of more compact RNA structures at lower concentrations of magnesium ions. In this study, we are using the pyrophosphate sensor helix of the thiamine pyrophosphate (TPP)- binding riboswitch to examine the ion and crowding effects on small RNA. The stability of multiple bulge and helix constructs was studied using thermal denaturation experiments in varying PEG and ionic conditions. Different cations,

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anions, and PEG concentrations influence small DNA and RNA stability. Comparative thermodynamic data from these experiments will be presented. This work was supported by NSF grant, MCB-0950582 to NG.

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Secure Grid for Renewable Energy Sources

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In deployed and disaster relief operations, the cost and logistics of fuel and energy can be a limiting factor in mission effectiveness. In areas where critical power infrastructure is damaged or non-existent, military and relief organizations must make power generation a top priority. This typically comes in the form of setting up an ad-hoc power grid using diesel generators. While this approach is mature and dependable, fuel cost and availability are a constant problem. This has caused many organizations to explore the use of renewable energy sources for deployed and disaster relief operations. One difficulty with this is the reluctance to pull from very reliable diesel generators to more sporadic power sources like wind and solar. It is clear that adding renewables to the ad-hoc grid increases the complexity and initial cost. In order to deal with this factor these micro-grids must become smart and self-managing. A first step in doing this is developing and maintaining a control network capable of managing a set of heterogeneous sources of energy. This paper begins this study by describing a small, SCADA-based, monitor and control network for heterogeneous energy systems. The system described is scalable and shown to be secure. It features an ability to monitor solar energy harvesting: the status of a power storage capacity as well as simulating loads and load shedding. The system also integrates wireless technology to connect and monitor two subsystems as a whole network.

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Synthesis of 1,3-dioxetane by Gold-Catalyzed Cycloaddition of Aldehydes in the Presence of Allenamides

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In an effort to identify novel chemical entities for materials applications, our team is actively engaged in the synthesis of next generation molecular structures that could open the door for the realization of new polymer frameworks. Recently, we discovered that the 1,3-dioxetane moiety could be produced ostensibly from the corresponding aldehyde under gold-catalyzed conditions in the presence of an adjunct allenamide.

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The success of this approach is highly dependent upon the optimization of various reaction conditions that lead to the 1,3-dioxetane moiety in greatest yield and purity. Efforts to date include varying reaction stoichiometry, type of allenamide utilized, reaction temperature, type of gold catalyst, and the use of aliphatic vs. aromatic aldehydes. Once in hand, the 1,3-dioxetane system may be exploited for the synthesis of novel polymeric frameworks constructed around this unique molecular theme.

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Tamarix Drought Response, Beetle Herbivory and Disturbance

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Tamarix ramosissima has had drastic effects on riparian ecosystem characteristics and relationships throughout the southwestern United States during the past century. *Tamarix* grows as small trees or dense stands of shoots and can outcompete native species of willow (*Salix exigua*) and cottonwood (*Populus deltoides*) along Fountain Creek, Colorado. *Tamarix* seedlings are at a disadvantage in willow and cottonwood riparian communities because of slow above-ground biomass accumulation and shade intolerance. *Tamarix* does benefit from deep reaching root structures and allelopathy due to increased soil salinity from leaf litter. Unnatural flood regimes have given a competitive edge to *Tamarix*, allowing it to colonize and dominate the banks of Fountain Creek. Historically Fountain Creek has had a healthy population of *Tamarix*, but in recent years the population has become noticeably diminished. We believe that heavy flooding and *Diorhabda elongata* (Tamarix leaf beetle) herbivory may have contributed to this population decline. Building upon previous data sets, we set out to determine how disturbance affects *Tamarix* water use, fitness and the relationship between these traits. Our study suggests that disturbance causes *Tamarix* to behave contrary to its previously observed drought strategies. *Tamarix* must have a higher conductance in order to compensate for decreased photosynthetic potential due to low foliar chlorophyll content.

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Leadership Style Salience: The Qualitative Effects of Reminders

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The purpose of our research was to use the Full Range Leadership Model (from Management-by-Exception- Active, to Transformational leadership) to analyze the effects of leadership discussion on individuals' job performance. The analysis was conducted on element leaders (low level superiors in charge of ~6 cadets) from January

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to May 2013. Interviews were conducted with element leaders to classify each person's leadership style within the Full Range Leadership Model. They were then watched by raters. Agreed leadership style was discussed with element leader to promote buy in. To ensure continued execution of their leadership style, each element leader was contacted through weekly reminders such as text, hallway discussions and emails to focus them on their chosen style. Each element leader was also reminded prior to major cadet wing events to practice their leadership style. Through these reminders we found that most element leaders were emphasizing individualized consideration rather than their assigned leadership style. Post-semester interviews were conducted to measure the effect of these discussions. Qualitative measures were used to gauge the effects of these weekly discussions. Overall, seven out of the nine element leaders felt the reminders were helpful.

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**Obstacles in the Face of Resiliency:
An Analysis of New York City's Response to Superstorm Sandy**

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With Capt Matthew Ream (Adviser)
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The purpose of this project was to analyze the causes of the prolonged and ineffective emergency aid response to Superstorm Sandy in New York City and to recommend solutions to improve the provision of emergency aid in the future. Specifically, this project focused extensively on the emergency aid response in The Rockaways in Queens, New York, as compared to other successful emergency aid responses to disaster areas caused by hurricanes. The comparison analysis began by evaluating the standard operating procedures and guidance of the Federal Emergency Management Agency for hurricane response with state analogs, paying particular attention to the distribution of relief supplies. The next step was to find why these standard operating procedures, which were in agreement, were not followed in New York City. The bulk of research included interviewing subject matter experts and members from volunteer organizations who stepped in when the city failed to provide legitimate relief. Research also included reading local news articles and after action reports from past storms. The research demonstrated that New York City's status as a "super city" perpetuated a belief among city officials that they were able to help themselves and control relief efforts rather than depend on federal and state emergency responders to do so. By not allowing federal and state experts the proper command and control of the situation, relief to the people of The Rockaways was delayed. This research is still in the draft phase and is expected to be proposed for publication in 2014.

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Vietnam MIA/POW Recovery Technological Advancements

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and Societal Perspective

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On February 12, 1973, Operation HOMECOMING initiated the retrieval and repatriation of 591 American prisoners of war from North Vietnam. Their return, made possible by the end of hostilities accomplished by the Paris Peace Accords of 1973, marked the success of a series of negotiations between American officials and North Vietnamese diplomats. However, there were still more than 1,300 Americans listed as POW or MIA following HOMECOMING, as well as approximately 1,200 listed as KIA whose bodies had not been recovered. In 1991, a committee was established under the supervision of Sen. John Kerry whose purpose was, in Schanberg's words, to "investigate the evidence about prisoners who were never returned and find out what happened to the missing men." The committee concluded its investigation in 1993, publishing a report which cited a lack of concrete proof in its refutation of the claim that there remained U.S. personnel in captivity in North Vietnam. The thousands of missing men and women would soon become an issue which remains prevalent and politically controversial to this day. The parallel advances of America's ability to recover remains and our society's ability to disseminate information (thereby spreading knowledge of those yet to be recovered) have maintained this issue's relevancy and caused both fresh discoveries and fresh calls for increased government action.

