MEETING OF THE MINDS

Carnegie Mellon Undergraduate Research Symposium
Presented by the Undergraduate Research Office

WELCOME

We welcome you to our 15th annual Meeting of the Minds. Nothing captures the exciting and groundbreaking work at Carnegie Mellon across all of the disciplines than this event. It is a unique chance to celebrate the academic creativity and inventiveness of our students and their mentors. If it seems a little overwhelming, the abstracts in this booklet are a good starting point. The opportunity to actually see the posters, hear the oral presentations, engage in an artist's project, or watch a performance will make those abstracts come alive in exciting and unpredictable ways.

There are two important times to keep in mind. At 2:30, Indira Nair, Professor in Engineering and Public Policy and Vice Provost for Education, will deliver a short keynote address in the first floor Kirr Commons area. We will also hold an iPod drawing and announcements of the final rounds for particular competitions will be made at this time.

Just as importantly, at 5:00 pm, our Awards Ceremony begins in McConomy Auditorium. Winners of the seventeen Meeting of the Minds competitions will be announced and prizes will be awarded. A list of all of the competitions is included near the end of this program booklet.

Thank you again for coming, and please enjoy our 15th Annual Meeting of the Minds

Stephanie Wallach
Assistant Vice Provost for Undergraduate Education
Undergraduate Research Office

Please Note: Research project titles, student names, advisor names and abstracts were submitted by the student researchers. Due to the great number of students and the large volume of text contained in this booklet, it is impossible for the Undergraduate Research Office to ensure the accuracy or omission of information sumbitted for publication.

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SPECIAL THANKS

We extend our special thanks to:

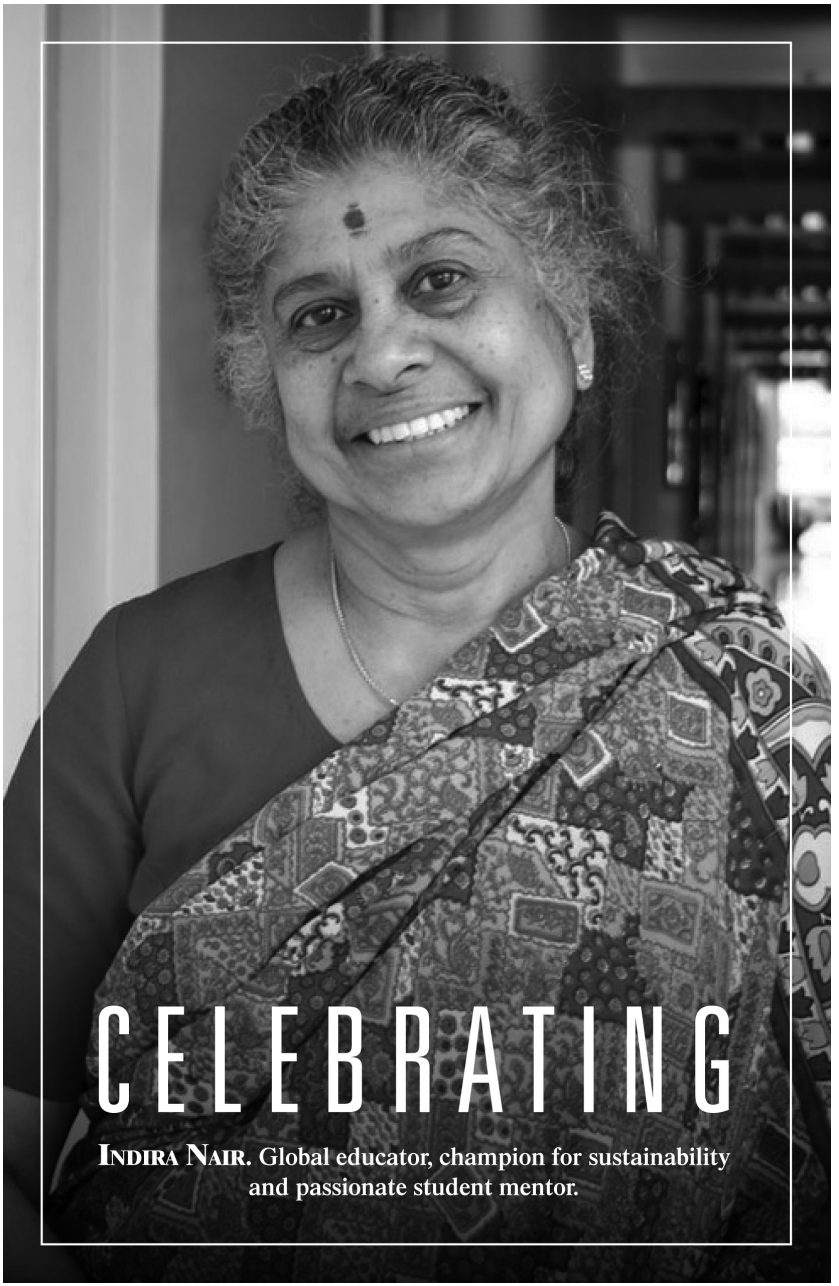
Carnegie Institute of Technology Dean's Office for the Mid-Afternoon Break

Google Pittsburgh for the Mid-Afternoon Break

School of Computer Science Dean's Office for the Judges' Reception

This symposium was funded by the Office of the Provost and the Undergraduate Research Office.

Many thanks to Sloane Astorino, Bryn Baldetti, Dan Barnett, Kathleen Bonte, Stephen Chan, Lynn DeFabio, Susan Finger, Marcia Gerwig, Anna Houck, Jen Keating-Miller, Kourtney Kissel, Maureen Mancuso, Thea Mann, Maureen May, Indira Nair, Molly Nix, Jessie Ramey, V. Emily Stark, Mark Stehlik, V. Emily Stark, Elisa Tragni Maloney, Jen Weidenhof, Instructional Technology, Catering and Staff, the University Center Staff, Balloons Instead, A.G. Trimble Company, Enhanced Digital Printing, ImagePoint Pittsburgh and all the other wonderful students and staff who make this event work.


CELEBRATING
INDIRA NAIR. Global educator, champion for sustainability
and passionate student mentor.

PRESENTATIONS

Students who are presenting at the symposium could sign up to do one of four different types of presentations:

Poster Presentation

Students will be standing by their posters for two hours or so to answer questions. Students participating in the Sigma Xi poster competition will be by their posters from 10 a.m. until 12:30 p.m. in Rangos 2 and 3. Students participating in the CIT poster competition will be by their posters from 12 noon to 2:30 p.m. in Rangos 1. Students participating in the general poster session will be by their posters from 12 noon until 2:30 p.m. or from 3 p.m. until 5 p.m. in the common areas of the University Center. Please feel free to wander through the poster presentations and ask questions of the students.

Oral Presentation

Students have been assigned a 20-minute time slot and will be located in one of six rooms along the second floor corridor (Peter, Dowd, Pake, McKenna, Wright or Class of '87). Students have been instructed to prepare a 10-minute oral presentation about their research, leaving five minutes for questions from the audience and five minutes to gather up their materials and make way for the next presentation.

Visual Arts Presentations

Students' work is displayed in several areas of the University Center. Students will be standing by their work from 3 until 5 p.m. to answer questions.

Performing Arts Presentations

Students will perform in McConomy Auditorium at a time assigned to them. They have been instructed to leave time after their performance for discussion with the audience.

ABSTRACTS

CARNEGIE INSTITUTE OF TECHNOLOGY

BIOMEDICAL ENGINEERING

2-Dimensional Fluid Structure Interaction Modeling of Endothelial Cells
Nicholas Russell / Biomedical Engineering
Advisor(s): Kerem Pekkan / Biological Sciences
Rangos 2 & 3 / Sigma Xi Group 6, 10:15am

There is strong evidence that flow induced mechanical forces acting on the endothelial cell lining of vascular systems can regulate the vascular tone, cause conformational changes within the intracellular domain, alter the gene expression and play important roles in the initiation and progression of cardiovascular disease. Understanding the endothelial mechanical response (cell deformation and stress distribution within the major load-bearing constitutive elements; the nucleus, microfilaments and cytoplasm) is an integral part of understanding the mechanism by which the flow induced forces (flow shear stress and pressure) are transduced to the biomolecular responses of the cell i.e. mechanotransduction. Our isolated cell assay experiments indicated that elevated structural stresses on the nucleus alters cellular signaling significantly and as a result requires accurate computational cell models to correlate nucleus stress with flow conditions. Current structural and fluid-structure interaction cell models have focused on the stress applied to the nucleus during sheared flow and attempted to match computational models to in vitro experimental results. However, these models are flawed in the initial assumptions about cell geometry, composition and structural behavior and produce inaccurate but self-consistent results. In this study we will demonstrate that considering the cell as having a fixed base, incompressible materials, and elastic materials produce divergent results and model cell behavior poorly when contrasted to physiologically motivated boundary conditions, compressible materials, and nonlinear materials. Our results demonstrated better consistency with current theories on cellular structure and response in comparison to the previous models is an important consideration when researching treatments or conditions that may result in significantly altered flow conditions.

A Bi-Ventricular Mock Loop
Soroush Khanlou / Biomedical Engineering & Patrick Lutz / Biomedical Engineering
Advisor(s): James Antaki / Biomedical Engineering & Conrad Zapanta / Biomedical Engineering
Hoch Commons-2nd Floor, Rangos side/12-2:30

A cardiovascular mock loop is a tool used for determining the hemodynamic effect of ventricular assist devices and for visualizing blood flow in the heart. Because animal testing for VADs is not always feasible, creating a system in the lab that can simulate the way a heart functions accurately and effectively is important. A brief description of the mock loop design and its original qualities is provided.

Alignment of Neural Tissue Images in 3-D for Enhanced Bouton Detection Accuracy
Robert Morhard / Biomedical Engineering
Advisor(s): Justin Crowley / Biological Sciences
Rangos 2 & 3 / Sigma Xi Group 6, 10:30am

Axonal boutons are pre-synaptic swellings that can be used to gather information about neural circuits, specifically, the presynaptic side of synapses. Bouton detection is typically done manually or through new, automated processes as has been developed through a collaboration between biologists and engineers at CMU. Manual detection is both time consuming and subject to human error. Early versions of our automated processes have a high false positive rate. Our automated process works by using simple geometric models to detect features in the image that are most likely boutons. In most 3-D microscopy images of neural tissue, the differences in depth are small enough that true boutons can be detected in multiple images in the z dimension. The false positive rate of our algorithm could be reduced if feature recognition of boutons only occurred if they were detected at multiple depths. Unfortunately, imaging processes vary in alignment over multiple depths due to inaccuracies in image acquisition and the movement of the tissue in relation to the camera. I present a method for aligning the images of various depths so that boutons may accurately be marked in multiple layers to decrease the false positive rate in automated detection methods.

Alpha Actinin 4 and Plectin-1 Expression in Melanoma Cells
Jaclyn Lock / Biomedical Engineering
Advisor(s): Alan Wells / University of PIttsburgh
Hoch Commons-2nd Floor, Rangos side / 3-5

Melanoma is an invasive skin cancer that arises from cells called melanocytes. The deregulated expresion of distinct proteins plays a vital role in the progression and metastasis of melanoma. Quantitative proteomic analysis of human melanoma tissue compared to normal skin revealed upregulation of several cytoskeletal proteins in melanoma. In this study, the expression levels of two proteins, alpha actinin 4 (ACTN4) and plectin-1, were analyzed during cellular growth and in tumor invasion. Both proteins are essential to cytoskeleton structure and ACTN4 is also associated with cellular motility. Western blot and quantitative real-time polymerase chain reaction analysis were utilized to determine relative protein and mRNA levels in melanocytes as compared to primary and metastatic tumor cells. ACTN4 was found to be upregulated in melanoma cells whereas plectin-1 was not upregulated. In addition, immunocitochemisty staining was utilized to assess the localization of ACTN4 in the cytoplasm of melanoma cells. It is hypotheszied that the over-expression and accumulation of ACTN4 plays an important role in tumor migration and invasion and future research is essential to determine its activation and role in signaling pathways that trigger metastasis and tumor cell progression.

Complex Fluids Based on Methacrylated Hyaluronic Acid
Tiffany Barth / Biomedical Engineering
Advisor(s): Newell Washburn / Chemistry
Rangos 1 / 12-2:230

Hyaluronic acid (HA) is a naturally occurring linear polysaccharide that is one of the chief components of the extracellular matrix and connective tissues. A substantial amount of research has been done on modifying HA in order to crosslink the material and produce biocompatible gels. By using a technique called emulsion polymerization, methacrylated hyaluronic acid is polymerized into small microgels that can be used in various applications. The main goal of this project is to create microgels containing moieties capable of deactivating the signaling proteins that cause scarring. Because protein communication is produced by a positive feedback system, a large surface area is required to absorb and deactivate the signals to avoid amplification and scarring. The mechanical properties of the microgels can be tuned depending on the method of purification of the microgels.

Delivery of siRNA using nanostructured star polymers to prevent craniosynotosis
Brian Bober / Chemical Engineering, Jonathan Leung / Chemical Engineering, & Eric Shyr / Biomedical Engineering
Advisor(s): Abiraman Srinivasan / Biochemical Engineering
Hoch Commons-2nd Floor, Window side / 3-5

Craniosynostosis is a birth defect characterized by the premature fusion of the cranial sutures during infancy. Newborns with craniosynostosis must undergo invasive recurring surgeries to separate the fused cranial sutures to enable brain growth. The commonly accepted cause of craniosynostosis is the over-expression of bone morphogenetic protein (BMP) at the suture site. One potential newapproach to mitigate this problem is to use short interfering Ribonucleic Acids (siRNA) that will be delivered to the cells using cationic star nanostructured polymers to suppress BMP induced bone mineralization and premature fusion of the cranial sutures. Objective The objectives of this research will be to determine that: a.siRNA can be efficiently encapsulated in cationic star polymers, b.Star nanostructured polymers will be able to successfully enter the cell types related to this pathology, and c. The released siRNA can efficiently target the respective messenger RNAs (mRNAs) and prevent osteoblast differentiation and bone mineralization in vitro.

Fluid Dynamic Assessment of Pediatric Hepatic Venous Flow Using Digital Partical Image Velocimetry
Mikhail Lara / Biomedical Engineering
Advisor(s): Kerem Pekkan / Biochemical Engineering
Hoch Commons-2nd Floor, Rangos side / 3-5

While it is established that pediatric liver transplantation can decrease the pulsatility and net outflow of blood into the inferior vena cava (IVC), it is unclear what mechanisms govern the change between hemodynamic states. Clinical studies have also shown that disruption of hepatic blood flow is linked to the pathologies external to the hepatic physiology, such as the progressive formation of pulmonary arteriovenous malformations (PAVMs). A detailed investigation of the flow within the hepatic vasculature is necessary to gain a comprehensive understanding on the origins of the characteristic abnormal venous flows in patients afflicted by cardiovascular disease. In this study, 2D Digital Particle Image Velocimetry was used to analyze the in vitro velocity and Reynolds Shear Stress (RSS) fields of pediatric models of the confluence of the major hepatic veins (HV) to the IVC. Steady flow rates corresponding to physiological and pathological scenarios were

driven through two vein models to assess the effects of vein geometry and inlet flow conditions on the behavior of the hepatic flow structures. This technique allowed us to image the flow field with high spatial resolution and identify both stable and unsteady flow structures within the vein geometry. Pressure measurements were also taken at the inlets and outlet of the models to estimate effective pressure drop and power loss of the vein geometries. Comparison of the results shows that flows within the venous confluences are characterized by the presence of distinct laminar and disturbed regions. The flow into both models is characterized by jet flows extending from the inlets of the hepatic veins as well as mixing regions resulting from crossflow between the jets and other inlet flows. The peak values for Reynolds Stress occur in the near jet regions and drop off abruptly upon collision with flow from the other hepatic veins. The association of peak Reynolds Stresses with the jets suggests a high degree of unsteadiness of the blood flow upon entry to the hepatic confluence. The disturbed flows in the jet and mixing regions are localized to the lower pouch region of the hepatic confluence as the flow field at the outlet exhibits negligible disturbances indicating a high rate of turbulent kinetic energy dissipation between the mixing region to the outlet region. Our study provides the first comprehensive quantitative analysis of the blood flow within the hepatic vasculature.