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Using Remote Sensing to Monitor the Effects of Elk (*cervus elaphus*) on Riparian Vegetation in the Great Sand Dunes National Park

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Elk (*cervus elaphus*) roam and forage through the San Luis Valley, especially along the western slopes of the Sangre de Cristo Mountains where there is an abundant of vegetation available from numerous streams. This research studies the relationship between riparian vegetation and ungulate species within and outside of the Great Sand Dunes National Park. This study contributes to recent concerns from public land managers and private landowners about the overconcentration of elk within protected lands. Riparian vegetation and wetland areas within the San Luis Valley play an essential role by providing habitats for various species and by maintaining the ecological balance of the area. Image analysis of vegetation through the use of satellite imagery, non-spatial data pertaining to climatic conditions and elk movement patterns, as well as in-situ data collection are used in order to determine the possible effects that

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elk may have on this vegetation type as a result of their overconcentration within non-hunting, protected lands.

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**Fast Forensic Toxicology: Quantitative Analysis of Fentanyl
by DLLME and GC/MS**

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Fentanyl is a synthetic narcotic anesthetic that is approximately 200 times more potent than morphine. Owing to the many uses of fentanyl, and the larger potential for abuse, the drug may be included in a forensic toxicology work-up. This creates a need for fast, precise and accurate measurements of fentanyl in a forensic setting. In the first round of experiments, the stability of fentanyl was assessed when stored at three different temperatures (-20, 4, and 25 °C) in simulated urine. Stability of the drug was demonstrated at those three temperatures during 12 weeks upon analysis by gas chromatography-mass spectrometry (GC/MS) with extraction by three different techniques: liquid-liquid extraction, solid phase extraction, and dispersed liquid-liquid microextraction (DLLME). Given the promising results of DLLME, this extraction method was optimized and validated at two concentrations: 10 ng/mL and 100 ng/mL. The DLLME procedure was then utilized in the analysis of fentanyl in urine samples obtained from autopsy cases at the El Paso County Coroner's Office for which liquid-liquid extraction had been previously utilized and where fentanyl had been a significant toxicological finding. The excellent comparability between DLLME and liquid-liquid extraction in these forensic cases is demonstrated by a Bland-Altman difference plot. The use of this methodology in the analysis of other forensically-relevant analytes is discussed.

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**Representational Drawing and Spatial Ability:
Exploring the Process of Creating Visual Art**

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Representational drawing (drawing realistically from life) is an essential skill for some visual artists, and the process appears straightforward at first glance; look at an object, then draw it. But this simplified explanation discounts the difficulty of the task as well as the practice involved in acquiring this skill. Previous research suggests that professional visual artists employ perceptual strategies acquired through experience in order to draw realistically. Interestingly, there is evidence that acquiring these perceptual strategies

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may interfere with the development of spatial perceptual abilities (such as the ability to mentally rotate images). The present study's purpose was to determine whether this impairment of spatial abilities could be induced in the short term by having participants (N = 50) perform a blind contour drawing, regular drawing, or arithmetic task before retesting their spatial abilities. The results did not show any significant effect of the type of task on spatial abilities performance; however this finding is still informative in the context of visual perception research as it relates to drawing.

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How Night Vision Goggles and Varying Aperture Widths Affect Passability Judgments

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The purpose of this research was to investigate whether night vision goggles and varying aperture widths influence a person's ability to make passability judgments through an aperture. Previous research has shown that NVGs affect visual acuity and spatial orientation; however, the question of passability judgments made while wearing NVGs has not been addressed. Furthermore, it is currently unknown how varying aperture widths affect a person's judgment of passability. Using a within-subjects design, participants were asked to make passability judgments while assessing 18 different aperture widths under six conditions: wearing NVGs and not wearing NVGs while holding a 4', 6' and 10' pole. The numbers of correct passability judgments under each condition were recorded. If participants responded that any of the aperture conditions were impassable, the aperture width was increased until participants stated that the new aperture width was passable. The average width change was recorded as well as how close to being actually passable the new aperture width was. It was found that the use of NVGs did not significantly affect the participants passability judgment or the distance which they increased impassable aperture widths. However, the aperture width and pole width did affect how much participants increased impassable aperture widths.

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Examining the Effect of Environmental Change in Determining Fire Evacuee's Responses to Natural Disasters

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This study examines the relationship between geographic factors, the environment and homeowner responses to natural disaster in a neighborhood affected by wildfire. The study area is located near the South Lake Tahoe Basin in California where the Angora Fire burned 3,100 acres in June of 2007. Utilizing a remote sensing-based exploration, vegetation and landscape patterns are analyzed to determine the role of environmental change in determining fire evacuees' responses. Using survey data measuring efficacy, this study examines the relationships amongst environmental changes, individual and community preparation for fire hazards, and the ability of homeowners to cope with fire related loss. During a period of nine years, this research assesses landscape changes. This time span allows for determination of spatial and temporal variation in vegetation patterns before the fire, right after the fire – measuring the intensity of the burn - and during the restoration of the vegetation up to five years after the fire. During the Angora Fire, 242 homes were destroyed in 16 days, making this study pertinent to research areas such the wildland urban interface, societal response to natural hazards and fire policy.

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An Efficient Micro Architecture Utilizing HAS and RISC Design Principles

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With the rise of mobile computing, consumers are demanding ever-increasing performance and battery life. Modern CPU companies have attempted to fix this by either adding more cores or using process die shrinks. Neither of these methods addresses the fundamental inefficiencies of modern CPU architectures. By implementing a new architecture, it should be possible to provide users with better performance per watt and lower manufacturing costs. This project is intended to produce a new architecture that provides an extensible and efficient framework for computation. At this point in time, a small-scale implementation of this architecture has been put on an FPGA, however power consumption figures cannot be generated until the architecture is in a more complete state.

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Retention of Verbal Recall across the Lifespan at Different Delays

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In the first scientific study of forgetting, Ebbinghaus examined time to relearning a list of nonsenses syllables at various times after learning. He showed that retention was an exponential function of the passage of time and strength of memory. In the current study participants ranging in age from 5 to 89 years old were administered five immediate trials of the 15 word Rey Auditory Verbal Learning task. The immediate trials were

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followed by a delay trial either 20 minutes, one hour, one day, or one week. Participants recalled significantly fewer words at one week than at all shorter retention intervals. Similarly, participants recalled significantly fewer words at one day than at shorter retention intervals. There was no difference across age groups in number of words recalled after a 20 minute and one hour delay. In general, at all delays individuals between 5 and 14 years of age and individuals between 60 and 89 years of age recalled fewer words than young and middle-aged adults. The degree of subjective organization at encoding was lower in children and older adults and significantly contributed to poorer recall in children and the elderly. Sex differences were examined at the four delay trials. Females recalled significantly more words than males ($p < .001$) at 20 minutes, one hour, and one week delay. No significant differences were detected at the 1 day delay.

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Holocaust Writing: An Individual's Account

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The Holocaust was arguably the most horrific event in modern history. Those that suffered at the hands of the Nazi saw their lives changed forever. Sometimes after going through a traumatic event, victims will choose to write about their experiences, never could this be truer than for the victims of the Holocaust. Thousands upon thousands have made the decision to write about their experiences in one way or another. The genres of Holocaust writing are many. Why does a Holocaust victim choose to write and how do they decide the genre and style of writing they will use? I will take a close look at five victims of the Holocaust and their writing.

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Learning Capabilities of the Mentally Disabled

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Within my study I plan on learning some methods the teachers/care providers use to help their disabled children or students learn to read and write. I am interested in the mechanics of their ability. For example, if they cannot write and read, I want to know what they do in place of that. For those who can learn, I want to know how they are taught and what, if any, standards are used. I observed people at Goodwill, a provider center for disabled people who ranged from teenagers to middle-aged. I am interviewing two of the workers about how mentally disabled learn and play.

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Cyanotypes

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Throughout this semester, I have learned the process of making pinhole cameras, developing film, enlarging negatives and making prints with one of the oldest processes of photographic print making—cyanotypes. The process is fascinating, as it utilizes ultraviolet light to develop the prints. After coating watercolor paper with cyanotype solution in low light, I take an enlarged negative and place it onto the dried, coated paper and then place the paper with the negative lying flat on it into a print box. Next, I place the print box outside facing the sun for about three minutes. The final steps are to wash the print in water, rinse in peroxide and then rinse in water again. Photography has become a widely accessible, universal art form with fewer people knowing its history. Demonstrating the cyanotype process shows the captivating past of early photographic methods and its connection to the present.

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Genetic Basis of Adaptation in *Drosophila mettleri*

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Adaptation is the force that creates the incredible range of diversity found on earth: Organisms adapt to their unique environment and become unique themselves. While the concept of adaptation has been understood for some time, the molecular basis that underlies adaptive traits is still poorly understood. Here we investigate the molecular mechanisms involved in host-plant adaptation in *Drosophila mettleri*, a fruit fly that utilizes soil soaked in rotting cactus as its feeding and breeding substrate. Specifically, we compared the gene expression of two populations of *D. mettleri* reared on different cactus hosts, each of which has a distinct chemical composition. We detected overrepresentation of classes of genes that were differentially expressed between cactus treatments, including those involved in metabolic activities. We also found certain detoxification genes differentially regulated between larvae reared on their native host and an alternative host, suggesting these are likely candidates in helping *D. mettleri* adapt to its host cacti.

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Assessing Quality of Life in Colorado Springs, Colorado, Using Landsat Remote Senses through Lenses of the US Census

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Quality of life in Colorado Springs is evaluated by incorporating biophysical and socioeconomic data from 1980 to 2010. The socioeconomic attributes, which include median household income, median home value, and percentage of college graduates, are obtained from the US census bureau. The biophysical attributes, which include normalized difference vegetation index and surface temperature, are derived from Landsat 4-5 TM imagery data sets. The research can be used to inform urban policy makers in the city of Colorado Springs, to further the refinement of QOL inquiry using census and remotely sensed data sets and to encourage spatiotemporal analysis in the developing field of remote sensing in urban environments

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Discursive Borderlands: Geopolitical Codes and the Creation of Landscapes

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Shifts in North American geopolitical codes indicate an increased politicization and securitization of the US-Canada border since 11 September 2001. Built landscapes and material geographies, specifically along the US-Canada border, have shifted along with these codes. Examining the ways in which the spatial distribution and material geographies of ports of entry along the border have changed since the terrorist attacks of Sept. 11 shows that despite US geopolitical codes shifting towards increased securitization, the changes in the landscape along the US-Canada border has been far less pronounced and visible than in the geopolitical codes.

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How do Life Experiences Alter the Way an Individual Feels About the Writing Process?

Shelby Kaylor

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During a lifetime, the writing process of an individual is likely to alter due to the different situations that each individual experiences. Through interviews and retrospective accounts of personal writings, this study will show how experiences, as well as aging, can influence the way an individual feels about the writing process. School-related material that has been collected over the years, if any, will also be acknowledged and taken into consideration when conclusions are made. The link between individuals who experience positive events in their lives and the way they feel about writing, as well as the link between negative events and their writing history, will be demonstrated. The findings will reveal the changes that occur within writing throughout the life of an individual, as well as the possible causes of these particular changes.

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Maryland v. King: The Future Impact of DNA Collection

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United States Air Force Academy

One of the most recent and important criminal cases presented before the Supreme Court regarding the Fourth Amendment, *Maryland v. King*, originated when Alonzo Jay King was arrested for assault. Upon arrest, King's DNA was collected pursuant to the Maryland DNA Collection Act, which claimed that DNA collection was legal in the case of violent and serious crimes, only for identification purposes. However, at the time of his arrest, King had already been identified via fingerprinting. Pending the results of DNA analysis, King's DNA matched that of unknown DNA found at a 2003 rape crime scene. King, then charged with rape, moved to suppress this evidence and appeals to the Maryland Court of Appeals, claiming that it violated his expectation of privacy and did not fulfill the requirements for individualized suspicion. The Maryland Court of Appeals ruled in favor of King, stating that DNA collection was a violation of the Fourth Amendment, as the arrestee's privacy interests outweighed the government's interest in obtaining information. The State of Maryland appealed to the Supreme Court, which determined on 3 June 2013 that it is lawful under the Fourth Amendment for arresting officers to take a DNA sample in the form of the cheek swab from an arrestee, stating that this action is the modern-day equivalent to fingerprinting and photographing. However, this decision carries several heavy implications. First, as a result of this decision, it is now legal to collect DNA from any and all arrestees for violent crimes, regardless of whether that particular person has actually committed a crime. This may seem like a promising step in the legal system as a way to reduce crime, but this decision can lead law enforcement down a slippery slope: Eventually, an arrestee could have their DNA collected and input into a database for any crime.

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Headspace Liquid-Phase Microextraction Analysis of Putative Hydraulic Fracturing Compounds

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Hydraulic fracturing or ‘fracking’ is a method of extracting natural gas from rock by applying pressurized fluid deep within underground formations. Hydraulic fracturing fluids contain chemicals that may have an effect on the environment. The objective of this work was to create an efficient technique utilizing green chemistry principles for the analysis of putative hydraulic fracturing chemicals. Headspace liquid-phase microextraction (HS-LPME) was utilized to extract alkylates (ASTM D5134 Qualitative Reference Standard), naphtha (ASTM D5134 Qualitative Reference Standard) and gasoline in water by using either 1-octanol or benzyl alcohol as a solvent. The experimental conditions were dependent on the concentration of analyte, volume of water used, amount of sodium chloride added to the sample, the temperature of the sample, distance of the solvent from the sample surface, and amount of solvent used. The samples were analyzed by gas chromatography-mass spectrometry (GC/MS) and the data analyzed using AMDIS (Automated Mass Spectral Deconvolution and Identification System).

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***De novo* Synthesis of Common Spice Metabolite UR-144 Degradant Acid**

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Spice and other cannabimimetics are gaining popularity within the population and such compounds pose a serious problem for employers and law enforcement. The novelty and the variety of synthetic cannabinoids available make detection of users of these drugs challenging. UR-144 is a popular synthetic cannabinoid found in many blends of Spice. *In vivo*, the compound is oxidized to a terminal carboxylic acid and presents in the urine as the UR-144 acid metabolite. Some metabolic processes and testing protocols induce a rearrangement of the cyclopropyl ring to yield the UR-144 degradant acid, which is much more prevalent as compared to the cyclopropyl analogue. In this work, UR-144 degradant acid has been prepared using novel precursors via a multistep synthetic strategy to provide spectroscopic and physical properties data on the degradant for application to the field of controlled substance testing.