Synergistic Study of Bone Morphogenetic Protein 2 and Platelet Derived Growth Factors On Mesenchymal Stem Cells
Chelsea Kennedy-Snodgrass / Biomedical Engineering
Advisor(s): Jinku Kim / Biochemical Engineering
Kirr Commons-1st Floor, Window side / 12-2:30

One method for a bone regenerative therapy is to use implantable scaffolds which will promote structured bone tissue growth using various growth factors. In particular, bone morphogenetic protein 2 (BMP 2) and platelet derived growth factor (PDGF) are important for promoting cell growth and inducing bone formation. While the effects of each growth factor is known individually, this study looked at their combined effects in an attempt to find a combination optimal for bone growth.

CHEMICAL ENGINEERING

Ceiling Shower Orifice Plate
Margaret Cruickshanks / Mathematics, Morgan Heskett / Materials Science Engineering & Celia Ludwinski / Chemical Engineering
Advisor(s): James Schneider / Chemical Engineering
Hoch Commons-2nd Floor, Rangos side / 12-2:30

In recent years, society has become fixated on the attempt to stop the overuse of natural resources, such as fresh water. However, many people do not wish to give up luxuries, even those as mundane as a high-pressure shower. It is our hope to create a shower that uses plates with orifices of varying size in order to provide people with the water pressure of their choice while using the same volume of water. This would not only help the environment and the budgets of consumers, but would still maintain their expectations for an enjoyable shower. We also hope to integrate this design into the ceiling of the bathroom for multiple reasons. Not only could all users experience a more natural shower imitating that of a waterfall, but residents of taller builds could more comfortably utilize the appliance.

Characterization of Ion-Exchange Resin OC_{1065} as Potential Candidate of CO_2 Sorbent Capture
Bryan Friedman / Chemical Engineering
Advisor(s): John Kitchin / Chemical Engineering
Rangos 1 / 12-2:30

Due to the current changes in the global climate from greenhouse gases, different ways of capturing these gases such as CO_2 are currently under examination to reduce the amount of gases put into the atmosphere from industrial practices. Currently, liquid based amine sorbents are the predominant technology due to their high capacity of CO_2 absorption, but they have large heat requirements for regeneration of the solvent and the volatility of a majority of the solvents increases the cost of capture. One of the alternatives

investigated today for potential CO_2 capture is adsorption onto a sorbent, or a solid state material. Ion-exchange resins (IER), commonly used for water purification and softening, have been studied in this project. Ion-exchange resin OC_{1065} is a good candidate for CO_2 capture due to its structure with primary amine groups. Using a packed bed reactor, adsorption and desorption cycles of CO_2 on this resin were examined. CO_2 capture quantities and thermodynamic properties of OC_{1065} are characterized and compared with other sorbents that have been investigated for CO_2 capture to determine its potential use as a sorbent for post-combustion CO_2 capture.

Characterizing the Error in Calculated Oxygen Adsorption Energies From First Principles
Carmeline Dsilva / Chemical Engineering
Advisor(s): John Kitchin / Chemical Engineering
Rangos 2 & 3 / Sigma Xi Group 6, 10:00am

Quantum chemical methods, such as density functional theory (DFT), have become increasingly popular to predict the behaviors of catalysts and adsorbates without experiments. However, these techniques are not always exact. There are often discrepancies between experimental and computational results for oxygen systems, and increasing the rigor of such calculations does not improve their accuracy. We studied these inherent discrepancies to determine whether the errors are systematic. We found that there is a systematic correlation between the experimental adsorption energies of oxygen on platinum (111) and the corresponding computational results independent of the computational parameters used. We then worked on developing a correction factor that will allow for adjustment of the computational results to better agree with experiments.

CMU Chemical Engineering Car
Alexander Chou / Chemical Engineering, Christopher Edwards / Chemical Engineering, Rogaite Shafi / Chemical Engineering, Robert Wiegmann / Chemical Engineering
Advisor(s): Schott Epstein / Chemical Engineering, James Miller / Chemical Engineering
Kirr Commons-1st Floor, Window side / 12-2:30

The Chemical Engineering Car Competition is a national, collegiate competition sponsored by the American Institute of Chemical Engineering (AIChE). The competition is based on the challenge of designing and building a car that is powered by a chemical reaction. The car must stop at a distance between 75 and 100 feet carrying a load of water. Both the distance and load are specified on the day of the competition. The competition is designed to give student engineers the opportunity to apply their knowledge to a design

project and to gain research experience. It also gives students an opportunity to meet with other students across the country, share ideas, and network. Our objective as a part of the Carnegie Mellon ChemE Car Team is to develop an efficient and accurate mechanism for stopping the car at the desired distance as well as a reliable manner to power the car.

Delivery of siRNA Using Nanostructured Star Polymers to Prevent Craniosynotosis Sorbent Capture
Brian Bober / Chemical Engineering, Jonathan Leung / Chemical Engineering, & Eric Shyr / Chemical Engineering
Advisor(s): Abiraman Srinivasan / Chemical Engineering
Hoch Commons-2nd Floor, Windowns side / 3-5

Craniosynostosis is a birth defect characterized by the premature fusion of the cranial sutures during infancy. Newborns with craniosynostosis must undergo invasive recurring surgeries to separate the fused cranial sutures to enable brain growth. The commonly accepted cause of craniosynostosis is the over-expression of bone morphogenetic protein (BMP) at the suture site. One potential new approach to mitigate this problem is to use short interfering Ribonucleic Acids (siRNA) that will be delivered to the cells using cationic star nanostructured polymers to suppress BMP induced bone mineralization and premature fusion of the cranial sutures.
Objective:
The objectives of this research will be to determine that:
a.siRNA can be efficiently encapsulated in cationic star polymers,
b.Star nanostructured polymers will be able to successfully enter the cell types related to this pathology, and
c. The released siRNA can efficiently target the respective messenger RNAs (mRNAs) and prevent osteoblast differentiation and bone
mineralization in vitro.

Effect of zero-valent Iron Nanopraticles on Sulfate Concentraction in Aqueous Systems
Anthony Yu / Chemical Engineering
Advisor(s): Robert Tilton / Chemical Engineering
Rangos 1 / 12-2:30

Sulfate ion reduction in natural aqueous systems is usually attributed to biological means (sulfate reducing bacteria). However decreases in sulfate ion concentration have been observed in ground water samples that have been treated with zero-valent iron nanoparticles (NZVI). The aim of this project is to understand the interaction between

sulfate ions and NZVI so as to minimize the potential negative consequences of using iron nanoparticles for ground water treatment. Sterile reactors were constructed to study whether or not the decrease in sulfate concentration could be attributed to NZVI. A clear decrease in sulfate concentration was seen in the presence of NZVI, and the interaction between NZVI and sulfate was found to be limited by NZVI. Adsorption isotherms and sulfide assays were conducted in order to understand the underlying mechanism. Results from these experiments, combined with cyclic voltammetry experiments indicate that decreases in sulfate concentration in natural systems amended with NZVI are caused by specific adsorption of the sulfate ion to the particle surface.

Effects of Fluid Shear Stress on Endothelial Cells Related to Premature Aging
Alexa Beaver / Chemical Engineering
Advisor(s): Kris Dahl / Chemical Engineering
Rangos 1 / 12-2:30

Hutchinson-Gilford progeria syndrome (HGPS) is a rare genetic form of premature aging which affects numerous load-bearing tissue types, most significantly the cardiovascular system. At the cell level, the nucleus is stiffened and shows a reorganized genome. The purpose of this project is to examine how this nuclear mutation prohibits cells from effectively remodeling cytoskeletal features in response to directional stress in endothelial cells. Specifically, this project focuses on the reorganization of mitochondria, which are attached to the cytoskeleton and provide an effective method for tracking intracellular remodeling. Also, mitochondrial proteins are misregulated in an HGPS mouse model, to a higher degree in cells under high shear stress. This may suggest that the HGPS mutation alters key cellular functions such as energy production, regulation of cell metabolism, and response to oxidative stress. We hypothesize that the stiffened nucleus may play a role in the cytoskeleton's ability to reorganize itself and mitochondria in response to cell stress, thus affecting mitochondria function. Mitochondria are labeled in live and fixed cells, including cells expressing the mutant HGPS protein, using fluorescent probes and measured using confocal and widefield microscopy. A better quantification of sub-cellular organization, especially related to functional shear-responsive elements such as the mitochondria, will provide a better understanding of HGPS etiology and may suggest new routes of treatment.

Grey Water - Water Recycling and Recapturing Heat
Issac Kwon / Architecture, Celia Ludwinski / Chemical Engineering, & Rebecca Willmott / Electrical & Computer Engineering
Advisor(s): James Schneider / Chemical Engineering
Hoch Commons-2nd Floor, Window side / 12-2:30

Gray water purification is used to take water from the shower, sink, dishwasher and washing machine and making it usable as toilet water or for watering plants. Standard gray water purification systems force gray water to flow through a sand filtration system, and then a simple plant filtration system before being re-used. On the other hand, commercial water treatment plants use a process called bioremediation to decompose the organic compounds in waste water, leaving the water more cleanly than had it been passed through a simple sand based filter. Bioremediation creates a by-product of heat, which can be harnessed to produce radiant heating, or to heat purified water. This, in turn, can help reduce the energy consumption of a household.

Hydrogen Reforming with Methanol and Glycerol
Dana Evert-Parise / Chemical Engineering
Advisor(s): John Kitchin / Chemical Engineering
Hoch Commons-2nd Floor, Window side / 12-2:30

Fossil fuels represent about ninety seven percent of the world's source of energy. Yet due to increasing signs of CO2 in the atmosphere and the fact that fossil fuels are a non-renewable resource, alternative forms of energy need to be produced to alleviate the world's dependence on this energy. Fuel cells are a part of the solution for our energy crisis due to the rising demand for clean and sustainable energy sources for the future. A fuel cell is a device that produces electricity or hydrogen that can be used for electricity from an electrochemical reaction. Current research has been applied to developing more efficient fuel cells to meet this demand in energy, since the current fuel cell model is too inefficient and expensive for the consumer market. One of the reasons this is so is because most current research into using hydrogen as an alternative energy source relies on producing hydrogen from fossil fuels. The production of hydrogen using biomass, a form of renewable energy, in fuel cells can eliminate these fossil fuels. By using glycerol as the input, the only outputs of this process would be carbon dioxide and hydrogen. Hydrogen production through this method is renewable because carbon dioxide can be recaptured by the environment through plant life to renew the necessary biomass, and the hydrogen can be used for energy.

Mixing of Organic Aerosols
Peter Mellott / Chemical Engineering
Advisor(s): Neil Donahue / Chemical Engineering
Rangos 1 / 12-2:30

Atmospheric aerosols make up an important part of atmospheric Chemistry. This research studies the miscibility of organic compounds in the highly dilute conditions that occurs in the atmosphere. The purpose is to study how an intermediate species allows mixing of two immiscible organics.The subjects of this research are squalane and 1,2,4-butanetriol. These two chemicals are mixed with an intermediate species, suberic acid.

One-Step Synthesis of Bimetallic Catalysts and FTIR Evalution
Johanna Lee / Chemical Engineering
Advisor(s): Nish Shukla / Physics
Hoch Commons-2nd Floor, Window side / 12-2:30

The project will study the synthesis of various nanoparticles including FeCo, FeNi, and NiCo, all of which are bimetallic catalysts. Different nanoparticles can be synthesized according to particle size, surfactants, surface properties, and interparticle interactions that take place during the synthesis. By coating these nanoparticles with silica, the porosity will be evaluated under the FTIR. Various nanoparticles are produced by differing the surfactants, solvents, heating time, or molar ratio of the two metals that are synthesized. Acknowledging these factors, we hope to synthesize ideal FeCo, FeNi, and NiCo bimetallic catalysts that have porosity. Three measurements will be taken for each sample where it will be exposed to different pressures while undergoing CO absorption. The porosity of these catalysts can be evaluated from the FTIR measurements using baseline and background corrections. The long term vision of this proposed study is to make stable and porous bimetallic catalysts that can be used commercially

Phase Diagrams of Block Copolymers Templated with Protein and Silica Nanoparticles
Brandon Chock / Chemical Engineering
Advisor(s): Lynn Walker / Chemical Engineering
Wean Commons-1st Floor, Connan side / 3-5

Having profound potential in the electronics and semiconductor industry, nanoparticles have become an active field of research. One main objective with nanotechnology is the need to have highly aligned and well controlled placement of nanoparticles. One method of organization is the usage of block copolymers. To determine the formation of nanoparticles in solution, the research objective has

been to create birefringence phase diagrams based on variations of concentrations and temperatures. To make this determination, Polarization testing has been used to test for birefringence.

Purification and Characterization of the Telomerase Enzyme from Large-Scaled Plasmodium Falciparum Cultures
Annie Sheng / Chemical Engineering
Advisor(s): Kausik Chakrabarti / Chemistry
Hoch Commons-2nd Floor, Rangos side / 12-2:30

Plasmodium falciparum is a parasite that causes human malaria. Annually, millions die from malaria worldwide. Although antimalarial drugs exist, high occurrence of drug resistant strains of P. falciparum underscores the urgency to find an alternative candidate. Targeting Telomerase, a cellular reverse transcriptase that protects the ends of chromosomes, could be an ideal target for malaria therapeutics because a majority of virulence factor genes are located at the chromosome ends of this pathogen. Therefore, blocking telomerase will adversely affect the maintenance of virulence genes, infectivity and survival of this pathogen. Biochemical characterization of telomerase catalysis should provide important insights to the development of therapeutic strategies targeting telomerase. To characterize telomerase from this important human pathogen, I seek to streamline an integrated process of purifying this enzyme on ion exchange and affinity based chromatography from large-scale pathogen cultures and develop a functional assay to biochemically characterize malarial telomerase. If P. falciparum telomerase can be purified, yielding high activity, I can further study the effect of telomerase inhibitors to block its enzymatic activity in vitro.

Shape and Size Controlled Synthesis of Nanoparticulate Catalysts
Abigail Ondeck / Chemical Engineering
Advisor(s): Nisha Shukla / Physics
Kirr Commons-1st Floor, Window side / 12-2:30

The main purpose of this research experiment is to determine the exact processes for creating metal nanoparticulate catalysts with certain shapes and sizes. When created and used, they are very important due to their beneficial effects on preserving the environment. Today, nanoparticles can be synthesized but their use is very limited due to the inability to produce batch processes all with similar shapes and sizes. The long term goal of this research project is to make stable nanoparticles with a procedure that will produce a certain size and shape nanoparticulate catalyst. Another goal is to also gain a

deeper understanding of different methods of creating nanoparticulate catalysts with a specific shape and size and their effects and when each method is more appropriate.

Sodium Alginate Gel for Bon Tissue Engineering
Young-Hye Song / Chemical Engineering
Advisor(s): Jeffery Hollinger / Biological Sciences
Rangos 1 / 12-2:30

Sodium alginate has recently gained attention as a 3-dimensional tissue engineering vehicle since it can be crosslinked in non-cytotoxic conditions with divalent cations in order to encapsulate and immobilize cells, as well as it can be easily un-crosslinked with mild chelating agents to release the entrapped cells. In addition, sodium alginate is soluble in aqueous solution, and forms stable 3-dimensional gels at room temperature. These properties allow sodium alginate to be utilized in drug delivery, wound healing, and tissue engineering applications. However, little work has been done demonstrating the efficacy of alginate gel for tissue engineering to date. In this project, we investigated in vitro biocompatibility and functionality of the sodium alginate gels. Commercially available hydrogels, namely Matrigel and Corgel, were also used to compare the performance of the sodium alginate hydrogels. The assays for in vitro functionality include elution assay of biologicals, bovine serum albumin (BSA), recombinant human bone morphogenetic protein-2 (rhBMP-2), and recombinant human platelet-derived growth factor-BB (rhPDGF-BB). As for biocompatibility, human mesenchymal stem cells were used to assess cell viability, cell proliferation, and cell differentiation on sodium alginate hydrogels as well as the two commercially available gel types.

Synthesis of Core - Shell Structures of Catalytic Nanoparticles
Seif Yusuf / Chemical Engineering
Advisor(s): Nisha Shukla / Physics
Rangos 1 / 12-2:30

The objective of the proposed work is to utilize these novel methods to synthesize metal nanoparticles with precise control over size and shape, and thus prepare catalysts with highly uniform distributions of active sites. The proposed effort will synthesize nanoparticle catalysts, characterize their size and shape distributions, and investigate their catalytic reactivity and stability for simple, but technologically relevant, probe reactions such as CO and hydrogen oxidation. In order to improve

catalyst stability, these nanoparticles will furthermore be coated with protective silica shells. The shell thickness and porosity will be controlled to attain maximum thermal stability with minimal loss of reactivity. The outcomes of the proposed work will include a set of highly optimized catalyst materials, a range of methodologies for the preparation of tailored catalysts, and an improved understanding for how size and shape of nanoparticles affect activity and selectivity of a catalyst.

Synthesis of Metal Nanoparticles with Zirconium Coatings
Eric Bosworth / Chemical Engineering
Advisor(s): Nisha Shukla / Physics
Hoch Commons - 2nd Floor, Window side / 12- 2:30

The main purpose of this research is to produce methods for coating metal nanoparticles with Zirconium shells. The advantage of zirconium coatings is that the pore size will be different from the previously standard coating of silica. This will allow for greater versatility when used in catalytic systems.

The Effect of Surfactants on the Rheology of Mucin Solutions
Austin Good / Chemical Engineering
Advisor(s): Robert Tilton / Chemical Engineering
Rangos 1 / 12-2:30

Cystic fibrosis is a hereditary disease that, amongst other things, causes the development of thick mucus build-ups in the lungs, which inhibit mucociliary clearance and provide good growing conditions for bacterial infections. The treatment of these infections has proved to be very difficult due to a limitation on the ability of aerosolized antibiotic drugs to surpass mucus blockages in smaller airways and reach these infected areas. The use of self-dispersing surfactant solutions is currently under investigation as a possibility for spreading antibiotics to these infected areas. Along with the ability of these surfactants to promote spreading of the drug, it is also of interest to investigate the effects that these surfactant solutions have on the viscosity of the mucus, as a thinning of the mucus may break up hardened clumps and enhance mucociliary clearance. To investigate this effect, solutions of porcine gastric mucin and saline were used to model the mucus of the lungs. Sodium dodecyl sulfate (SDS), cetyl trimethyl ammonium bromide (CTAB), and tyloxapol were combined with mucin to determine whether these surfactants changed the rheological properties of the mucin solutions. These effects were also used to gain a better understanding of the interactions between the mucin polymers and surfactants of various charges.

The Effect of the Delta50 Mutation in Lamin A on the Stability of the IG Fold Domain
Schott Chapman / Chemical Engineerin
Advisor(s): Kris Dahl / Biomedical Engineering
Rangos 1 / 12-2:30

Hutchinson Gilford progeria syndrome is a premature aging disease caused by a mutation in the nuclear structural protein lamin A, resulting in a deletion of 50 amino acids at the tail. The mutation is near an Ig-fold, which is responsible for many protein-protein and protein-DNA interactions. Other Ig-fold proteins have shown functional mechanical unfolding, suggesting that the tail domain of lamin A may be mechanically sensitive. To clarify the mechanism of disease progression, previous studies have looked at how the delta50 mutation affects lamin A binding to other proteins, but no one has examined changes in the mechanics of the protein itself. We have performed spectroscopy experiments of purified recombinant proteins to examine effects of the delta50 mutation on the thermodynamic stability of lamin A. The folding and unfolding properties of the delta50 and normal lamin A protein were compared to discover whether the mutation affects the stability of the adjacent Ig-fold. Protein fragments were expressed in E. coli bacteria and purified using a GST-tag. Proteins were tested for Ig-fold stability by measuring the beta-sheet structure via circular dichroism and by measuring the fluorescence of tryptophans embedded in the hydrophobic core as functions of temperature. We found xyz... Also, differential DNA binding of lamin protein fragments were compared using UV/Vis absorbance. The effect of the delta50 mutation will help determine whether normal function of lamin A is disrupted by intramolecular forces or by extramolecular interactions.

CIVIL AND ENVIRONMENTAL ENGINEERING

A Comparative Analysis of Carbon Emissions per Transportation Source in America's Three Biggest Cities: New York, Chicago, Los Angeles
Sabrina Porter / Civil and Environmental Engineering
Advisor(s): Mitchell Small / Civil and Environmental Engineering
Rangos 2 & 3 / Sigman Xi Group 7, 10:00 am

With populations of 7.9, 8.2, and 9.8 million people respectively, the Chicago metropolitan area, New York, and Los Angeles County are the United States' three largest metropolitan centers. They face the challenges occasioned by cities on a larger scale including health care, electricity, water systems, education, and public safety. In terms of the environment however, there is no greater challenge for the megacity than transportation. Nationwide, transportation is responsible for 42 percent of the total United States' carbon emissions. The challenges of transportation for these three cities thus have significant global as well as local implications. My research breaks down the carbon emissions in each city per its three main transportation sources – car, bus, and subway, in order to determine the greatest contributors to each city's carbon footprint. The results demonstrate that the car footprint in Los Angeles is the highest of all estimates, dwarfing transportation emissions in Chicago and New York, particularly in terms of their subway and bus patterns. The research infers that a change in transportation use is in order to maximize the sustainability of the cities. A change in the transportation pattern in each city is the first step toward sustainability. This is explored by projecting future CO2 emissions for each city for different scenarios of population, automotive fuel efficiency, and shifts from cars to subway or bus trips. The process of changing these types of societal trends in transportation requires a host of policy initiatives, which are also examined in my research.

Engergy Saving Through Predictive Techniques
Benjamin Som-Pimpong / Mechanical Engineering &
Karen Yu / Civil and Environmental Engineering
Advisor(s): Anind Dey / Human Computer Interaction Inst. &
Jennifer Mankoff / Human Computer Interaction Inst.
Kirr Commons-1st Floor, Window Side / 3-5

Heating and cooling make up about 56% of energy costs in the typical American home (US Department of Energyhttp://www.energy.gov/heatingcooling.htm), making it the main contributor to the 4 metric tons of carbon dioxide coming from American homes per person per year (EPA - http://epa.gov/climatechange/emissions/ind_home.html). More efficient use of HVAC systems can significantly reduce energy consumption and greenhouse gas emissions, but it is often a hassle for people to turn their thermostats down as they leave the house and back up when they return. In the Human Computer Interaction Institute we have developed a solution using a CMU-grown location prediction technique to automatically control user's thermostats. The prototypical system we used for a user study consists of a programmable thermostat, a Google android phone, and Smarthome controllers that allow home heating systems to be controlled remotely. In our study, we had a participant pool separated into two groups, one having "automatic" control of their thermostats and the other having "non-automatic control." The automatic control group had phones that were trained using GPS logs of the participants and a prediction algorithm to anticipate when they would arrive and leave the home and turn the heating on or off accordingly. Users could also manually control the system through the phone. The second group only had the manual control. As the participants interact with their thermostats through their phones, they are given feedback through the application. Participants were given surveys at the beginning and throughout the 8 week period that they had the phones to determine how their energy usage behavior changed. In a city like Pittsburgh where winter temperatures are often below freezing, efficient control systems for residential heating can have a large impact on CO2 emissions. We envision that automatic control of the system will reap large savings in money and CO2 emissions.

Tetris Building Blocks
Reyes Flete / Mechanical Engineering,
Elizabeth Hohenstein / Civil and Environmental Engineering &
Richard Musgrave / Mechanical Engineering
Advisor(s): Susan Finger / Civil and Environmental Engineering
Connan / 12:30-3:30pm

Tetris Building Blocks are designed to introduce children to the basic principles of structures and geometry though modular building blocks in geometric shapes. Because of the shape of the blocks, children can learn about the forces and moments through building structures with overhangs. The Tetris shapes of the blocks allows for unbalanced forces and moments to develop and cause a tendency for these blocks to tip over. The blocks are made of cardboard which is a sturdy, but light material so children can pick them up and stack them into substantial structures.

Tiny Tractable Trebuchet
Tyrone Celoza / Mechanical Engineering,
Madeleine Stearns / Civil and Environmental Engineering &
James Hresko / Mechanical Engineering
Advisor(s): Susan Finger / Civil and Environmental Engineering
Connan / 12:30-3:30pm

The Tiny Tractable Trebuchet is designed to engage children in learning about projectile dynamics, center of mass, gravity, and moment arms. Two to four people can play the trebuchet game. The goal is to use the trebuchet to launch a projectile and hit small castles at various distances from the trebuchet. The player must change the settings of the trebuchet in order to hit a specific target. The trebuchet can be manipulated in a way so that players can experiment with different settings to get the greatest distance, height, speed, or accuracy. Points are awarded whenever a player directly hits a castle, and more points are given for hitting castles farther away from the trebuchet.

Why Buggy?: Documentary Film Project
Erin Gantz / Chemistry
David Kinskey-Lebeda / Civil and Environmental Engineering &
Advisor(s): Timothy Haggerty / Undecided
McConomy Auditorium / 10:00-11:00

Buggy is a longstanding tradition on Carnegie Mellon's campus, inspiring students to awaken on weekends before the sun rises to send individuals racing up and down hills in a vehicle that resembles a torpedo on wheels. The question that those not involved in the activity must ask, is "why?" We created a video documentary on the subject of Buggy, focusing on one specific organization, the Carnegie Involvement Association. No documentary has been presented on Buggy thus far, and this video narrative will show viewers not only what Buggy is, but give them an appreciation for why students become so dedicated to this sport which combines athleticism with science and technology.

XyloHero
Jacob Divone / Mechanical Engineering
Mohiuddin Mohamad Ali / Civil and Environmental Engineering &
Advisor(s): Susan Finger / Civil and Environmental Engineering
Connan / 12:30-3:30

The XyloHero is designed to give children an appreciation for music through the concept of synesthesia. The XyloHero creates both aural and visual outputs from the child's tactile input to a xylophone. The XyloHero is a fully functional xylophone with two octaves. When a key is pressed, a colored light is activated that corresponds to that note in an octave. This augmented sensory response enables children to see and hear the concept of an octave because the same note in two different octaves sound different but illuminate a single light. Children will be able to play songs that are either provided with the XyloHero or create their own tunes. The visual response of colored lights when notes are played takes advantage of synesthesia and gives children an appreciation for music in a 'different light'.

ELECTRICAL AND COMPUTER ENGINEERING

A Photoluminescence Mapping System for Two-Dimensional Characterization of III-V Devices
Rebecca Asher / Electrical and Computer Engineering
Advisor(s): Elias Towe / Electrical and Computer Engineering
Rangos 1 / 12-2:30

As novel III-V semiconductor materials are grown for use in light emitting and solar cell devices, assessing the new compounds' optical quality is essential. Such assessment is typically accomplished using conventional photoluminescence spectroscopy. However, because surface defects may occur in various positions on the material face, single spot photoluminescence measurements are not sufficient to accurately quantify optical quality. More promising, a two-dimensional photoluminescence scan can detect material

defects at multiple points. We present a two-dimensional mapping system that will scan the material face while acquiring photoluminescence data. The system was constructed using two high-precision linear stages controlled concurrently. Two-dimensional photoluminescence spectroscopy can reveal spatially distributed defects that could be overlooked by conventional photoluminescence and thus provides a more comprehensive method for the assessment of optical quality in III-V devices.

ASME EarthSaver: Autonomous Recycling Sorter
Jaime Bourne / Mechanical Engineering, Collin Buchan / Mechanical Engineering, Katherine Coste / Mechanical Engineering, Megan Dority, Mechanical Engineering, Steven Ford, Mechanical Engineering, Szu-Chieh Lu / Mechanical Engineering. Prerak Patel / Electrical and Computer Engineering. Michael Saitta / Undecided, Daniel Shope / Mechanical Engineering, David Stonestrom / Mechanical Engineering & Christopher Tomaszewski / Mechanical Engineering
Advisor(s): Cecil Higgs / Mechanical Engineering
Hoch Commons-2nd Floor, WIndow side / 3-5

Recycling is a growing industry accounting for more than 1.5 million jobs and $100 billion in revenue. More than 600 million metric tons of material is processed globally every year. Green initiatives have raised public awareness of recycling and other earth-conscious practices. This expansion has resulted in a demand for efficient and cost-effective means of processing recyclable waste. Material sorting is a costly step in the recycling process. Improperly sorted items slow down the process, reducing the monetary margin of recycling. To this effect the researchers have developed a household scale material sorter. The system autonomously sorts commonly recyclable items by material.

Assistive Automotive Intelligence Technology
Ilya Kelner / Electrical and Computer Engineering
Advisor(s): George Kantor / Robotics Institute
Hoch Commons-2nd Floor, Rangos side / 12-2:30

This project is the creation and testing of a driving assist technology called Assistive Automotive Intelligence Technology, or AAIT (pronounced “a’ight”), that is designed to give predictive feedback to the user by helping to guide the user’s actions, but not supersede them, to provide a safer and easier control of the vehicle. The aim is to make the AAIT system both versatile/robust and fast, so that it can function as designed well beyond the range of normal expected operation.

Association Fields in Coregistered 2D-3D Images
Ian Lenz / Electrical and Computer Engineering
Advisor(s): Tai-Sing Lee / Computer Science
Rangos 1 / 12-2:30

The human brain is capable of inferring the underlying three-dimensional structure of an image quite effectively, even without the aid of stereoscopic cues. An analysis of statistical relationships in a coregistered database of two-dimensional images and three-dimensional range data provides some insight into other cues which could possibly explain this inferential ability. This is useful both in hypothesizing as to how the human visual system works and for developing computer vision systems to perform similar inference.

Automatic Surface Mesh Generation for Human Abdominal Aortic Aneurysms
Amber Xu / Electrical and Computer Engineering
Advisor(s): Ender Finol / Biomedical Engineering
Hoch Commins-2nd Floor, Window side / 12-2:30

The surfaces of human abdominal aortic aneurysms (AAAs) are characterized by local curvature changes which we can assess using geometric indices calculated from a surface mesh of the AAA outer wall. Reconstructing the 3D surface mesh from segmented images creates low-quality elements, unrealistic sharp corners and surface irregularities. To optimize the mesh quality, an iterative algorithm was developed to perform mesh refinement and smoothing. Triangular surface meshes are generated and refined using an Delaunay triangulation based algorithm that forces mesh nodes into equilibrium positions. An initial interpolation of wall points is performed to minimize irregularities of the surface. A surface smoothing algorithm based on a low pass filter is applied to remove sharp corners. The optimal number of iterations for mesh refinement and smoothing are determined by a minimum average quality index and AAA sac volume change. This framework automatically generates high quality triangular surface meshes that can be used to characterize local curvature changes of the AAA wall.

Automatic Synthesis of MIPS and ARM Pipelines using T-piper
Rachata Ausavarungnirun / Electrical and Computer Engineering
Advisor(s): James C. Hoe / Electrical and Computer Engineering
Rangos 1 / 12-2:30

Pipelining is a technique that is widely used to optimize the performance of processors. However, manually writing a pipeline datapath is a tedious process. This project created a case study on one of the tools called T-piper that will automatically synthesize an in-order implementation from the transactional datapath specification. In order to make a comparison between the manually written pipeline and the generated pipeline, a datapath that are capable of running MIPS and ARM assembly is built. Then, several transactional datapath specifications describing different pipeline structures were designed. Based on the specification, T-piper will generate the RTL-Verilog implementation. The method of comparison involved running benchmark programs on the generated processor. The result shows that the performance on the manually written design and the generated pipeline are comparable. In addition, MIPS design exploration shows that a processor development cycle can be reduced significantly with T-Piper.

Autonomous Energy House
Ivan Lee / Electrical and Computer Engineering &
Yixin Liu / Electrical and Computer Engineering
Advisor(s): Benoit Morel / Engineering and Public Policy
Rangos 1 / 12-2:30

The earth's reserve of fossil fuels is depleting at an alarming rate due to rapid population growth. In the near future, these non-renewable sources of energy will be exhausted. Hence, there is an important need to explore and develop sources of renewable energy. However, there is currently a limitation of the current renewable energy sources for them to be used independently on an everyday basis due to environmental limitations and the difficulty of storing these forms of energy. By introducing the idea of electrolysis as a form of energy storage, the project aims to explore how this can be used to generate the starting materials required for hydrogen fuel cells. The research that we are doing aims to explore the feasibility and economics of a system of energy production which combines solar energy, electrolysis of water and hydrogen fuel cells to produce an autonomous system which would allow for the generation of electricity in homes on a large scale basis that rely solely on renewable resources present in our environment.