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Effects on U.S. Military Personnel Run Performance at Various Altitudes

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The objective of this study was to determine the variation in running performance among various altitudes. This study used simulated altitudes of 7,200 feet (2,195 meters; ~21 percent O₂), 6,300 feet (1,920 meters; ~21.5 percent O₂), 5,750 feet (1,753 meters; ~21.9 percent O₂), 5,375 feet (1,638 meters; ~22.2 percent O₂) and 850 feet (259 meters; ~26 percent O₂) on an individual's calculated VO₂ max via the 1.5 mile (2.41 kilometer) run time. Altitudes were simulated using the Normobaric Hyperoxic Colorado Altitude Tent. Results from the study showed there was a significant difference in time performance between 7,200 feet and 850 feet. There was no significant performance difference between the other altitude iterations. These results suggest that different training elevations need to be assessed when testing run times for U.S. military personnel.

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**Post-Mating Reproductive Isolation Between
Populations of Geographically Isolated *Drosophila***

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New species arise as a result of reproductive isolation between populations. Pre-mating isolation occurs when mechanical, temporal or behavioral factors limit copulations between individuals from different populations. Post-mating isolation results from incompatibilities that lead to poor fertilization success or the reduced viability or fertility of hybrid offspring. Our research focuses on these reproductive barriers between geographically isolated populations of the fruit fly, *Drosophila arizonae*. This study model offers us the chance to examine which barriers function in early stages of speciation. Previous work from our lab suggests that pre-mating barriers exist between some populations. We are now testing for evidence of post-mating isolation through selective crossing and observation of F₁ offspring viability.

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**The RNA binding protein Cg11505 functions in multiple cell types
during *Drosophila* neurogenesis**

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Neurons often exhibit highly complex cellular morphologies that are necessary for proper cellular function and for establishing appropriate neural connections. Post-translational gene regulation has recently been implicated in dendrite morphogenesis and the plasticity of neurite morphology during learning. RNA binding proteins play an integral role in directing mechanisms of post-transcriptional regulation of gene expression including translation, splicing and mRNA localization. To determine the extent to which post-translational gene regulation mediates neurite morphogenesis, we previously conducted an RNA interference (RNAi) screen in *Drosophila melanogaster* to identify RBP encoding genes involved in the elaboration of the highly complex dendritic trees of Class IV dendritic arborization (da) neurons. The screen identified Cg11505, a well conserved but previously uncharacterized RBP, as an important player in dendrite elaboration in da neurons. We performed a detailed molecular genetic analysis of *cg11505* throughout *Drosophila* embryonic and larval development to determine the requirement of *cg11505* in multiple cell types during morphogenesis. Our expression analyses reveal that *cg11505* mRNA and protein is present in the central nervous system, peripheral nervous system, tracheal system and germ-line stem cells (GSCs) during embryonic development.

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International Students on Foreign Soil: How International Students are able to Learn and Succeed in an American University System

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Globalization has influenced the world of education and at the University of Colorado Colorado Springs we have seen globalization through our ever-growing population of international students. As of spring 2014, there are 332 international students who have chosen to continue their education at the UCCS campus. For many of these students, English is not their native language and they face many difficulties as they continue on their path towards their degree. It is the goal of this research to highlight the problems that these students face and how these students were able to be successful in their classes. I have conducted this research through the use of interviews from students who were international and/or non-native English speakers and faculty members who are in contact with international and non-native English speakers.

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Functionalized Hydrogel Synthesis for Single-Chirality Single-Walled Carbon Nanotube Separation

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Carbon nanotubes contribute to a useful class of nanotmaterials, the applicability of which is expanded when tubes of a single chirality (diameter) are utilized. Sephacryl S200 functionalized hydrogel is currently the most effective gel medium used to separate carbon nanotubes. Sephacryl S200 contains properties allowing for site selection chromatography of nanotubes, however, because its formulation was not intended for nanotube separation, there is opportunity for the improvement upon the site selection process through custom made functionalized hydrogels. Using Sephacryl S200 as a guide, hydrogels can be synthesized with relative ease, and their specific properties which are responsible for nanotube separation can be identified and enhanced, tending towards a less expensive and more efficient carbon nanotube separation process.

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Dispersed Liquid-Liquid Microextraction with Matrix Solidification for the Analysis of Tetrabromobisphenol-A (TBBPA)

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A rapid, efficient, and environmentally friendly pre-concentration method was developed for the detection of tetrabromobisphenol-A (TBBPA), a brominated flame retardant, from complex samples including dust. This novel adjustment to the traditional dispersed liquid-liquid microextraction (DLLME) reduces the use of toxic solvents. Traditional DLLME is rapid and cost-effective but the utility of this method for the treatment of complex matrices is limited. In this new method, water samples are sonicated with solvents used for extraction (toluene) and dispersive solvents (acetonitrile and methanol). The solvent phases are separated by centrifugation before freezing the matrix in a CO₂ (s)/ethanol bath and removing the top extraction solvent (toluene). The TBBPA in the toluene is derivatized with acetic anhydride prior to analysis by gas chromatography-mass spectrometry (GC/MS). Current studies are focused on optimizing the method for improved analyte recovery, method validation, and adoption of the method for analysis of TBBPA in dust sampled from an electronics recycling facility.

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Cytoplasmic roles for the Rad26^{ATRIP}/Rad3^{ATR} complex in fission yeast

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Tom Wolkow

Department of Biology, University of Colorado Colorado Springs

Fission yeast Rad26^{ATRIP} is a regulatory subunit of Rad3^{ATR} that occupies central positions within DNA damage response pathways. We have shown that Rad26^{ATRIP} is also required in the cytoplasm, where it (1) delays entry into mitosis following damage to interphase microtubules, (2) preserves cellular morphology and chromosome stability, and (3) localizes to the spindle pole body. Here, we report that the microtubule crosslinking protein Ase1^{PRC1} also participates in the Rad26^{ATRIP}-dependent checkpoint response to interphase microtubule damage. We discuss the possibility that this response is compromised in microcephalic primordial dwarfism.