CMU Virtual Coach and TravellingWave VoicePredict Integration project
Jun Woo Park / Electrical and Computer Engineering
Advisor(s): Asim Smailagic / Electrical and Computer Engineering
Rangos 2 & 3 / Sigma Xi Group 5, 10:15am

Existing interfaces for mobile devices broadly include the 9-digit keypad, miniature keyboards, and more recently touch-based inputs. These interfaces are being used by mobile users to enter text into applications like email, messaging, or internet browsing. It is widely acknowledged that these low-level input methods are “clumsy” and lack the speed, accuracy, and user-friendliness of a full-size keyboard. To address this problem, this project will develop a “predictive speech-to-text” prototype, as a new user interface paradigm for interacting with CMU Virtual Coach. These technologies have been incorporated into first iteration of a product, called “VoicePredict”, which in turn claims to be one of the first multimodal mobile user experience. More broadly, voice prediction technology has the potential to become a ubiquitous interface for a variety of computing platforms including the personal computer, the embedded technology industry, and assistive technologies. The research project involves extending speech-to-text technology with voice prediction for integration with CMU Virtual Coach that involve assistive technologies. It is anticipated that the end product will result in a powered wheel chair with an inherent multimodal user interface that will significantly benefit the lives of the elderly and people with disability.

Design and Implementation of an Optimized Method of Solar Panel Charge Control
David Brombert / Electrical and Computer Engineering
Austin Bucan / Electrical and Computer Engineering
Rahee Ghosh / Electrical and Computer Engineering
Christopher Palmer / Undecided
Robert Wedler / Electrical and Computer Engineering
Advisor(s): Susan Finger / Civil and Environmental Engineering
Hoch Commons-2nd Floor, Rangos side / 12-2:230

Placing individual panels in a solar array in parallel has several advantages over the traditional way of connecting panels in series. Motivation for placing panels in parallel stems from safety considerations; series configurations result in systems with hazardously high voltages. In addition, when solar panels are placed in series, any part of the array that is compromised will cause a significant drop in total output. To use solar panels in parallel, improvements to the standard charge controller must be made. A typical charge controller operates by matching the impedance of the entire solar array, but when the panels are placed in parallel, the converter cannot match the impedance of more than one set of panels at a time. This raises the need for a design with multiple smaller charge controllers for each set of panels so that they can be individually optimized. The proposed research

involves using CAD software to design a charge controller. Once the operation of the standard charge controller has been verified by physical construction and testing, multiple charge controllers will be designed with added functionality that enable them to operate in parallel.

Design of a Mobile Retail Application
Amandianeze Nwana / Electrical and Computer Engineering &
Devon Yang / Electrical and Computer Engineering
Advisor(s): Priya Narasimhan / Electrical and Computer Engineering
Rangos 1 / 12-2:30

With mobile phone applications becoming increasingly popular, we are looking to expand mobile applications into the retail space by utilizing newer technologies such as QR codes and augmented reality to encode new types of data. Our research includes user studies on various types of technologies and interfaces that can be incorporated into a mobile application. In the retail space, we look into incorporating several facets of retail market research into our application by aggregating metrics to automate many decision tasks that are currently performed manually, including inventory management and planogram design. With the maturity of these topics, mobile applications will likely play a significant role in the future of the retail space.

Design of a Thermal Cooling System for a Solar-Powered Vehicle to Increase Power Efficiency
Michael Barako / Mechanical Engineering,
David Bromberg / Electrical and Computer Engineering.
Stephen Mead / Electrical and Computer Engineering
Advisor(s): Susan Finger / Civil and Environmental Engineering
Hoch Commons-2nd Floor, Rangos side / 3-5

In order to maximize the efficiency of solar alternative energy systems, thermal cooling techniques must be researched and implemented. In general, the silicon solar cells that constitute solar arrays perform at maximum efficiency at lower temperatures, but during operation, average temperature increases. Thermal cooling devices to counter this effect are necessary to ensure a solar array is operating at maximum output. The proposed research involves the design of such a cooling system to be used for a solar-powered vehicle, a new and growing application of solar energy. It includes the exploration of various factors that may influence temperature reduction, including solar panel backing and coating, as well as active and passive cooling systems. The custom cooling system will then be implemented in a full-scale solar-electric race boat, where it will be used to cool an array of four commercial solar panels.

Economizing the Autonomous Underwater Vehicle
Ethan Minogue / Electrical and Computer Engineering
Advisor(s): George Kantor / Robotics Institute
Hoch Commons-2nd Floor, Window side / 12-2:30

My project will be the refitting, programming and testing of the ShallowX Underwater Autonomous Vehicle (AUV). The intent of this project is to create a robust, yet affordable, platform capable of autonomously performing missions such as hull and foundation inspections. The robotic systems developed during this project have applications in infrastructure maintenance and commercial shipping.

Education e-Village
Saurabh Sanghvi / Electrical and Computer Engineering
Advisor(s): Mary Bernardine Dias / Robotics Institute
Rangos 2 & 3 / Sigma Xi Group 7, 11:00am

The Education e-Village project was created to increase access of technical resources to developing regions around the world. Our specific goal is to create an online virtual community to share technical course ware that can be used to empower a new generation of technologists in developing regions. However, unlike current Open Course ware we want to explore the role of collaboration and online communities in spreading education of technology in developing regions. The goals of the project are to design, implement, launch, and evaluate an online virtual community of post-secondary-school educators dedicated to educating technologists in developing communities around the world. Through E-Village, educators from around the globe will be able to share ideas, experiences, expertise, resources, and strategies for effective technology education in under-resourced regions. The iterative design was created based on feedback from needs-assessment surveys of professors in both developed and developing regions. Conversations with several individuals and organizations in developing regions around the world revealed that many people are seeking increased access to education at all levels. E-village will give educators in developing regions the opportunity to teach more advanced technical subjects which will help students in developing regions use technology to solve challenging problems within their communities. This presentation focuses on the features implemented to address the needs of educators in both developing in developed communities. It highlight E-Village's help, course sharing, search, and usability. Presentation will highlight how these design decisions were made and feedback we received from instructors around the world.

Effective Tracking and Visualization of Household Energy-Usage
Maxim Buevich / Electrical & Computer Engineering,
Advisor(s): Ragunathan Rajkumar / Electrical and Computer Engineering
Kirr Commons-1st Floor, Window side / 12-2:30

The objective of this research is to investigate and optimize energy usage in buildings through use of wireless sensor networks. Wireless sensor networks provide a cost-effective solution for outfitting existing buildings with sensors and actuators thereby monitoring exactly where, when and how much energy is consumed. Energy sensors and remotely controlled switches connected to appliances can provide users with a detailed breakdown of individual appliance energy consumption while at the same time giving them the ability to disable devices that are not being used. One of the main challenges in achieve this goal is to design a visualization portal for non-technical operators. This front-end should enable users to configure, monitor and control a variety of sensors and actuators deployed across the building. It should locally store sensor data and highlight various trends at different timescales giving insight into daily usage patterns. Organization of sensor information should be customizable based on the logical functionality from the user's perspective independent of the underlying network's physical topology. Our envisioned system will provide policies for energy reduction that can be customized, remotely configured, or optimized based on user needs. To enable wide-scale deployment, this interface will be built to run as a web application on a low-cost embedded platform. Ultimately, we intend to use this infrastructure to collect both fine-grained and aggregate energy consumption information, and to determine practical and automated techniques that can be later used to conserve energy.

Facilitating the Citizen-Government Relationship Through Mobile Technology
Justin Beaver / Electrical & Computer Engineering
Advisor(s): Priya Narasimhan / Electrical and Computer Engineering
Rangos 1 / 12-2:30

iBurgh, developed for the City of Pittsburgh, was the nation's first mobile 311 app and was directly integrated as a service into Pittsburgh's City Information System. Using iBurgh on their cellphones, Pittsburghers have been able to report auto-geotagged, timestamped pictures of potholes, fallen trees, grafitti, traffic, etc., directly to their city for resolution. iBurgh was downloaded 3200 times in the first week of its release alone, and has been continuously used since August 2009 by residents of the City of Pittsburgh. iBurgh is now under consideration for deployment as a service by multiple other cities in the U.S. and also by university campuses as a means of mobile

complaint-reporting. The ultimate purpose of mobile e-government services such as iBurgh is to promote transparency in government function, giving people an immediate voice and a direct two-way electronic channel into their local governments.

Find My Face!
Ping-Hsiu Hsieh / Electrical & Computer Engineering,
Maxwell Jordan / Electrical & Computer Engineering,
Saurabh Sanghvi / Electrical & Computer Engineering
Advisor(s): Dave Casasent / Electrical and Computer Engineering
Rangos 2 &3 / Sigma Xi Group 6, 10:45am

The motivation for our project is to auto-tag friends on the popular social networking website Facebook.com. Tagging is the Facebook term for labeling users in a photo. For example, if a photo uploaded by a Facebook user contains the user's friend, then the user can tag the friend in the photo. This sends a notification to the friend that they have been tagged, and provides the friend a link to see the photo whenever he or she logs onto Facebook. The project had two stages, face detection and face recognition. First, we separated a color image into individual Red, Green, and Blue (RGB) channels on the PC to send to the Digital Signal Processor (DSP). The program on the DSP detects the locations of faces and eye pairs and sends these coordinates back to the PC. The recognition algorithm identifies the cropped image or rejects the image as a non-friend (a face that was not trained). The detection algorithm uses a skin model proposed by Rein-Lien Hsu that takes into account the luminance channel of the skin pixels in the YCbCr color space. This makes the face detection algorithm more accommodating to changes in lighting conditions (indoor or outdoor) because the brightness of the faces is also taken into account. The detected skin region then undergoes morphological opening to remove skin regions too small to be faces (i.e. arms, and hands). Once potential faces have been found, the Eye Map is built. The Eye Map equation, also proposed by Hsu, involves gray-scale morphological erosion and dilation on the luminance channel of the input image. It uses the fact that the luminance channel of the eye regions has high-contrasted bright and dark pixels. Once the Eye Map is constructed, a dynamic threshold scheme is applied to each potential face to identify the eye regions. Blob coloring is then applied to the eye blobs detected to reject any eye blobs that are most likely false detections. We finally normalize potential faces so the angle between the found eye pair is zero and matches the dimensions of our face database. For the recognition part, the project used gray-scale images of the size 60 x 60. Images were trained using the PIE database which covers 24 different illuminations from a moving light source. Recognition used PCA

algorithm to train a group of 20 people and resulted in an 85% recognition rate. Images were all mean centered and normalized before recognition. Errors mostly came from dark images where there was no identifiable data in the picture. To deal with illumination variation the top 3 principle components were thrown out and a total of 7 eigenvectors were used.

Formation Control in a Low-Cost Robot Colony
Jaime Bourne / Mechanical Engineering,
Austin Buchan / Electrical & Computer Engineering,
Megan Dority / Mechanical Engineering,
Emily Hart / Electrical & Computer Engineering,
Christopher Mar / Electrical & Computer Engineering,
Evan Mullinix / Electrical & Computer Engineering,
Bradford Neuman / Computer Science,
Nicole Paris / Electrical & Computer Engineering,
David Schultz / Physics,
John Sexton / Electrical & Computer Engineering &
Bradley Yoo / Electrical & Computer Engineering
Advisor(s): George Kantor / Robotics Institute
Rangos 2 &3 / Sigma Xi Group 5, 10:00am

Formation control, as it applies to the field of mobile robotics, is having robots maintain a certain distance and orientation between each other as they move as a group throughout an environment. This can be a simple and effective method of coordinating the movements of multi-robot systems and has several applications. Through this proposed research, the Colony Project will investigate how the principles of formation control apply to a colony of low-cost robots. In an attempt to develop a flexible research platform for formation behaviors, we will explore how formation control can enhance the movement and sensory capabilities of our robot colony. This work is a continuation of previous Colony Project research and will serve as a foundation for future research within the Robotics Club

GPGPU Applications: Analysis & Modeling of Particle Flow
Sean Coleman / Electrical & Computer Engineering,
Advisor(s): Cecil Higgs / Mechanical Engineering
Rangos 1 / 12-2:30

Over the past several years, desktop GPUs have been harnessed to provide large amounts of parallel computational power. This project examines the applicability of GPUs to solving problems related to fluid and particle flow as encountered by the Particle Flow &

Tibology Laboratory. We consider two test cases, PAML, a multiphysics CMP simulator, with a focus on accelerating the CFD portion of the simulator, and DPTV, digital particle tracking velocimetry, analysis. Applicability is primarily determined by benchmarking the resulting GPU-enhanced simulations against their prior counterparts.

Graphics In The Cloud
David Klionsky / Electrical and Computer Engineering &
Bo Xian See / Electrical and Chemical Engineering
Advisor(s): Adrien Treuille / Computer Science
Rangos 1 / 12-2:30

Computer graphics can produce stunning examples of curling smoke, crashing waves, even dancing patterns of underwater light. However, real-time graphics architectures emphasize view-dependent computation which ignores important global phenomena such as diffuse interreflection and fluid dynamics. This proposal explores a radical new cloud-based architecture for real-time graphics which will efficiently simulate complex global dynamics enabling highly detailed and interactive virtual worlds. We propose to calculate all graphics in the cloud, amortize computational costs across users, and stream fully rendered images from the cluster to each client. Graphics architecture plays a dominant role in the synthesis and even content of multi-user virtual environments. By creating a framework for amortized algorithms and data-structures, we lay the groundwork for a new generation of virtual environments which will overcome the limitations of client-based graphics and enable us to simulate profoundly more realistic interactive worlds.

Hardware Development for Brain Computer Interface
SooHyun Jang / Electrical and Computer Engineering
Advisor(s): Jeyanandh Paramesh / Electrical and Computer Engineering &
Lee Weiss / Robotics Institute
Wean Commons-1st Floor, Connan side / 3-5

The development of electronic Brain Computer Interfaces (BCI) to improve the quality of life of people with motor disabilities is an area of intense research. A BCI is a hardware electronic system that aims to provide an alternative communication pathway from the brain to a prosthetic device. The major components of this system includes: (1) electrodes to detect neural signals, (2) a recording and conditioning electronic, and (3), wireless communication module to transmit the signal to an external device for analysis or actuation of a prosthetic device. This project explores the recording and conditioning electronic

interfaces of BCIs to develop a second generation neural recording interface. The development of the second generation interface includes improving data rate and wireless communication with a new wireless subsystem, and enhancing the conditioning of the recorded signals. This requires fabrication of circuit prototypes and testing of the functionality of various designs.

Hazardous Chemical Sensor using Nonlinear MEMS Oscillators
Kahini Shah / Electrical and Computer Engineering
Advisor(s): Gary Fedder / Electrical and Computer Engineering
Rangos 2 & 3 / Sigman Xi Group 4, 11:45am

We propose a nonlinear microelectromechanical (MEM) oscillator that detects small changes in mass to be used as chemical sensor. The sensor is a parametric resonator that oscillates between unstable and stable states making it ideal for high sensitivity gravimetric sensing. The Mathieu Equation governs the operation of this device with electrostatic and mechanical nonlinearities taken into consideration. This poster covers the device design, governing math and simulations of theoretical device behavior of such a chemical sensor. The sensor is to be used in breathing respirators to protect fire fighters and industrial workers against toxic gases.

Hybrid Fiber Optic Lighting System
Yordanis Diez / Electrical and Computer Engineering,
Prerna Singh / Mechanical Engineering &
Rebecca Willmott / Electrical and Computer Engineering
Advisor(s): James Schneider / Chemical Engineering
Hoch Commons-2nd Floor, Rangos side / 3-5

Hybrid solar fiber optic lighting is different than traditional solar power, which converts sunlight into electricity. Solar fiber optic lighting uses a solar concentrator to expose one end of a fiber optic cable to sunlight. The fiber optic cable is then run through the building where the other end delivers light to an interior room. During the day, these fiber optic cables can light windowless rooms in buildings ranging from houses to commercial offices with natural sunlight. However, this technology cannot function in shade or at night. Therefore, a prototype hybrid technology was designed and fabricated to combine LED and solar fiber optic technology to create a light which can produce light at all times of the day using minimal electricity.

JEULES (Smart Outlets)
Joshua Debner / Electrical and Computer Engineering,
Ilyua Kelner / Electrical and Chemical Engineering,
Siddharth Nangia / Electrical and Computer Engineering
Advisor(s): Philip Koopman / Electrical and Computer Engineering &
Priya Narasimhan / Electrical and Computer Engineering
Kirr Commons-1st Floor, Window side / 12-2:30

This invention provides a method for allowing a user to both track the energy usage of the whole power used by an electrical connection (such as an electrical socket) and track the energy usage of individual devices attached (or, plugged in) to the electrical connection. It is capable of identifying a unique electrical device attached to any "Jeules unit" in the network, and allows a user to administer the energy policy (including turning off the power coming out of any electric outlet) remotely, helping to save substantial amounts of energy that is currently wasted in homes and businesses.

Localization and Motion Compensation in Prismatic Cube Robots
Emily Hart / Electrical and Computer Engineering,
Advisor(s): Seth Goldstein / Computer Science
Rangos 2 & 3 / Sigman Xi Group 5, 10:30am

I will be investigating the problem of distributed localization and motion compensation within a group of prismatic cube robots. At the moment, the robots are capable of forming simple ensembles with the help of a centralized computer equipped with the knowledge of the location of each robot. However, this system is not scalable. As the size of the esemble grows, centralized control will become infeasible and localization will have to be implemented on each robot using the aggregated local data of many surrounding robots. Additionally, the current formations of the robots do not compensate for the effects of gravity, which deflects the robots from their desired positions. I will use the results of the localization to implement motion compensation in order to counteract this problem.

Monitoring and Recognizing Medical Context Through Analysis of Sounds
Tian Seng Leong / Electrical and Computer Engineering,
Advisor(s): Dan Siewiorek / Human Computer Interaction Inst. &
Asim Smailagic / Electrical and Computer Engineering
Rangos 2 & 3 / Sigman Xi Group 7, 10:15am

Current technology-driven solutions for medical monitoring of elderly persons mainly consist of monitoring patients using a series of on-body sensors. Users can find these systems intrusive and they may forget to wear the sensors. In addition, since many of these systems are intended for use at home or in elderly community environments, the introduction of increasingly intrusive devices would be difficult. Another current approach to the problem is to monitor the elderly through use of the Internet from anywhere in the world. This type of system permits fewer medical personnel to monitor a greater number of patients. However, these systems raise privacy concerns and data on these systems can easily be compromised. The primary motivation of our proposed systems research is the need for an inexpensive system, to be deployed to monitor elder patients. To tackle the emerging problem of care of the elderly in an overextended medical system, we plan to focus on an application that will allow nurses to care for patients more effectively, without sacrificing quality. In addition, the application should be able to reduce the invasion of privacy by recording only necessary information and securely transmitting this information. We plan to focus the main motivating goal for the application: to detect impending health risks. Secondly, patients often fail to recall or fail to recognize significant cues to possible health risks. Without the near-continual presence of medical personnel, these cues will go unnoticed. Therefore, the system will represent the nurse when he is not physically present. To this end, the system will listen for troubling sounds, such as coughs (primarily), vomiting, or sneezing, and quickly forward relevant information so that, when a nurse is available, they can review such information. For example, a nurse might tell patient A to take medicine X. After doing so, the patient might tell the nurse that she is experiencing no side effects. However, the patient might make unexpected sounds, one hour after taking the medicine. The system then alerts attending medical personnel to possible problems. The sensors (microphones) will perform basic keyword recognition and content filtering based on pre-defined user profiles. Onboard sound detection will identify whether the input acoustic signals contain one of the medically-significant sound objects, such as “coughing,” or “speech.” Information consisting of sound objects and their time-stamps will be sent to the monitor agent to log a user’s health-related activities. When content is determined to be medically significant, the agents will offer the system a stream of relevant sounds, from microphones. By reducing the amount of data collected these agents reduce energy consumed, prevent network congestion and improve privacy assurance of the monitored environment.

MRAM Testing with Scanning Probe Microscopy
Timothy Farkas / Electrical and Computer Engineering
Advisor(s): Sara Majetich / Physics
Kirr Commons-1st Floor, Window side / 12-2:30

The following research will collect data regarding the failure rate, reliability, and operation ranges of magnetic nanopillars that could potentially serve as data storage elements in MRAM (Magnetic Random Access Memory). The data collection described above will be done with a scanning probe microscope.

Novel Ultrasonic Motor Using Torsional and Longitudinal Vibration
Samarth Bhargava / Electrical and Computer Engineering
Advisor(s): David Greve / Electrical and Computer Engineering
Kirr Commons-1st Floor, Window side / 3-5

An ultrasonic motor uses axial and torsional vibrations of ultrasonic frequencies to achieve a net torsional rotation on a rotor. The simple design of ultrasonic motors makes them promising candidates for miniaturization and operation in micro-robotics. Micro-robotics is especially exciting for biomedical applications, where a micro-robot could navigate blood vessels to act as a minimally-invasive sensor, drug delivery mechanism, or surgical tool. Recently, longitudinal-to-torsional mode converters have greatly simplified the structure of such ultrasonic motors, making miniaturization more practical. In such a design, piezoelectric material generates solely axial vibration from an input electrical excitation, and a twisted stator beam converts some of the axial vibration to torsional vibration. Together, these mechanical vibrations in the stator beam apply a net torque onto a rotor through frictional forces. A previous design used a thick multi-layer piezoelectric stack to generate axial vibration. In this paper, we report on the performance of motors using a different actuation scheme, consisting of a pair of thin piezoelectric wafers, which has a simpler structure and requires a reduced volume of piezoelectric material.

Opaque Glass: Thermally Activated Materials vs. Smart Glass
Yordanis Diez / Electrical and Computer Engineering,
Deborah Gruner / Self-Defined, Morgan Heskett / Materials Science Engineering &
Jennifer Williams / Materials Science Engineering
Advisor(s): James Schneider / Chemical Engineering
Hoch Commons-2nd Floor, Window side / 3-5

Materials which can become clear or opaque simply by providing heat or by running a current through them have a wide variety of applications: in professional settings such as offices, public restrooms, or, more commonly, in households. Materials which have this property can be used as windows or transparent doors in multiple places around a house (for example, the restroom). Such panes would essentially eliminate the need for items such as window blinds, shower curtains and other such coverings, meaning the application of such technology could ultimately prove to be cost effective to consumers. We hope to test the energy and cost efficiencies of different materials and eventually determine which specimen is the best choice to fulfill these applications around one's home.

OrthAssist: Towards an Actuated Upper Extremity Orthosis for Strength Augmentation and Rehabilitation
Alexandra Cirillo / Mechanical Engineering,
Marina Musicus / Mechanical Engineering,
Vani Rajan / Electrical and Computer Engineering,
Daniel Shope / Mechanical Engineering,
Andrew Strat / Electrical and Computer Engineering &
Heather Tomko / Mechanical Engineering
Advisor(s): James Antaki / Biochemical Engineering
Rangos 2 & 3 / Sigman Xi Group 5, 10:45am

Neuromuscular diseases affect the peripheral nervous system, which includes muscles, the nerve-muscle junction, peripheral nerves in the limbs, and the motor-nerve cells in the spinal cord. These disorders often result in an overall muscle weakness that hinders the user from independently performing normal day-to-day activities. Thus we propose a safe, efficient and controlled strength augmentation device to assist the subject with daily lifting and mobility. The device will assist users with lifting and carrying objects beyond their natural capability.

Pulley Drag Race: Building Intuition about Simple Machines
Ibuki Kamei / Mechanical Engineering,
Daniel Miller / Mechanical Engineering &
Nicolas Paris / Electrical and Computer Engineering
Advisor(s): Susan Finger / Civil and Environmental Engineering
Connan / 12:30-3:30pm

The goal of the Pulley Drag Race is to teach children the fundamental relation between pulley ratios and torque/speed tradeoffs. Drawing inspiration from the speed changing mechanisms found in drill presses and mills, we have created a car that allows children to

discover how a change in pulley ratio results in a change of both torque and speed. In addition to seeing the effects of changing ratios on flat ground, children can run their cars on an inclined plane for a better understanding of the need for torque in the system.

PURRS: Profile-Based Email Organization using User Response Behaviors and Social Networks
Kornchawal Chaipah / Electrical and Computer Engineering,
Tanachat Nilanon / Computer Science &
Dolsarit Somseang / Electrical and Computer Engineering
Advisor(s): Hyong Kim / Electrical and Computer Engineering
Rangos hallway, 2nd Floor / 12-2:30

We propose PURRS, a profile-based email management system that provides personalized email prioritization and adapts to users' changing behaviors. The proposed system learns and leverages behavioral and social-networking information to build profiles of email senders. Users will be able to identify important email quickly based on senders' ranking. Therefore, they can handle email more efficiently as the system mitigates their frustration and negative impacts from email cluttering. Although standard email systems allow users to define rules for email prioritization, they require the users to update the rules manually and regularly as user behaviors and contacts change over time. Previous work on automatic email prioritization mostly focused on text categorization using email bodies and subjects. Spammers and/or non-important contacts can craft email to bypass these filters. Our work takes a different approach by mimicking users' perceptions-how they examine senders and subjects to triage email. We hypothesize that users tend to handle email from senders within their social networks first because they already learned of the senders' importance. For this reason, our system transparently learns how users interact with contacts, and then it clusters contacts into Social Network Rings (SNR). Contacts whom the users have paid more attention to are in higher priority groups and placed closer to the center of the SNR. The system prioritizes incoming email by senders' positions in the SNR. Moreover, the system uses information from the users' social networks to prioritize email from unknown senders. The specific contributions of this work are as follows:

1) We use an extensive set of user actions, including reading (and reading delay), deleting (and deleting delay), replying, forwarding, composing, flagging, and archiving email. 2) We introduce the Social Network Rings (SNR) with five rings/layers to represent not only users' social network maps but also relationship strength. The five rings represent five priority groups, which include five relationship strength levels, adapted from a human relationship development model. 3) Since user behaviors and relationships change over time, we propose to apply the time-sliding database and the Slow Adjustment Tuner. Our time-sliding database assigns decaying weights to older user actions, giving more attention to recent ones. The Slow Adjustment Tuner, adapted from the TCP Slow Start with Fast Recovery scheme, regularly updates the system parameters in accordance with user feedback on email priority classifications. 4) Because a user does not have information about unknown contacts, we propose to apply a social network concept to help identify new contacts that could be important to the user. The user's profile is shared among selective contacts, and potentially important new contacts are suggested from the user's social networks. For privacy, the user has control over who receives which pieces of his/her profile information. We will implement PURRS as a Microsoft Outlook 2007 add-in and conduct a user study to evaluate the system. The evaluation goals are:
1) To verify the project concept, by confirming the actions that indicate the relationship strength with contacts and by studying the user's information sharing behaviors, 2) To measure system performance, including the priority prediction correctness, the system's learning ability, and the correctness of the unknown contact's rank estimation,
3) To measure the typical system resource consumption, and 4) To assess user feedback of the system performance. We will conduct a 12-week user study in which participants use the system, while we automatically collect data weekly. At the end of the study, we will conduct an email-identification study, conduct a user feedback survey, and analyze the collected data. Upon the completion of the work, the system will allow the user to handle a large volume of email more efficiently

Real-Time Image Processing Effects on Mobile Platform
Sandeep Atluri / Electrical and Computer Engineering &
Anish Mathur / Electrical and Computer Engineering
Advisor(s): Priya Narasimhan / Electrical and Computer Engineering
Rangos 1 / 12-2:30

The goal is to be able to use the camera of a mobile device, select any portion of the image as seen by the person in real-time, and add effects to one's choosing. The project itself is inspired by the Andy Warhol effect.

Real-time learning mobile application for inferring psychosocial stress
Sang Won Lee / Electrical and Computer Engineering
Advisor(s): Asim Smailagic / Electrical and Computer Engineering
Rangos 1 / 12-2:30

This project develops a real-time machine learning software that will be integrated to our body-worn multi- wireless sensor system for personalized inferring of stress from physiological measurements in subjects' natural environment. For the field studies, the users' feedback will be solicited on the cell phone (Android G1) based on two sources of triggers – physiological changes, and random prompts. The machine learning software will use the self-report collected during the initial phase to adapt the stress inference procedure to be used in the next phase. The final phase will be used for validation of our stress inference algorithm.

First, we will develop a base algorithm for inferring stress from physiological measurements based on currently available population data but one that uses existing and new features for all sensors (e.g., heart rate, additional heart rate, heart rate variability, respiration rate, skin conductance, pulse wave velocity, skin temperature, and metabolic expenditure). Second, we will develop a machine learning algorithm that uses self-reported inputs to adapt to each participant. There will be a lab study and a field study with over a dozen of participants, each of whom will wear the multi-sensor system during the lab study and on each of the two days of field study in their natural environment to conduct both development and validation of the stress inference software. Our real-time machine learning software will get progressively accurate over time by adapting to each participant and changes in his/her natural environment. After the adaptation phase, the system should fairly accurately determine each time the subject is exposed to stress and can ask for additional inputs from the subject to capture the environmental stressor that may have triggered a stress event. The platform includes a completely wireless sensor system that provides continuous measurement of heart rate, heart rate variability, respiration rate, skin conductance, pulse wave velocity, skin temperature, and physical activity, to provide a comprehensive physiological measurement of stress response. The sensors are hosted on a tiny computing platform called wireless sensor mote (similar form factor as an SD card that is used in digital cameras). Several motes are placed at different locations on the body (around the chest area and forearm).

RobOrchestra V
Rohan Aletty / Electrical and Computer Engineering,
Douglas Bernstein / Mechanical Engineering,
Jonathan Boerner / Mechanical Engineering,
Andrew Burks / Mechanical Engineering,
Gerald Carlson / Mechanical Engineering,
Katherine Coste / Mechanical Engineering,
Daniel Curhan / Mechanical Engineering,
Jaywoo Kim / Mechanical Engineering,
Michael Ornstein / Mechanical Engineering,
Michael Sandbothe / Computer Science &
Daniel Shope / Mechanical Engineering
Advisor(s): Roger Dannenberg / Computer Science
Wean Commons-1st Floor, Connan side / 12-2:30

The RobOrchestra project is dedicated to the creation of music using technology coupled with art. Now in its fifth year, RobOrchestra has created a number of robots with specific musical functions and generated meaningful ways for them to play together cooperatively. In previous years, this organization was dedicated to establishing a basis upon which a few instruments could play, but this year we plan to expand the number of instruments at our disposal and to bring out the "Orchestra" in RobOrchestra. In addition to building more instruments, expanding our reach to both the string and brass sections, we will also investigate creating methods for humans to interact with the robots' performance. In this manner we will expose the connection between science and art by showing the mathematical complexity of music and the artistic possibilities of robotics.

Supporting Blinky Blocks Deployment
Eric Cheng / Electrical and Computer Engineering
Andrew Hillenius / Electrical and Computer Engineering
Advisor(s): Seth Goldstein / Computer Science
Dowd / 4:20

Blinky Blocks are a tangible interface allowing for research and education into massively distributed systems. Supporting the ongoing development of this platform will help widen the user base for this hardware by making the Blinky Blocks more available, accessible, and useable to the general public. Our project will provide both hardware and software support for the continuing development and deployment of the Blinky Blocks.

The Mind and the Muscle
Kwabena Agyeman / Electrical and Computer Engineering
Advisor(s): James C. Hoe / Electrical and Computer Engineering
Wean Commons-1st Floor, Connan side / 12-2:30

Maintaining student interest in the areas of foundation for computer science and engineering has been a particularly challenging problem in today's high schools and middle schools. Too many of the current educational tools and programs focus on providing college level introductions to programming over just getting students "hooked on programming". The Mind and the Muscle is an educational platform designed to get students "hooked on programming" through the use of fun and interesting programming projects and problems that attracted the first generation of computer scientists and engineers. By using The Mind and The Muscle educational platform high school students will learn to program through the use of a drag and drop development environment designed to graphically introduce students to programming in the C language. The educational program covers the use of keyboard, mouse, serial, video, audio, and file system drivers through which the students will learn to program simple graphical user interface applications on The Mind and Muscle educational platform.

Towards Simultaneous Location and Mapping (SLAM) for Mobile Robots in Indoor Dynamic Environments
Jonas Cleveland / Electrical and Computer Engineering,
Brett Harris / Computer Science &
Francisco Santiago / Mechanical Engineering
Advisor(s): John Dolan / Computer Science
Hoch Commons-2nd Floor, Rangos side / 12-2:30

We will tackle several obstacles in the field of mobile robotics by developing an inexpensive, reprogrammable platform for the development of indoor robotic applications. This platform will employ the capabilities required of a mobile robot in an indoor environment - traversal over objects such as stairs, movement in tight spaces, carrying of medium-sized payloads- in an inexpensive platform. Foremost, this platform will be equipped with a novel SLAM(Simultaneous Location and Mapping) algorithmic approach, which will allow it learn new environments, localize itself in a self-created map, and therefore easily traverse to a desired place or object.