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Micro-Separation Procedure to Fractionate the Mononuclear Cell Population in Umbilical Cord Blood

John Patterson

Ivan Rich

University of Colorado Colorado Springs

As of 2012, 68,400 hematopoietic stem cell transplants have been performed worldwide. Of those, 26 percent used umbilical cord blood as a source of stem cells. The growing demand for UCB stem cell transplantation has also required a greater demand for UCB units to be stored. There are now 485 cord blood banks worldwide, divided into public and private banks. In the United States alone, there are 70 public and private UCB banks. For cord blood units to be stored they must have the correct total number of nucleated cells, volume, weight and/or other factors. In the United States, 75 percent of all cord blood units collected are rejected based on one or more of these criteria. An additional problem, attributed primarily to low or lack of potency, is that 15-20 percent of all UCB transplants result in graft failure. This is due in part to measuring the total nucleated cell (TNC) count instead of the mononuclear cell (MNC) count. The TNC count can contain 30 percent or more red blood cells as well as high concentrations of granulocytes and platelets. All these cell types dilute the very low number of stem cells present and make it very difficult to measure stem cell quality and potency. The problem is compounded even further by only having 0.1ml or less of cells

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to work with. Therefore, the aim of the study was to develop a micro-separation procedure to fractionate the MNC population that contains the hematopoietic stem cells so that their potency and quality can be reliably measured. This was accomplished using a micro density gradient separation method that allowed the potency and quality of the stem cells in the MNC fraction to be measured using a specific, validated potency assay called HALO-96 PQR. The results demonstrate that little or no stem cell potency can be measured using a TNC preparation. However, the MNC fraction allows both primitive and mature stem cell potency to be enumerated. The fractionation procedure is simple, fast (30 minutes), and provides sufficient cells to perform the assay.

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Towards the Design of New Fulvene-Derivatized Conjugated Polymers

Matthew J. M. P. Piazza, Kelsey M. B. K. Dees, Hannah A. Miller, Endrit Shurdha
With Scott T. Iacono (Adviser)
Department of Chemistry & Chemistry Research Center
United States Air Force Academy

Molecules containing conjugated π -electron building blocks such as aryl-vinyl, thiophene, and pyridyl groups continue as the focus of many investigations in synthesis and structure property relationships. Compared to these conjugated systems, organic and organometallic materials based upon substituted pentafulvenes have received little research investigation in this area. In the course of our studies on 6-substituted 1,3-diphenylfulvenes, we discovered a synthetic methodology that allows for the selective and stepwise attachment of functional substituents at the 1, 3 and 6 positions of the fulvene nucleus. This substitution pattern provides entry into the versatile design of unique new materials because the 1,3,6-trisubstituted core allows for incorporation of the fulvene skeleton into polymeric or supramolecular networks which have led into investigations of donor-acceptor properties important in electronic materials.

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The Role of *shep* (*RBMS3*) in the Developing Nervous Systems of *Drosophila melanogaster* and *Danio rerio*

Ismail Sola, Laura Hernandez, Mary Morton, Adam Postovitz, Kristen Artinger
Eugenia Olesnicky Killian
University of Colorado Colorado Springs
University of Colorado Anschutz Medical Campus
The BRAiN Program, University of Colorado, Anschutz Medical Campus

Post-transcriptional gene regulation, including mRNA localization and translational repression, plays an important role in the generation of asymmetric cellular environments and morphologies. During embryonic development, neurons take on diverse, often complex morphologies that ultimately enable neuronal function and the formation of appropriate neural circuits. The well-conserved *Drosophila melanogaster*

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RNA binding protein, Alan shepard (*Shep*) results in dendrite morphogenesis defects in Class IV dendritic arbor (da) neurons upon RNAi knockdown. In-situ hybridization and immunofluorescence indicates that *shep* is expressed during neurogenesis in a subset of cells of the peripheral nervous system (PNS) and the central nervous system (CNS). Additionally, loss of function of *shep* results in PNS and ventral nerve cord defects. In Zebrafish, in-situ hybridization of the *shep* homolog *RBMS3* shows expression in the embryonic sensory Rohon-Beard (RB) neurons. A *RBMS3* morpholino results in a decrease of the dendritic field in RB neurons. Taken together our results suggest that *Drosophila shep* and its homolog *RBMS3* in Zebrafish play multiple roles in the development of their nervous systems. Interestingly, our results indicate *shep/RBMS3* plays a role in the genesis of sensory neuron dendrite morphology in both model systems indicating functional homology.

~ 40 ~

The Effect of Stereotype Threat on Student-Athlete Math Performance

Shaina Riciputi
Kristi Erdal
Colorado College

The current study expanded on previous research showing stereotype threat related decrements in the academic performance of student-athletes by measuring their performance on a difficult math test after either being primed with their athletic identity or not. The primary hypothesis was that athletically primed student-athletes would perform more poorly than unprimed student-athletes. Males and females were also anticipated to be differentially affected by the prime, with females performing more poorly than males when primed. Furthermore, Division I and Division III athletes were expected to be differentially affected by the prime, with Division I athletes performing worse following priming than Division III athletes. The results of the study supported the hypothesis about the overall effects of the prime. This experiment provides the first evidence for stereotype threat effects in Division III athletes of both genders and female Division I student-athletes. These findings add to a growing picture of the effects of student-athlete stereotyping on the academic success of student-athletes across a spectrum of collegiate environments, with important implications for understanding how and why stereotype threat hinders performance in different groups.

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Model Catecholate Siderophore Synthesis and Characterization for a Bioinorganic Chemistry Laboratory

Dylan Shuster
Renee Henry
University of Colorado Colorado Springs

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Chemistry 4100/5100 is a bioinorganic course taught at the University of Colorado Colorado Springs that currently lacks a laboratory accessory. One particular topic covered in the lecture course includes a section detailing iron transport by catecholate siderophores; a section that requires a coinciding laboratory experiment. The laboratory is a multi-period experiment that includes a siderophore introduction. The experimental laboratory includes both traditional heat and stir, and microwave synthesis. Multiple characterization techniques of the model siderophore are also included in this laboratory experiment.

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Automated Cooking Appliance

Sergio Sierra, Tyler Conrad, and Tara Zartman
With Maj. Daniel White and Capt. Jason Belvill (Advisers)
Department of Management, United States Air Force Academy

Skipping meals is a common occurrence in the life of the average person. There are a number of reasons why people skip meals, however, time constraints and cooking limitations are the primary ones. The solution to addressing these time constraints and cooking limitations is an automated cooking appliance. An automated cooking appliance is a product that seeks to improve the quality of life for the user through a variety of ways. Such an appliance would prevent the user from having to spend his/her time cooking. Instead, the user would only have to input the ingredients ahead of time and let the machine do all of the cooking. This would relieve the user of any time constraint or cooking limitation issues and provide the user with a new level of convenience.

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The Effects of Reading Speed on Reader Comprehension

Greyson Smith
With Michelle Neely (Adviser)
Department of English, University of Colorado Colorado Springs

As society moves forward into an increasingly fast-paced society, there is an assumption that quicker execution of a task leads to a more productive world. However, does that increased speed lead to a lack of focus and decreased reader comprehension? My project looks for any connection between reading speed and the resulting comprehension. Five adults, all of whom have either college experience or a degree, will read selected passages and answer comprehension questions. Generally speaking, prior research of this topic has been limited to studies with younger subjects. Clearly, there must be differences in reading style and their ability to read at a faster pace while maintaining their normal comprehension levels is less likely. When comparing my data to those prior studies, I hope to find the difference between a child and adult's comprehension abilities, if there is any at all.

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Malcolm Gladwell and Analysis Paralysis Theory

Kimberly Smith

With Professor Kurt Heppard (Adviser)

Department of Management, United States Air Force Academy

Malcolm Gladwell was born in London and grew up in Elmira, Ontario, Canada. After receiving his bachelor's degree in History in 1984 from the University of Toronto, he moved to the U.S. to become a journalist. He is now an esteemed author of five *New York Times* bestsellers and has been named one of the 100 most influential people by *TIME* magazine. He has been a staff writer for *The New Yorker* since 1996 and continues to expand his career as a public speaker. In *Blink: The Power of Thinking Without Thinking*, Gladwell describes the idea of analysis paralysis. This concept explains that information overload is worse than having too little information. At the U.S. Air Force Academy, cadets are taught numerous approaches to leadership. This paper attempts to apply Gladwell's analysis paralysis theory to explore the correlation of an overabundance of information and leadership development.