Using Multiple Wearable Sensors Dynamically to Facilitate Activity Recognition
Cem Onyuksel / Electrical and Computer Engineering,
Advisor(s): Dan Siewiorek / Human Computer Interaction &
Asim Smallagic / Electrical and Computer Engineering
Rangos 2 & 3 / Sigma Xi Group 5, 11:00am

Multiple wearable sensors can be used to detect user activities, movements, and status through machine learning techniques. Sensors utilizing accelerometers are worn on the wrist, ankle, arm, and as a lanyard; in addition, a hand-held or holstered device with sensing capabilities is used as a master device. Sensors can be selectively used, and the system dynamically adapts to the sensors available to give the best possible activity classification for the user. The system can be used in package delivery, retail, healthcare, and exercise domains, and data can be synchronized with a computer or server.

WiMAX as an Optimized Software-Defined Radio
Matthew Wagner / Electrical and Computer Engineering,
Advisor(s): Christian Berger / Electrical and COmputer Engineering
Rangos 1 / 12-2:30

With constantly changing wireless communication standards, communications companies are forced to consistently upgrade equipment while still maintaining old equipment. Here, we present a software implementation of the WiMAX 802.16-2004 standard based on optimized blocks generated with SPIRAL that can easily be changed to implement a large variety of communications standards.

MATERIALS SCIENCE ENGINEERING

A Study on the Feasibility of Lithium-Ion Battery Rejuvenation
Ankur Gupta / Materials Science Engineering
Advisor(s): Jay Whitacre / Materials Science Engineering
Rangos 2 & 3 / Sigma Xi Group 4, 10:15am

It is believed that the primary degradation mechanism for aged batteries is the growth of the Solid Electrolyte Interphase (SEI) layer on the battery electrodes. The SEI layer is composed of various lithium-based compounds such as lithium fluoride and lithium carbonate. The layer diminishes battery performance by increasing the resistance of

electrodes and diminishes capacity by reducing the amount of functional lithium ions. The purpose of this study was to demonstrate the SEI layer as the primary cause for battery degradation and determine whether or not battery capacity could be restored by rinsing the electrodes in water. The results proved to be compelling to warrant future work in this area. A flow cell fixture was also made to attempt in-situ rejuvenation, however the results were inconclusive. Rejuvenating dead lithium-ion batteries may be an alternative that is more cost-effective than building new lithium-ion batteries in the future.

ASME EarthSaver: Autonomous Recycling Sorter
Jaime Bourne / Mechanical Engineering, Collin Buchan / Mechanical Engineering, Katherine Coste / Mechanical Engineering, Megan Dority, Mechanical Engineering, Steven Ford, Mechanical Engineering, Szu-Chieh Lu / Mechanical Engineering. Prerak Patel / Electrical and Computer Engineering. Michael Saitta / Undecided, Daniel Shope / Mechanical Engineering, David Stonestrom / Mechanical Engineering & Christopher Tomaszewski / Mechanical Engineering
Advisor(s): Cecil Higgs / Mechanical Engineering
Hoch Commons-2nd Floor, WIndow side / 3-5

Recycling is a growing industry accounting for more than 1.5 million jobs and $100 billion in revenue. More than 600 million metric tons of material is processed globally every year. Green initiatives have raised public awareness of recycling and other earth-conscious practices. This expansion has resulted in a demand for efficient and cost-effective means of processing recyclable waste. Material sorting is a costly step in the recycling process. Improperly sorted items slow down the process, reducing the monetary margin of recycling. To this effect the researchers have developed a household scale material sorter. The system autonomously sorts commonly recyclable items by material.

Autonomous Operation of Mobile Robots via the Efficient Implementation of Sensor Fusion Algorithms
Jakub Poznanski / Computer Science & Itai Stein / Materials Science Engineering
Advisor(s): Hagen Schemph / Robotics Institute
Hoch Commons-2nd Floor, Window side . 3-5

Explosive Ordnance Disposal, or EOD, is a critical application of robotics in today's world. EOD is a good example of an application where mobile robots are presently used along- side human operators, but could operate more effectively without humans if they were autonomous. The reason why many mobile robots cannot operate autonomously is because they cannot make decisions efficiently enough to guide themselves on their

own, therefore requiring an operator to make these decisions for them. To allow mobile robots to make decisions more efficiently, allowing autonomy, we propose research into increasing the speed and efficiency of several sensor fusion algorithms, the effect of different implementations of these algorithms on their efficiency, and whether the sensor fusion algorithms can be simplified to operate on a barebones system without losing their efficiency and accuracy. To attempt to answer these questions, we will build a mobile robot, and then subject it to experiments that incorporate real world conditions, and finally race the mobile robot in the CMU Mobile Robot competition to evaluate the enhancements resulting from our novel implementation of sensor fusion algorithms.

Ceiling Shower Orifice Plate
Margaret Cruickshanks / Mathematics, Morgan Heskett / Materials Science Engineering & Celia Ludwinski / Chemical Engineering
Advisor(s): James Schneider / Chemical Engineering
Hoch Commons-2nd Floor, Rangos side / 12-2:30

In recent years, society has become fixated on the attempt to stop the overuse of natural resources, such as fresh water. However, many people do not wish to give up luxuries, even those as mundane as a high-pressure shower. It is our hope to create a shower that uses plates with orifices of varying size in order to provide people with the water pressure of their choice while using the same volume of water. This would not only help the environment and the budgets of consumers, but would still maintain their expectations for an enjoyable shower. We also hope to integrate this design into the ceiling of the bathroom for multiple reasons. Not only could all users experience a more natural shower imitating that of a waterfall, but residents of taller builds could more comfortably utilize the appliance.

Fe-Co-Cr Nanocomposites for Application in Magnetic Refrigeration and Self-Regulated RF Heating
Anna Colletti / Materials Science Engineering
Advisor(s): Michael McHenry / Materials Science Engineering
Hoch Commons-2nd Floor, Rangos side / 12-2:30

The purpose of this research is to study the Curie temperature (Tc) of magnetic nanoparticles. The Curie temperature is the temperature at which a material changes from ferromagnetic to paramagnetic causing the magnetic dipoles to become randomly aligned and the material to lose its magnetic properties. FeCoCr alloys with the chromium ratio between 10 and 20 will be studied for both the application of magnetic refrigeration and a

self-pumping apparatus which relies on heating and cooling caused by the magnetocaloric effect. The magnetocaloric effect occurs when a magnetic field is applied to a magnetic material and causes the magnetic dipoles to align and the magnetic entropy to decrease. The lattice entropy then increases causing the temperature to increase.
When the magnetic field is removed, this process is reversed. This process is most effective at the Tc which can be explained by the Maxwell relation (âS/âB)T = (âM/âT)B. This relation states that there will be a greater entropy change for a given change in magnetic field when there is a large change in magnetization for a given change in temperature. This occurs at the Tc because the slope of magnetization vs. temperature graphs has the greatest value (Figure 1). A self-regulated heating and cooling system (Figure 2) was designed by Robert OâHandley at MIT who studied FeNi particles for this application. The system is designed to pump a ferrofluid through polyurethane tubing driven by magnetic attraction. The particles begin in a ferromagnetic state so that the dipoles are aligned and are attracted to the magnetic field in a thermal load created by copper coils. The fluid is then heated past its TÂ-₁TÂ-₁c so that the particles become paramagnetic no longer attracted to the coils. The fluid then continues through the cycle to the heat release station where the heat is absorbed and permanent magnets cause the dipoles to realign and the cycle repeats. Similar apparatuses can also be used for magnetic refrigeration applications. The FeCoCr alloy will be weighed out from pure Fe, Co and Cr powders. The mixture will then be melted and alloyed together using an arc melter which uses a high energy electric arc to melt the metals into an ingot. The ingot will then be placed in a crucible in a melt spinner where it will be melted and forced through a small hole onto a water cooled copper wheel. The alloy is cooled at a million degrees per second, quenching it into the amorphous phase and creating a metal ribbon. The ribbon will be crushed in a blender and cryo-milled. The cryo-mill submerges the sample in liquid nitrogen to make it brittle and prevent aggregation and grinds it to nanoparticle size. This powder will then be placed into a vibrating sample magnetometer (VSM) to measure the magnetic properties of the sample. The cryo-milled powder will then be mixed into a surfactant and ultrasonicated to create a ferrofluid. This ferrofluid will then be placed inside of a radio frequency (RF) coil to examine the heating behavior of the fluid. The alternating magnetic field causes the magnetic moments in the alloys to rotate back and forth causing the fluid to heat up. The temperature will be recorded with respect to time to determine the Tc. The overall goal of the research is to find a composition of FeCoCr that gives a Tc of approximately 70Â°C for OâHandleyâs apparatus and approximately room temperature for magnetic refrigeration.

Identification of Mineral Species for CMNH Hillman Hall
Vincent Parker / Materials Science Engineering &
Ellen Tworkoski / Materials Science Engineering
Advisor(s): Marc DeGraef / Materials Science Engineering
Hoch Commons-2nd Floor, Window side / 3-5

Due to the rapid evolution of classification methods in mineralogy, it becomes increasingly likely for the nomenclature of the older specimens within collections to become outdated. This research project aimed to confirm the species of a set of roughly 90 samples belonging to the Carnegie Museum of Natural History's Hillman Hall of Minerals and Gems. The chemical composition of the specimens in question was identified and, when necessary, the data was supplemented with an analysis of the samples' crystal structures. Characterization techniques included X-ray fluorescence spectroscopy, X-ray diffraction, energy dispersive X-ray spectroscopy, and scanning electron microscopy.

Investigation of 200 °C Curie Temperature Materials for Self-Limited Heating
Thomas Fortner / Materials Science Engineering
Advisor(s): Michael McHenry / Materials Science Engineering
Rangos 1 / 12-2:30

There is current interest in magnetic materials with low Curie temperature for use in applications from magnetic refrigerators to biomedical devices. Because of the low Curie temperature of the FeNi-based alloys coupled with high moments, large magnetic cooling and self-limited heating are possible at the Curie temperature through the use of an external magnetic field. It is expected that these magnetic alloys will have a Curie temperature around 200 °C and can be used in self-limited heating of ferrofluids for naval and aerospace applications.

Investigation of Electrical Properties at Metal-Graphene Interfaces.
Brian Hoskins / Materials Science Engineering
Advisor(s): Lisa Porter / Materials Science Engineering
Rangos 2 & 3 / Sigma Xi Group 4. 10:30am

Graphene films, which can be described as very thin sheets of graphite, are being intensively researched for future high-speed electronic devices. In this project we have been investigating graphene films created on single-crystal silicon carbide surfaces. Because there has been little experimental work on metal (contact)- graphene interfaces (e.g., as employed in graphene-based transistors), we are investigating the electrical properties at such interfaces as a function of the selected metals. Nickel, titanium, and

chromium were deposited onto the graphene surface and patterned using a standard lithography process. I-V curves were measured across the patterns to measure contact resistance and Schottky barrier height of the metal-graphene interface. A combination of exposure to acid and annealing in nitrogen were used to attempt doping the graphene so as to measure the change in resistance due to changing carrier concentration. The effects of chemisorption vs. physisorption, as well as properties such as metal work function, on the interfacial electrical properties will be presented.

Kinetic Modeling of L10 phase Formation in FePt and Related Alloy Films for Heat Assisted Magnetic Recording Media
Andrew Jesanis / Materials Science Engineering
Advisor(s): Katayun Barmak / Materials Science Engineering
Wean Commons-1st Floor, Connan side / 12-2:30

L1o FePt, which is the chemically ordered tetragonal phase in the Fe-Pt system, and the L1o phase in related systems are potential candidates for heat assisted magnetic recording media with storage densities of 4 Tb/in2 and beyond. However, when sputter deposited at room temperature these alloys form the chemically disordered A1 (face centered cubic) phase. Post deposition annealing or deposition onto a heated substrate is necessary to form the L1o phase. The objective of this project is to develop quantitative kinetic models of the formation of the L1o phase by nucleation and growth from the parent A1 phase. In particular, we have examined the ability of a thermally-activated continuous nucleation and interface controlled growth model to describe the experimental transformation data obtained by differential scanning calorimetry.

Magnetic Field Gradiometer for Biomedical Applications
Maryanna Saenko / Materials Science Engineering
Advisor(s): Michael McHenry / Materials Science Engineering
Rangos 2 & 3 / Sigma Xi Group 4, 10:45am

This project proposes to build a device for biological sensing applications, to measure the homogeneity of the nanoparticle distribution indirectly via the measurement of the variations of the field gradient of a scaffold with the immersed ferrous nanoparticles. The proposed magnetic sensor provides a rugged and reliable technology to accurately depict the nanoparticle distribution for future thermoablative therapy techniques. The sensor head would consist of a permanent FePt magnet deposited using a thin film sputtering technique to create a checkerboard pattern onto a Si substrate. The Si substrate will be attached to a 5mm x 5mm Si membrane using a high temperature adhesive.

A set of several induction coils will be used to generate the driving gradient. The magnetic force is proportional to the magnetic moment of the sample and the field gradient. The magnetic force can be defined using Cartesian components of force in relation to the geometry and configuration of the coils. These expressions will used to calculate magnetic induction and gradient position of the magnet for various coil configurations. The variation of the movement, caused by an external magnetic field gradient or a magnetic specimen, will be measured by an optoelectronic method.

Magnetic Particle Composites for Flip-Chip Packaging
Matthew Ondeck / Materials Science Engineering
Advisor(s): Michael McHenry / Materials Science Engineering
Kirr Commons-1st Floor, Window side / 3-5

Most solders that are commercially sold and used are composed of the Pb –Sn system (Mostly the near eutectic composition of 63Sn-37Pb). They are used because of their superior thermal and mechanical properties, melting at approximately 183°C. However, the toxicity of Pb has brought about a number of environmental and health concerns regarding the use of Pb solders. Much research has been devoted to developing a good substitute for the Pb-Sn system with similar thermal and mechanical characteristics. One Pb-free system that is currently in use is the Sn-Ag-Cu (SAC) system. The melting temperature of the SAC system is higher than Pb solders, at approximately 220°C. A conventional reflow process for forming electrical interconnections involves the SAC solder being placed on an electronic chip and then inserted in a convection oven. Both the chip and solder would be subjected to the high melting temperature of the SAC solder, which can result in damages to the electronic chip. To eliminate this problem, we proposed to mix FeCo magnetic nanoparticles into SAC solder paste in the hope that localized heating will occur solely within the magnetic nanoparticles while limiting eddy current losses from the solder paste, when placed within an alternating magnetic field. This composite can be used for electronic packaging, specifically flip-chip packaging.
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Molecular and Macroscopic Bonding Mechanisms in CdSeS Quantum Dot / Shell / Ligand / Polymer Systems

Michael Schmitt / Materials Science Engineering
Advisor(s): Robert Davis / Materials Science Engineering
Class of '87 / 3:20

Light Emitting Diodes (LEDs) offer a high efficiency and long lifetime alternative to standard incandescent and fluorescent light sources. While red and blue LEDs have very high efficiencies (>65%), green LEDs have an inherent problem which limits efficiency with current devices only capable of ~15% efficiency. This limitation is preventing the creation of efficient white LEDs capable of replacing standard sources. Quantum Dots (QDs) offer extremely high efficiency light emission (>85%) throughout the visible spectrum. Thus,

QDs can be utilized to down-convert light for the efficient creation of green light. However, down-conversion QD devices have best reported efficiencies of ~10%. To that end, much has yet to be elucidated about the QD/shell/ligand/polymer system with regards to efficiency loss mechanisms. Experiments are proposed to determine the nature of such mechanisms by modeling the system on a larger scale in order to develop an efficient QD/shell/ligand/polymer solution.

Nanocrystallization of amorphous cobalt-rich FeCo multilayer thin films and the associated changes in magnetic properties
Yue Ma / Materials Science Engineering
Advisor(s): Nicholas Jones / Materials Science Engineering &
Michael McHenry / Mechanical Engineering
Hoch Commons-2nd Floor, Rangos side / 3-5

$(Co95Fe5)88Zr8B_4$ is a material of interest in magnetic tunnel junction applications due to its reported soft magnetic properties. Multilayer thin films of amorphous (Co95Fe5)88Zr8B4, separated and capped with 5 nm of alumina, were fabricated to varying thicknesses. X-ray diffractometry (XRD) and alternating gradient field magnetometry (AGFM) were used to characterize the structure and magnetic properties of these films. The same films were then annealed in a furnace to nucleate and grow nanocrystals within the amorphous matrix, observing the kinetics using the vibrating sample magnetometer (VSM). The structure and magnetic properties of the resulting products were again characterized by XRD, AGFM.