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Analysis of Synthetic Cannabinoids by GC/MS and HPLC

Andrea K. Tully, Simon Johnson

Janel E. Owens, Werner W. Jenkins

University of Colorado Colorado Springs

Synthetic cannabinoids are increasing in popularity as drugs of abuse and it is becoming increasingly important to develop methods to identify and quantify these drugs and their metabolites in postmortem specimens. Solid phase extraction was employed on two antemortem samples (blood and cerebrospinal fluid) and postmortem samples (brain and bile) from a patient who was a reported user of the synthetic cannabinoids UR-144 and XLR-11. Internal standard (IS) XLR-11-D₅ (20 ng/mL) was added to each sample prior to sample clean-up by SPE and subsequent analysis by gas chromatography-mass spectrometry (GC/MS). XLR-11 and IS were detected in the antemortem blood whereas no parent drug was found in the brain or cerebrospinal fluid. Neither the IS nor the parent drugs were detected in bile. A calibration curve was created for these two synthetic cannabinoids for the analysis of blood containing the IS. Using these calibration curves, the concentration of XLR-11 in the patient's blood sample was 8.03 ng/mL by GC/MS. Current work is focused on the use of dispersed liquid-liquid microextraction and high performance liquid chromatography (HPLC) with

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diode array detection to identify and quantify synthetic cannabinoid metabolites, which have increased water solubility, in various matrices.

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UV Cross-linking RNA to Protein in Whole *Xenopus* Oocytes

Kenneth Valles
Amanda Charlesworth
University of Colorado Denver

A *Xenopus laevis* oocyte embarks on its journey to adulthood when a fertilized egg begins rapidly dividing, and its incredible growth rate is maintained by alternating between mitosis and DNA synthesis, with little time and resources to dedicate to mRNA transcription. Rather, essential proteins can be quickly and efficiently translated from previously placed maternal mRNAs, and the regulation of such mRNA is vital to the embryo's viability. During embryogenesis, maternal mRNA is regulated by translational control, and zygote arrest proteins (Zar1 and Zar2) have been shown to play an essential role in this regulation. Despite Zar's crucial operations prior to the activation of the zygotic genome, many of its details have remained elusive. At present, the translation of two maternal mRNAs that Zar2 regulates are Mos and Wee1. Yet neither Mos nor Wee1 offer adequate explanation for the observed phenotype of Zar knockout mice, indicating that Zar regulates additional mRNAs. The identification of the remaining maternal mRNA transcripts that Zar2 binds would clarify the essential role it plays in the early development of the zygote. The identity of the RNA transcripts can be determined by high-throughput sequencing of cross-linked immunoprecipitations (HITS-CLIP). CLIP works by exposing a living sample to a dose of UV irradiation, however, *Xenopus* oocytes are large, pigmented and opaque, and UV penetration is an issue. Here, we attempt to cross-link endogenous maternal mRNAs to endogenous Zar proteins with minimal oocyte manipulation. We will show results from whole oocytes and after cryogenic homogenization.

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Advanced Concept Energy System, A Service Academy Competition to Increase Power Reliability at the United States Air Force Academy

Jacob Ceynar, James DeSanctis, Jonathon Flynn, Jared Greene, Daniel Levy,
Kevin Mook, Jonathon Reasoner, Andrew Shea, Timothy Walsh
With Major Bryan Cooper, Dr. John Ciezki (Advisers)
Department of Electrical and Computer Engineering, United States Air Force Academy

This presentation will highlight the work performed on the United States Air Force Academy's senior design project titled "Advanced Concept Energy System. ACES is sponsored by Boeing Corporation and run as a tri-service competition project, where each service academy is tasked to come up with innovative solutions to decrease their

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respective Academy's reliance on the power grid by the year 2040. To achieve this, five focus areas are being considered: generation and storage, management of demand side resources, thermal distribution systems, electrical distribution systems and energy management and control systems. The USAF Academy team chose to highlight their energy management and control focus area to emphasize lower level system design and provide an efficient example of physical and cyber security components. A software model of the entire electrical system has been created using PowerWorld Simulator and a prototype hardware component is being developed to detect electrical faults and autonomously enter into microgrid operation. The technology and designs are projected to be implemented within the 2040 timeframe while assuming 25 percent increases in energy demand and meeting thresholds such as supplying energy at \$0.05 per kilowatt-hour. This technology design may be tailored for forward operating base applications.

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Our "Mother"

Marcelo Weese

Linda Watts

Department of Anthropology, University of Colorado, Colorado Springs

Today, the fluency of the Northern Tiwa language is becoming endangered past the age of 35 years old. Many middle school students on the pueblo that are switching to high school have to go through a class to transition to a public school. Once in high school, there is no curriculum to teach or keep up with their language. The aim of this project is to establish the current general level of usage and functionality of Tiwa at Taos Pueblo. In order to institute Language Maintenance and Revitalization programs, communities find it useful to gauge, at first, the current 'state of the language.' This is helpful because depending on this current environment, certain types of language maintenance or revitalization or reclamation programs have been found to be most appropriate and effective in moving a language program to a next 'level.' Languages with many fluent speakers at all ages, for instance, may benefit from larger scale language maintenance and reinforcement projects such as radio programs. Language communities with only a handful of speakers such as in California have been developing language apprenticeship programs with surviving elders. I anticipate that Taos Tiwa might be a step beyond the California situation because the home community remains intact with many opportunities for instituting and revitalizing native language use.

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Body Language

Jenny Wool

With Dr. Tomi-Ann Roberts (Adviser)

Colorado College

We tested whether tilting the head upward or downward differentially affects feelings of

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power, taking action, and abstract thinking depending on gender. Participants posed in either an upward or downward head tilt position before completing an abstract thinking task, a mood questionnaire, and a simulated blackjack game to measure taking action. In support of the hypothesis, results showed men in the upward condition were more confident than men in the downward condition in terms of choosing whether they had previously seen critical lure words during the memory task, whereas women showed the reverse pattern. Contrary to the hypothesis, results showed men in the downward condition felt more positive, powerful, proud, inspired and active than men in the upward condition, while women showed the reverse pattern. Gender, but not condition, affected the likelihood of participants choosing to take another card in the simulated blackjack game, suggesting inherent problems with this measurement.

~ 50 ~

Investigating Tyrosine FRET in Fluorescent Protein for Biosensing Applications

Pamela Zhang

With Maria Lamb-Hall and Barry W. Hicks (Advisers)
Department of Chemistry, United States Air Force Academy

Fluorescent proteins have many applications in biomedical research, but are not widely used directly as biosensors because the chromophore resides inside the α -barrel structure of the protein and is thus remarkably stable and relatively insensitive to the external environment. In previously published work, we showed that quenching of Forster Resonance Energy Transfer (FRET) from UV-excited endogenous tryptophan (W) residues to the chromophore was sensitive to the environment and could be used to detect nitroaromatic explosives like TNT and RDX, even though these agents have virtually no effect on the normal visual excitation and emission (Fig. 1). This means that quenching agents have only moderate accessibility to enable collisional quenching. In contrast, due to the hydrophilic phenolic functional group, most of the surfaces of the many tyrosine (Y) residues are on exterior of the FP. We obtained a DNA construct encoding for a W-less GFP and have shown that Y-to-chromophore FRET exists in this protein. Furthermore, the Y-to-chromophore FRET can be quenched by nitroaromatic explosive simulants. We are currently investigating the relative sensitivity and selectivity of FRET from Y to that of W, as well as examining the palette of quenching agents that can be detected by this methodology.

Oral Session III

(3-4 p.m.)

Designs of the Future

Room: L-1

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Means of More Comfortable Flights in Extreme Temperatures

Davis Gray
With Maj Byron Miranda (Adviser)
Engineering Mechanics, United States Air Force Academy

Research was conducted in order to determine a viable means of making flight in the T-53 aircraft more comfortable in hot summer temperatures. The various commercial solutions are expensive. The goal of this project was to create a cooling option that can be replicated by T-53 pilots for a relatively low cost. Commercial off-the-shelf products such as the Cool Shirt proved to be the most effective and suitable for the cockpit's constraints and environment. Two types of cooling systems were tested during summer flight. The first was an air conditioner aimed at lowering ambient air temperature. The second was the Cool Shirt. The Cool Shirt's method of cooling proved to be the most effective. To mitigate the cost associated with commercial cool shirt units, a smaller scale, homemade prototype was developed. Due to the smaller size of the prototype unit, its design was based off of a medical cooling pad intended to ice a localized area. Data was gathered from the medical pad and was attempted to be replicated in a manner that could be accomplished by pilots at home. Tests on the home-built cooling pad showed that it was able to bring the stabilized temperature on the back of the neck to 69.8°F, within 5°F of the medical unit. This home-built design ended up costing \$187.89 which is 63 percent less than a \$500 Cool Shirt.

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A Novel Automatic Spacecraft Anomaly Detection System

Joshua Mote
With Lt Col David Barnhart and Capt. Joseph Robinson (Advisers)
Department of Astronautics, United States Air Force Academy

The United States Air Force Academy is the only undergraduate institution that constructs and operates satellites completely "in house." Under the direction of the Space Systems Research Center, the FalconSAT mission is to have cadets "learn space by doing space." Starting from FalconGOLD, which was launched in October 1997, the program is currently producing the multi-million dollar FalconSAT-6 mission. Due to the expensive nature of space missions and a decrease in government funding, the FalconSAT program has placed a higher emphasis on program and hardware testing. In the FalconSAT-6 project, this emphasis has led to a new test coined the "Gold Standard Test." Specifically the test stimulates all of the satellites' systems to determine the health and status. A novel analysis tool is used to evaluate the data generated by the GST, which is called Gold Standard Data. The tool compares original GSD to data taken at a future time. By making this comparison the FalconSAT program

has a unique method to automatically identify unwanted trends across the entire satellite. This paper will illustrate the design, capabilities and results of this new tool.

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Light Emitting Diode Impact Investigation

Aaron Hartmann

With Lt Col Richard Buckley (Adviser)

Department of Mechanical Engineering, United States Air Force Academy

Detailed examination of headlights, tail lights and dash indicator lights are often used in vehicle accident investigations. There is an established set of physical cues from the light bulbs that can be used to determine whether the lights were illuminated or not at the time of a crash. In recent years, both the automotive and aircraft industries have begun using Light Emitting Diodes extensively for applications that were previously the exclusive domain of incandescent bulbs. No research has been done to determine whether LED bulbs exhibit a similar signature during impact, or if such a signature can be used to determine if the bulb was illuminated. An impact test was developed to deliver a standard impulse to a set of lit and unlit LEDs and incandescent bulbs. After the impact, all the lights were analyzed to determine if the lit LEDs had a signature that separated them from unlit LEDs. Initial testing results are presented.

Linear and Nonlinear Models

Room: L-2

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Disaster Relief Optimization for NORTHCOM

Lauren Clisby, Michael Whiteside and Jeremy Sunshine

With Dr. Peterson, Maj Pietz, Lt Col Roesener, Dr.Siegel, Dr. Elmer (Advisers)

United States Air Force Academy

This project uses network flow optimization and an attacker/defender model to optimize the relief effort after natural disasters. Specifically, it targets the New Madrid Seismic Zone, in the central United States, which is predicted to suffer and M_w 7.7 earthquake within the next 10 years. This research will give decision makers a broad overview of the relief network, determining which arcs (mostly roads) are most vital, how much demand can be met within a time frame, and how much efficiency is lost depending on actual damage. This information can be used to reinforce vital arcs before the disaster, to dictate evacuation policy, and to determine which roads to consider for immediate repair. The program produced by this project will be generalized for any disaster area, as well as programmed in Microsoft Excel, chosen for its versatility and availability.

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Modeling the Flightline of the Future

Daniel Boylen, Thomas Dickey, Amanda Herman, and Suzann Nordquist
With Maj Jesse Pietz (Advisers)
Department of Management, United States Air Force Academy

In order to assess the impact of policy changes on an Air Force flightline, we create a discrete event simulation to model the flow of aircraft through various aspects of the flightline. This simulation is developed based on data collected on a trip to Hill AFB to observe an F-16 squadron. We design and implement an interface for this simulation that allows users to see the impact of changing various key flightline parameters in order to select the best course of action based on reducing cost, improving aircraft availability, maintain a high quality of life for flightline workers.

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Extending the Transient Lifetime within a Magnetic Nanoparticle

Matthew Phelps
With Dr. Robert Camley and Dr. Karen Livesey (Advisers)
Department of Biology , University of Colorado Colorado Springs

There are many things in this world that seem to behave without any strong sense of order – systems like weather patterns, stock markets, ocean currents and even the migratory patterns of birds. They are systems with extreme sensitivity, fluctuating from one second to next, some of them moving in such random, chaotic motion that any attempt to discern an underlying pattern would seem fruitless. These are nonlinear systems, which often show complex and sometimes chaotic results. But despite their unstable nature, it is possible (at least to some extent) to predict and analyze such systems. The purpose of this research is to gain insight into the behavior of such a system. Specifically, we will be exploring the nonlinear behavior of a magnetized nanoparticle. Through use of numerical approximation and computer modeling, the motion of our system will be quantified and characterized in order to form a precise theoretical model that accurately predicts its behavior. In particular, we find a fascinating result that, in the nonlinear limit, the time decay of an initial transient can be increased by several orders of magnitude.