Opaque Glass: Thermally Activated Materials vs. Smart Glass
Yordanis Diez / Electrical and Computer Engineering, Deborah Gruner / Self-defined, Morgan Heskett / Materials Science Engineering, Jennifer Williams / Materials Science Engineering
Advisor(s): Nicholas Jones / Materials Science Engineering &
Michael McHenry / Mechanical Engineering
Hoch Commons-2nd Floor, Rangos side / 3-5

Materials which can become clear or opaque simply by providing heat or by running a current through them have a wide variety of applications: in professional settings such as offices, public restrooms, or, more commonly, in households. Materials which have this property can be used as windows or transparent doors in multiple places around a house (for example, the restroom). Such panes would essentially eliminate the need for items such as window blinds, shower curtains and other such coverings, meaning the application of such technology could ultimately prove to be cost effective to consumers.

We hope to test the energy and cost efficiencies of different materials and eventually determine which specimen is the best choice to fulfill these applications around one's home.

RobOrchestra V
Rohan Aletty / Electrical and Computer Engineering,
Douglas Bernstein / Mechanical Engineering,
Jonathan Boerner / Mechanical Engineering,
Andrew Burks / Mechanical Engineering,
Gerald Carlson / Mechanical Engineering,
Katherine Coste / Mechanical Engineering,
Daniel Curhan / Mechanical Engineering,
Jaywoo Kim / Mechanical Engineering,
Michael Ornstein / Mechanical Engineering,
Michael Sandbothe / Computer Science &
Daniel Shope / Mechanical Engineering
Advisor(s): Roger Dannenberg / Computer Science
Wean Commons-1st Floor, Connan side / 12-2:30

The RobOrchestra project is dedicated to the creation of music using technology coupled with art. Now in its fifth year, RobOrchestra has created a number of robots with specific musical functions and generated meaningful ways for them to play together cooperatively. In previous years, this organization was dedicated to establishing a basis upon which a few instruments could play, but this year we plan to expand the number of instruments at our disposal and to bring out the "Orchestra" in RobOrchestra. In addition to building more instruments, expanding our reach to both the string and brass sections, we will also investigate creating methods for humans to interact with the robots' performance. In this manner we will expose the connection between science and art by showing the mathematical complexity of music and the artistic possibilities of robotics.

Self-limited Heating and Biocompatibility of Ferrofluids Synthesized from Fe-Ni-based SPEX-milled Nanocomposites
Marianna Sofman / Materials Science Engineering,
Advisor(s): Michael McHenry / Materials Science Engineering,
Kelsey Miller / Materials Science Engineering
Hoch Commons-2nd Floor, Window side / 3-5

This research is a continuation of last year's research project on Fe-Ni based nanoparticles for self-limited RF heating behavior. Previously, two FeNi compositions at 23% and 25% Ni were studied, each made from SPEX-milling of pure powders. X-Ray diffraction patterns will be performed on these samples in order to see if a stable form of gamma -FeNi was achieved. X-ray diffraction scattering patterns revealed that the Fe73Ni27 particles were a mixture of BCC alpha-Fe and FCC FeNi3 phases. After annealing the samples into the FCC gamma -FeNi phase and water quenching a stable form of gamma -FeNi was achieved. Using vibrating sample magnetometry (VSM), the Curie temperature (Tc) of the particles was found to be 120 °C. This year, I continued looking at the effect of Curie temperature on the self-limited heating properties of Fe-Ni nanoparticles. Having reduced the Curie temperature of the Fe-Ni nanoparticles by a significant amount, and after successfully synthesizing the metastable gamma-FeNi phase, I looked at the effects of doping the Fe-Ni composites with a certain element in order to further reduce the Curie temperature. I studied the exchange energy of transition elements, including: manganese, chromium, iron, cobalt, and nickel. The exchange energy of these transition elements versus the ratio of the interatomic distance to the radius of the 3d shell is shown in the Bethe-Slater curve. These differences in exchange energies are associated with a difference in spin alignment resulting in ferromagnetic and antiferromagnetic states. By studying the different effect of the exchange energy interactions, namely manganese and FeNi, one can further reduce the Curie temperature of the nanoparticles to a temperature that is of interest for biocompatible applications.

Self-Regulated Heating in Hyperthermic Cancer Therapy
Youngun Kim / Materials Science Engineering
Advisor(s): Michael McHenry / Materials Science Engineering
Wean Commons-1st Floor, Connan side / 12-2:30

In our research, we seek to test the efficacy of radio-frequency (RF) heating on magnetic nanoparticles (MNPs) in killing cancer cells, also known as magnetic hyperthermia. Since cancer cells are more sensitive to high temperatures, heating to above 43°C would selectively damage the cancerous cells. We try to control RF heating by using self-regulating materials that are designed to have Curie temperatures near 45°C. Our project employs the synthesis-structure-properties paradigm of materials science to investigate new MNPs with Curie temperatures tuned to these temperatures. Our research is also coupled with the demonstration of self-limited heating and tests for hyperthermic effects in collaboration with the Hillman Cancer Research Center.

Synthesis and Characterization of Multicomponent Polymer Nanofilaments
Emily Walker / Materials Science Engineering,
Advisor(s): Michael Bockstaller / Materials Science Engineering
Hoch Commons-2nd Floor, Rangos side / 3-5

We intend to develop a process by which we can synthesize multicomponent nanofilaments. Currently, nano-additives are either cylindrical nanofilaments (which enhance mechanical, but not optical or magnetic, properties) or spherical particles (which enhance optical and magnetic, but not mechanical properties). Multicomponent nanofilaments would combine both cylindrical and spherical additives, thus making new property combinations available for materials.

Thermal and Electrical Properties of Carbon Nanotube Aerogel
Itai Stein / Materials Science Engineering,
Advisor(s): Mohammad Islam / Chemical Engineering
Wean Commons-1st Floor, COnnan side / 3-5

Although much work has been done on the thermal and electrical properties of isolated single walled carbon nanotubes (CNTs), not much work has been done regarding the thermal and electrical properties of CNT networks. Here we study the thermal and electrical properties of three dimensional CNT networks - we call them CNT Aerogel. We measure the electrical conductivity of “fused” CNT Aerogel, where the junctions between CNTs within the Aerogel have been fused, and “non-fused” CNT Aerogel, where the junctions have not been fused. Finally, we also measure the thermal conductivity of non-fused CNT Aerogel and found them to be highly insulating. In future, we will explore the thermo-electric conversion capabilities of the non-fused CNT Aerogel.

MECHANICAL ENGINEERING

A case study on web-enabled residential electronics: The web-enabled automatic pet feeder
Jason Calaiaro / Mechanical Engineering
Advisor(s): Jeremy Michalek/ Mechanical Engineering
Wean Commons-1st Floor, Connan side / 3-5

In a world increasingly connected, residential electronics largely remain in communicative stagnation relative to advances in telecommunications over the past two decades. Consider that today, an overwhelming majority of the US has a home network with a router, and access to the internet. The infrastructure for remote operation and device status inquiry of residential electronics is therefore already firmly implanted. Remote operation and notification of device status enhances experience, increases productivity, decreases stress, and reduces costs otherwise incurred. To explore the design space of all residential electronics, a single product was chosen whose communicative backbone would be common to all devices. This product is an automatic pet feeder. A prototype was built to explore the challenges of system integration. In this research, hardware, software, and web-content are developed to show how a residential electronic device can be integrated with existing residential Wi-Fi infrastructure to allow remote operation and notification of the automatic pet feeder. The results of these studies are presented here.

Analysis of Composite Manufacturing Methods in Maximizing Production Efficiency
Joseph Meyer / Mechanical Engineering
Advisor(s): Susan Finger / Civil and Environmental Engineering
Hoch Commons-2nc Floor, Rangos side side / 12-2:30

Composite manufacturing effectiveness can be maximized through the implementation of proper methods during construction. In a fixed resource application, where possibilities are limited by specific factors such as cost and time, certain methods of manufacturing will prove to be more efficient than others. The proposed research

involves the investigation of fiberglass manufacturing techniques to determine which method will yield the best result at the lowest cost. Cavity, positive, and twice-casted molds will be assembled and then used in the production of composite bodies. The cost and error of each manufacturing method will be assigned values and then averaged together, with error factored in twice because it is more important, and this final number will then be used to determine the method that maximizes the effectiveness of the composite manufacturing process.

ASME EarthSaver: Autonomous Recycling Sorter
Jaime Bourne / Mechanical Engineering, Collin Buchan / Mechanical Engineering, Katherine Coste / Mechanical Engineering, Megan Dority, Mechanical Engineering, Steven Ford, Mechanical Engineering, Szu-Chieh Lu / Mechanical Engineering. Prerak Patel / Electrical and Computer Engineering. Michael Saitta / Undecided, Daniel Shope / Mechanical Engineering, David Stonestrom / Mechanical Engineering & Christopher Tomaszewski / Mechanical Engineering
Advisor(s): Cecil Higgs / Mechanical Engineering
Hoch Commons-2nd Floor, WIndow side / 3-5

Recycling is a growing industry accounting for more than 1.5 million jobs and $100 billion in revenue. More than 600 million metric tons of material is processed globally every year. Green initiatives have raised public awareness of recycling and other earth-conscious practices. This expansion has resulted in a demand for efficient and cost-effective means of processing recyclable waste. Material sorting is a costly step in the recycling process. Improperly sorted items slow down the process, reducing the monetary margin of recycling. To this effect the researchers have developed a household scale material sorter. The system autonomously sorts commonly recyclable items by material.

Battle Curling
Tammy Dvir / Mechanical Engineering, Kin Hang Leung / Mechanical Engineering & Brian Mizrahi / Design
Advisor(s): Susan Finger / Civil and Environmental Engineering
Conon / 12:30-3:30pm

The goal of the Battle Curling game is to teach children general laws of energy ranging from the idea of stored energy in a spring, to angular momentum and conservation of energy in collisions, to general laws of energy conservation. The game is played on a board with a player at each end. Each has a disc and a shooting mechanism, which is a spring in a box that can both rotate and move across the board. Each player chooses the

position of the shooter and how far to compress the spring. The goal is to get as close to the center target as possible, while keeping your opponent out of the target. By playing the game, children will learn principles of physics. Their curiosity may lead them to stretch the spring too far, or see what happens when the disc is aimed at one of the walls of the board.

Circuit City
Asa Berg / Mechanical Engineering,
Charles Doomany / Design & John Ni / Mechanical Engineering
Advisor(s): Susan Finger / Civil and Environmental Engineering
Conon / 12:30-3:30pm

Circuit City is an interactive game for children that teaches about circuits and electricity, while promoting collaboration and problem solving skills. Circuit City is a board game that is wired to allow connections between various electronic components, such as lights, motors and batteries. Using these components, which are on individual pieces, children will solve puzzles and explore many basic principles of electricity, including circuits and how to power multiple objects. The puzzles can be solved individually or in teams and will have varying levels of difficulty. The playing board and pieces will all be themed around a city, with the playing pieces designed to look like many different buildings. This game is a safe and fun way to teach about electricity.

Comparing Open Source vs. Proprietary Computational Fluid Dynamics
Thomas Lambert / Mechanical Engineering
Advisor(s): Cicil Higgs / Mechanical Engineering
Rangos 1 / 12-2:30

In many different applications of Mechanical Engineering in industry,proprietary computational fluid dynamics (CFD) software is bought for a large price. However, today there are many different open source computational fluid dynamics solvers that are becoming more and more prominent in performing complex CFD analysis. Throughout my research I have performed many different analyses on the open source CFD code, OpenFOAM, as well as the open source meshing code, GMsh. The goal of my presentation is to critically compare the results of approaching both simple and complex flows with these open source codes to approaching the same problems with their proprietary code counterparts of Gambit and Fluent.

Design of a Thermal Cooling System for a Solar-Powered Vehicle to Increase Power Efficiency
Michael Barako / Mechanical Engineering,
David Bromberg / Electrical and Computer Engineering &
Stephen Mead / Electrical and Computer Engineering
Advisor(s): Susan Finger / Civil and Environmental Engineering
Hoch Commons-2nd Floor, Rangos side / 3-5

In order to maximize the efficiency of solar alternative energy systems, thermal cooling techniques must be researched and implemented. In general, the silicon solar cells that constitute solar arrays perform at maximum efficiency at lower temperatures, but during operation, average temperature increases. Thermal cooling devices to counter this effect are necessary to ensure a solar array is operating at maximum output. The proposed research involves the design of such a cooling system to be used for a solar-powered vehicle, a new and growing application of solar energy. It includes the exploration of various factors that may influence temperature reduction, including solar panel backing and coating, as well as active and passive cooling systems. The custom cooling system will then be implemented in a full-scale solar-electric race boat, where it will be used to cool an array of four commercial solar panels.

Design of Quasicrystal Nanostructures for Low Thermal Conductivity
Michael Barako / Mechanical Engineering
Advisor(s): Alan McGaughey / Mechanical Engineering
Rangos 1 / 12-2:30

Quasicrystals are composite aperiodic structures. They can be built from thin semiconductor layers (1-10 nm) for use in thermoelectric energy conversion devices. These devices use a temperature gradient to induce an electric current (or vice versa). There are a variety of potential applications for thermoelectric devices including direct solar energy conversion and waste heat recovery from automobiles to reduce the net carbon footprint. Low efficiencies have limited thermoelectric technology to a niche market including radioisotope thermoelectric generators in deep space satellites and small-scale refrigeration. The thermoelectric figure of merit ZT is used to quantify the effectiveness of a thermoelectric material. ZT is linearly proportional to the electrical conductivity and inversely proportional to the thermal conductivity [1]. The best commercially available thermoelectric materials are Bi2Te3-based alloys which have ZT~1. Research has focused on increasing ZT by using nanostructured materials to decouple the electrical properties from the thermal conductivity. This effect can be achieved with closely-spaced interfaces, which disrupt the periodicity of the material, preventing coherent phonon development.

Development of an Adjustable Headrest for a Hug Machine and Evaluating System Effectiveness for Calming Autistic Children
Ming-Yang Hung / Mechanical Engineering
Advisor(s): Mark Friedman / Biomedical Engineering
Hoch Commons-2nd Floor, Window side / 3-5

This proposal is to refine one component of the award-winning Hug Machine project by making a more affordable device to calm hypersensitive people with Autism and then to evaluate the completed system's potential effectiveness. An adjustable headrest will be designed and constructed to complement the existing adjustable body pressure framework. Furthermore, effectiveness of the new system will be evaluated through surveys of clinical professionals caring for autistic people and – if Institutional Review Board (IRB) approval is obtained – doing pilot tests with subjects under the care of some of these professionals. Ultimately, instructions on how to build the new Hug Machine, as well findings from this project, will be posted on a website to aid people coping with autism and their caregivers.

Development of an Optimized Muffler for a Formula SAE Racecar
Michael Lin / Mechanical Engineering & Ian Norman / Mechanical Engineering
Advisor(s): John Wiss / Mechanical Engineering
Wean Commons-1st Floor, Connan side / 3-5

This project aims to investigate the parameters that affect the performance of mufflers for internal combustion engines. This research will utilize both computational fluid dynamics simulations as well as experimentation to find a relationship between the muffler parameters and its noise attenuation characteristics. The results of this research will manifest themselves in an optimized muffler that will be run by Carnegie Mellon Racing (CMR) in the 2010 Formula SAE competition.

Effect of colloidal microspheres on tipstreaming in droplets
Charbel Eid / Mechanical Engineering
Advisor(s): Shelley Anna / Mechanical Engineering
Rangos 1 / 12-2:30

The goal of this project is designing a lab-on-a-chip microfluidic device that will test the effect of jamming colloidal microspheres on the surface of droplets. Microspheres of different properties are used, and their effect on tipstreaming in droplets will be the primary focus of this study. This technology will allow the carrying out of

antibody-antigen interactions on the surface of the droplet and eventually be used as a diagnostic device in developing countries, simulating the ELISA test in a cheaper, faster, and more automated setting.