Management Ethics

Room: L-3

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Lee Iacocca and Decisiveness in Management

Alex Lindsay

With Dr. Cynthia Cycyota (Adviser)

Department of Management, United States Air Force Academy

Lee Iacocca characterizes management in the 20th century with his push for decisiveness in management. He believes anyone can make a decision with 100 percent of the facts, but a true manager can be decisive with 95 percent of the facts for a \$300,000 project which involves redesigning a vehicle bound for the market. Iacocca stresses that decisiveness does not mean sticking with a decision, but being able to change your mind with changing facts and being able to explain the change in decision. Lee Iacocca's career revolves around the American auto industry, centered in Detroit, MI. His career included engineer, salesman, regional manager, vice-president, president and CEO. He served most of his career for Ford, but ultimately revived Chrysler Corporation as president and eventually CEO and Chairman of the Board. Iacocca is a bestselling author with his book, *Where Have All the Leaders Gone?*; where Iacocca addresses all the tough questions American leaders must be able to answer. This paper addresses the legacy of Iacocca and the purpose that led him from the bottom to the top of the American auto industry.

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Determining Associations between Middle School Students and Controlled Substances

Aubrey Hasvold

Gail Murphy-Geiss

Colorado College

This study investigates the associations between nine developmental assets and the use of tobacco, alcohol, and marijuana among middle and high school students in Old Rocky Mountain City School District 10. Two cycles of survey data – 2009-2010 and 2012-2013 – were analyzed using quantitative methods. The study addresses longitudinal trends in risk-taking behaviors, assets possessed by youth and the protective power of individual assets in relation to participation in risky behaviors. The strength of the effects of different assets in Cycle Two and the cumulative impact of assets in both cycles are also examined. The results show that use of each substance has decreased, the percentage of students who possess each asset has increased and the average number of assets students have has increased.

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Organizational Culture and Ethics: Alignment to Promote Innovation

Anna Cruz
With Dr. Cynthia S. Cycyota (Adviser)
Department of Management, United States Air Force Academy, CO 80840

Models for instilling ethics in organizations have long ignored the importance of culture to promote organizational innovation and growth. Organizational culture establishes the customs and shared beliefs of employees within an organization. Employee interactions inside and outside of the organization, as well as the decision processes that employees develop, are grounded in the organizational culture which they operate. For this reason, ethical behavior in the social context of an organization can be attributed in part to its culture. Through the synthesis of various models, a model is proposed that not only creates and maintains a culture which operates with a constant ethical tone, but also does so in a matter that fosters innovation and creativity. Ethical principles provide the stable foundation that organizations need to support innovation and growth.

Education Research

Room: L-4

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Learning Orientations: Effects on Motivation and Test Scores

Nico Ravitch, Roshni Patel, Erica Hoffman and Laura DiRusso
Emily Chan
Colorado College

This study examined the differences between learning orientations and motivation as well as learning orientations and test performance. Two types of learning orientations that most people adopt are either an approach-orientation or an avoidant-orientation. Previous research suggested that approach-oriented groups, or people that were driven by success rather than the fear of failure, would be motivated to try harder than avoidant-oriented groups. This study focused on how being placed into one of these learning groups would affect students' motivation and test scores. Sixty Colorado College students participated in an online survey that included 10 math questions. They were primed either by gaining a point for each correct question, or losing a point for

each incorrect question (approach v. avoidant). Results indicated that there were no significant differences between the two learning groups and motivation, however analysis concluded that there was a difference in how the groups scored on the math test. Implications of this research suggested that people perform better when positively encouraged rather than being fearful of failing. Future research could measure motivation differently to see how it plays a role in approach and avoidant-oriented people.

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Impact of Syllabus Design and Manner of Delivery on Memory and Attitudes

Jasmine Leyro
With Dr. Lauren Scharff (Adviser)
United States Air Force Academy

Given the prevalence of syllabi and the lack of prior research directly related to syllabus design and instructor manner of delivery, this study investigated how syllabus target content location (top vs. middle) and content design (textual vs. graphic), in conjunction with instructor manner of delivery (verbal overview of syllabus, forewarning of quiz, independent review by students), impacted students' impressions and retention of syllabus content. Based on research related to vision science, memory, serial position, and first impressions, these manipulated variables are likely to have effects on syllabus content retention and on student attitudes about and expectations for the course. A 10-question memory and attitude assessment was completed by 166 participants after exposure to each of two syllabi that varied in target content location; content design and manner of delivery were varied between groups. Results indicated that target content accuracy was highest when placed in the middle of the syllabus and used textual formatting. Overall content retention was lowest when the syllabus was verbally reviewed; however, verbal review led to the greatest reported interest in the hypothetical course and ratings of the instructor. This work has implications for both the structure of syllabus design as well as instructor methods of presentation.

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Accounting for Purpose in the Age of Accountability: Grounded Theory and Discretion in Educational Institutions

Jacob Kirksey
Mark Smith, Jim Parco, Manya Whitaker
Colorado College

Through the use of grounded theory methodology and the operationalization of a representative bureaucracy framework, this study investigates the perception of discretion within public administration in educational institutions. Public administrative actors in schools use discretion to provide equitable learning opportunities, and without said discretion, underrepresented groups of students would have no extra support

despite numerous disadvantages. In an attempt to give cause or further explanation as to the nature of this discretion, evidence from 20 interviews and 30 hours of observation of 5th grade classrooms in seven urbanized schools suggests a grounded theory of *purposeful accountability* to link an increased perception of discretion for teachers and principals. School officials can stay afloat in the age of accountability as long as their sense of *belonging* and ability to *mobilize* their organizations are maintained through proper access to centralized knowledge and expectations, the ability to fulfill needs unique to the organization, and the recognition of efforts and status through trust from centralized authority. With this theoretical foundation, public administration can find greater strife and progress in assuring active representation through discretion.

Family and Society

Room: L-5

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William Faulkner, the Dysfunctional Family Unit, and the Old South

Ashley Christ, Wilson Brissett

Department of English and Fine Arts, United States Air Force Academy

One of William Faulkner's most poignant themes woven through each of his works is family, specifically the dysfunctional family unit. In fact, Faulkner uses genealogies and complex family lineages as a metaphor for the ultimate dysfunctional family unit of America and the fratricide between brothers during the Civil War. Alongside the disintegration of the family unit, Faulkner depicts the splintering of the old southern order. An examination of two of Faulkner's most compelling families—the Compson's in *The Sound and the Fury* and the Sutpen line in *Absalom, Absalom*—highlights the ways in which the breakdown of the family mirrors the destruction of the Old South.

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The Reality of Violence as a Product of Irresponsibility

Allison Egan

Lin Zeller

Department of English and Fine Arts, United States Air Force Academy

The history of mankind is no stranger to the powers of domination. As a result, rulers, leaders and social classes emerged in an attempt to establish and prolong control. However, women in the 18th century were subjected to the violent aspect of power – often in forms of brute force and sexual aggression. To understand these behaviors, one must understand and study the history of violence and its cultural implications of the time. Socialites and Libertines in Frances Burney's *Evelina* (1778) lack an essential sense of responsibility, further influencing their ideas of appropriate interactions with women. In an analysis of the various men in Evelina's life, the association between responsibility and aggression is strikingly transparent. It is important to understand the tyrannical control of men over women in order to understand the effects of their power over one's position. With their delicacy at stake, women were limited to their roles in society and were often subjected to the mercy of a man's idea of discretion. In an analysis of Burney's novel, the effects of violence are shown to be products of frivolity, wickedly reflecting the acceptable customs of 18th century society. A warning of the consequences of irresponsibility, Burney's men are the source of her inspiration to amplify the awareness of the physical abuse inflicted upon the women around them.