Energy Saving Through Predictive Techniques
Benjamin Som-Pimpong / Mechanical Engineering &
Karen Yu / Civil and Environmental Engineering
Advisor(s): Anind Dey / Human Computer Interaction &
Jennifer Mankoff / Human Computer Interaction
Kirr Commons-1st Floor, Window side / 3-5

Heating and cooling make up about 56% of energy costs in the typical American home (US Department of Energyhttp://www.energy.gov/heatingcooling.htm), making it the main contributor to the 4 metric tons of carbon dioxide coming from American homes per person per year (EPA - http://epa.gov/climatechange/emissions/ind_home.html). More efficient use of HVAC systems can significantly reduce energy consumption and greenhouse gas emissions, but it is often a hassle for people to turn their thermostats down as they leave the house and back up when they return. In the Human Computer Interaction Institute we have developed a solution using a CMU-grown location prediction technique to automatically control user's thermostats. The prototypical system we used for a user study consists of a programmable thermostat, a Google android phone, and Smarthome controllers that allow home heating systems to be controlled remotely. In our study, we had a participant pool separated into two groups, one having "automatic" control of their thermostats and the other having "non-automatic control." The automatic control group had phones that were trained using GPS logs of the participants and a prediction algorithm to anticipate when they would arrive and leave the home and turn the heating on or off accordingly. Users could also manually control the system through the phone. The second group only had the manual control. As the participants interact with their thermostats through their phones, they are given feedback through the application. Participants were given surveys at the beginning and throughout the 8 week period that they had the phones to determine how their energy usage behavior changed. In a city like Pittsburgh where winter temperatures are often below freezing, efficient control systems for residential heating can have a large impact on CO2 emissions. We envision that automatic control of the system will reap large savings in money and CO2 emissions.

Ex-situ visualization of two-phase flow in parallel PEM fuel cell air delivery microchannels
Michael Burkholder / Mechanical Engineering
Advisor(s): Shawn Litster /Mechanical Engineering
Rangos 1 / 12-2:30

Proton exchange membrane (PEM) fuel cells are a key potential energy conversion technology for future transportation and backup power systems, having high efficiency and low emissions. These fuel cells operate on hydrogen and oxygen from the air. The largest parasitic load on PEM fuel cell systems is the load to generate air flow rates and pressures needed to expel water from the fuel cell. Without proper water management, the water generated by the electrochemical reaction on the cathode side of the fuel cell can block air transport within the fuel cell and starve areas of the cathode of oxygen, leading to unstable fuel cell performance. In order to mitigate this parasitic load, it would be advantageous to use low air flow rates and parallel channel air delivery flow fields with low pressure drops. However, this makes it necessary to properly understand the two-phase flow that occurs in these microchannels and how the air flow rate and water production rate lead to detrimental cathode flooding. This research uses an ex situ parallel channel flow field apparatus in which the two phase flow is visualized using a microscope while the air and water flow rates are individually varied, simulating fuel cell operation. The results of this research include the correspondence between air and water flow rates and the resulting two-phase flow regime, as well as the relationship between the pressure fluctuation power spectrum and the two-phase flow regime.

Explicit FEM Modeling of the Coefficient of Restitution of Granules
Christopher Rizzo / Mechanical Engineering
Advisor(s): Cecil Higgs /Mechanical Engineering
Rangos 1 / 12-2:30

In this study, the Coefficient of Restitution (COR) of various steel-material combinations is predicted through both physical experiments and explicit finite element modeling (FEM) of a falling granule colliding with a stationary plate. This work performed here is an i mportant component of developing granular flow models. At present the Particle Flow and Tribology Lab employs COR in its cellular automata (CA) models and discrete element method (DEM) models. COR is measured experimentally using a setup where a granule is bounced off of a plate and the initial and rebound heights are measured. The LS-DYNA explicit FEM simulation is based off of the experimental setup and calculates the COR in the same manner. For both the experimental and FEM case COR is plotted against the

impact velocity of the granule, which is obtained via the initial drop heights (9-19 inches). The FEM simulations yield results that are within the error of the results determined by experimentation, but the trends in COR vs. impact velocity do not match for the current explicit FEM models. Partly explaining this discrepancy could be the small impact velocity range. The addition of an FEM simulation reduces the need for costly and time consuming experiments while adding the chance to tests scenarios which could not be easily created in the lab (such as variation in singular particle properties). If the trends for COR match those determined by experimentation the explicit FEM model can be used to produce a COR formulation based on varying material properties and collision parameters. This formulation will give the CA and DEM modelers a more accurate representation of COR for inclusion in their contact models, which in turn can lead to greater practical applications and more results for multi-particle granular flow system simulations.

Exploring the effect of roofing materials and general energy consumption on greenhouse gas emissions
Keith Baren / Mechanical Engineering
Advisor(s): Jonathan Cagan / Mechanical Engineering
Rangos 1 / 12-2:30

The project initially began as research on passive cooling of houses using alternative roofing materials. This led into an exploration of techniques and materials with a goal of customizing the absorbance and reflectance of a roof. The project progressed into broader territory concerning economic life cycle analysis of energy consumption, and its effect on total greenhouse gas emissions on a large scale.

Formation Control in a Low-Cost Robot Colony
Jaime Bourne / Mechanical Engineering,
Austin Buchan / Electrical & Computer Engineering,
Megan Dority / Mechanical Engineering,
Emily Hart / Electrical & Computer Engineering,
Christopher Mar / Electrical & Computer Engineering,
Evan Mullinix / Electrical & Computer Engineering,
Bradford Neuman / Computer Science,
Nicole Paris / Electrical & Computer Engineering,
David Schultz / Physics,
John Sexton / Electrical & Computer Engineering &
Bradley Yoo / Electrical & Computer Engineering
Advisor(s): George Kantor / Robotics Institute
Rangos 2 &3 / Sigma Xi Group 5, 10:00am

Formation control, as it applies to the field of mobile robotics, is having robots maintain a certain distance and orientation between each other as they move as a group throughout an environment. This can be a simple and effective method of coordinating the movements of multi-robot systems and has several applications. Through this proposed research, the Colony Project will investigate how the principles of formation control apply to a colony of low-cost robots. In an attempt to develop a flexible research platform for formation behaviors, we will explore how formation control can enhance the movement and sensory capabilities of our robot colony. This work is a continuation of previous Colony Project research and will serve as a foundation for future research within the Robotics Club

Friction and wear in a self replenishing WS2 powder film
Daniel Liptz / Mechanical Engineering & Ryan Yates / Mechanical Engineering
Advisor(s): Cicil Higgs / Mechanical Engineering
Rangos 1 / 12-2:30

Powder lubricants are extensively used in extreme-temperature, severe load conditions, and high vacuum environments, where liquid lubricants are currently inadequate. One approach to using solid lubricants is to create a coating over wearing materials; however, these coatings have limited lifespan and experience other age-related issues. Instead, this research aims to test the effectiveness of using powder compacts (pellets) to generate self-replenishing films of lubrication. We tested the lubricity of molybdenum disulfide (MoS2) pellets using a rotating tungsten carbide (WC) disk and a WC slider. Using a control volume fractional coverage model previously developed by Wornyoh and Higgs, we were able to examine the wear of the pellet against a dry disk, a lubricated disk, and against a disk with compacted lubricant. We also examined the wear and friction properties under different loading conditions. Through this research we will come to better understand the various factors that affect friction and wear in self-replenishing powder lubricant films.

Hybrid Fiber Optic Lighting System
Yordanis Diez / Electrical and Computer Engineering,
Prerna Singh / Mechanical Engineering &
Rebecca Willmott / Electrical and Computer Engineering
Advisor(s): James Schneider / Chemical Engineering
Hoch Commons-2nd Floor, Rangos side / 3-5

Hybrid solar fiber optic lighting is different than traditional solar power, which converts sunlight into electricity. Solar fiber optic lighting uses a solar concentrator to expose one end of a fiber optic cable to sunlight. The fiber optic cable is then run through the building where the other end delivers light to an interior room. During the day, these fiber optic cables can light windowless rooms in buildings ranging from houses to commercial offices with natural sunlight. However, this technology cannot function in shade or at night. Therefore, a prototype hybrid technology was designed and fabricated to combine LED and solar fiber optic technology to create a light which can produce light at all times of the day using minimal electricity.

Hybrid Locomotion for Increased Urban Mobility in Robots
MEgan Dority / Mechanical Engineering,
David Hamilton / Mechanical Engineering,
Evan Moss / Mechanical Engineering,
Samuel Nalbone / Mechanical Engineering &
Michael Ornstein / Mechanical Engineering
Advisor(s): Robert Reid / Mechanical Engineering
Hoch Commons-2nd Floor, Window side / 12-2:30

Robots commonly find themselves in an urban environment. Most wheeled robots are well suited to the relatively level ground found in these environments, but the urban environment also contains an obstacle that stops most robots in their tracks; this simple obstacle is the stair. Currently, most robotic platforms use one form of locomotion. The majority of robots use wheels for their simplicity, speed, and accuracy that they provide the platform. These wheeled platforms, however, cannot go up stairs. The second most common form of locomotion is some form of legs. Legs allow a robot to cope with obstacles but cannot, at this point in time, allow for high speeds. Our proposal to the problem that stairs pose to robots is a Ã¢ÂÂhybrid-locomotionÃ¢ÂÂ system. Our robot would combine the strengths of both wheeled and legged robots, allowing it to traverse over obstacles, such as stairs, and maneuver at high speeds. Our robot would use its wheels to travel along level surfaces, transitioning to its legs to navigate across obstacles, such as stairs.

Investigating Quadrupedal Gaits: A Platform for Rapid Locomotion and Terrain Navigation
Daniel Shope / Mechanical Engineering
Advisor(s): Robert Reid / Mechanical Engineering
Pake / 3:00

The current state of wheeled locomotion is unsuitable for complex terrain navigation that can be accomplished by a legged vehicle. Current legged robotic gaits, however, are too slow for intended applications in civilian and military use. A major issue with these designs is the lack of compliance and energy storage mechanisms such as those found in animal quadrupeds. The proposed design draws heavily from biomechanics principles to create an energy efficient quadruped that is capable of high speed locomotion. A passive spinal structure is introduced that allows spring potential storage during running, modeled after the Acinonyx jubatus, or cheetah. The quadruped platform will have an increased stride length compared to existing state of the art legged robots currently in the field. Conventional energy storage elements such as springs are used to increase the efficiency of locomotion. The platform was tested with different gaits such as prancing, trotting, and galloping, using a genetic algorithm based approach to optimize speed and minimize power consumption. The technologies innovated in the platform will scale to larger payload carrying quadrupeds useful for exploratory robotics and military troop support.

Jack Plate and Trim Switch Implementation for Thrust Optimization
Ibuki Kamei / Mechanical Engineering,
Advisor(s): Susan Finger / Civil and Environmental Engineering
Hoch Commons-2nd Floor, Rangos side / 3-5

The inclusion of a jack plate and trim switch on a powerboat will greatly alter the boat's maneuverability and acceleration. For a boat at a given speed, drag forces will effect the optimal application of the thrust provided by the motors, which will maximize the rate at which the boat can accelerate. Due to such differences, a moveable jack plate (which controls thrust elevation) in combination with an adjustable trim switch (which controls the thrust angle) can be used to alter the thrust of the motors. Through the observation of real-time data during lake-trials of a powerboat outfitted with such mechanisms, analysis can be performed to determine the optimal settings for both the jack plate and the trim level at any given velocity of the boat, such that it accelerates as quickly as possible.

Lubrication of ultra deep drilling for fossil fuel energy
Yung-King Leo Ma / Mechanical Engineering
Advisor(s): Cecil Higgs / Mechanical Engineering
Rangos 1 / 12-2:30

Shortage for energy has been a heated topic for years. With terrestrial oil reserves quickly running out new sources for oil are desired. Aquatic oil reserves fit right into this category. These oil reserves however, cannot be easily exploited; the brutal environments in the wells mean plenty of study and development are needed for efficient practice in the future. Due to friction between the drill bit and the rock layers, the drilling process inevitably creates a huge amount of heat. Drilling fluid, or lubricant, is constantly applied to cool and stabilize the surroundings. This research investigates the interaction between the lubricant and the drilling surface, exploring possible ways to develop improved techniques for more efficient drilling. A Rapid Characterization Filtration Rig (RCFR) is used to simulate the drilling process experimentally, with a mixture of Titanium Dioxide and deionized water acting as the lubricant. Experimental results are recorded and studied to better understand the diminutive relations in the drilling process.

Mechanical Design of a Miniature Climbing Robot
Matthew Glisson / Mechanical Engineering & Sara Whitby / Mechanical Engineering
Advisor(s): Metin Sitti / Mechanical Engineering
Rangos 1 / 12-230

This robot uses synthetic fibers similar to those on the feet of geckos to cling to and climb up walls. Our research focused on mechanism design, specifically design for manufacture and redesign for turning capability. Originally, the robot was difficult to assemble, as it was constructed with only functionality in mind. It could move in a straight line across a wall in any direction fairly reliably. We have redesigned it so that it is easier to manufacture and assemble, is slightly more robust, and can turn in place.

Mentos and Diet Coke Car
Jocelyn Avila / Mechanical Engineering,
Kellen Chow / Mechanical Engineering &
Michael Serebrennikov / Mechanical Engineering
Advisor(s): Susan Finger / Civil and Environmental Engineering
Connan / 12:30-3:30

Our goal is to engage children in an activity that teaches them the basic principles of thermodynamics and physics. The final product is a “Mentos and Coke” car with various wheel sizes. The variety of wheels will challenge the students to experiment and see which combination works best. After they construct their car, an adult assists them with inserting the Mentos. After all of the students have tested their cars, the winner will be based on whose

goes the farthest. The students learn a variety of basic principles in this game. First they learn about friction because it is important that the bearings have little interference with the axel. This is so that the majority of the pressure is directly transfered to propelling the car. The other way they learn is by seeing the result of the chemical reaction. The Mentos provides nucleation sites for the dissolved carbon dioxide in the Diet Coke so the reaction happens quickly. There will be a handout for curious children to explain the exact reactions going on, and all of the children will be able to see first hand what the result is. Students will take away from this project an understanding of the construction of the car. By realizing that the larger wheel in the back is more successful, that is directly related to how much coke will fit in the bottle, it teaches them that increasing either of the contents for the reaction results in a larger reaction.

Metallic Micro-Droplets from a Microfluidic Process
Alberto Landa Montano / Mechanical Engineering
Advisor(s): Burak Ozdoganlar / Mechanical Engineering
Rangos 1 / 12-230

To achieve the fabrication of a perfectly spherical metallic droplet is a challenging task. To do so when the desired diameter is in the micro scale is a lot more complicated. Being able to obtain perfectly spherical droplets at that size is something that has been attempted in the past but never successfully achieved. My goal for this research is, in collaboration with Profs. Ozdoganlar and Anna and their graduate

Modeling abrasive wear in artificial hip joints
Geo Thukalil / Mechanical Engineering
Advisor(s): Cecil Higgs / Mechanical Engineering
Rangos 1 / 12-230

The average lifespan of an artificial hip replacement can range from ten to twenty-five years, depending largely on the level of activity of the user. Through everyday motion, fragments from the ultra-high weight polyethylene acetabular cup break off and become present in the synovial fluid separating it and the femoral head. These particles cause wear and further degradation. By modeling this interaction, a better understanding of the wear mechanics can be achieved, leading to hip replacements with a longer lifespan. Through further development of the model created by Jhurani and Higgs, wear calculations will be developed.

Optimization and Parallelization in Particle Dynamics Simulation
Alejandro Queiruga / Mechanical Engineering
Advisor(s): Cecil Higgs / Mechanical Engineering
Wean Commons-1st Floor, Connan side / 12-2:30

We present algorithms for optimized general particle dynamics simulations based on the discrete element method and impulse-based physics. Our summer work involved optimizing a cellular automata model of granular flow with impulse based physical interactions. The simulation was for granular flow lubrication, which involves the flow of granular materials in sliding contacts such as annular or bearing-type. In this simulation, the locations and motions of the particles are constrained to a grid, where only one particle can occupy a cell at a time. This constraint allows for a highly efficent collision detection algorithm, as well as a parallelization scheme. With basic optimizations and a highly optimized parallelization code, we extended this simulation to larger systems than were previously modelled. At this level, we noticed that the cellular automata model is inadequate to model systems beyond its original designed scale. After seeing that the previous impulse based model was too simplified to be able to capture a variety of systems, we implemented a new model using the Discrete Element Method. This more in depth, but computationally expensive model, allows us to model a wider range of systems. We apply this model to multiphase simulations of Chemical Mechanical Polishing, in which the particles are immersed in a fluid and wear away a surface, and Deep Sea Oil Drilling, in which we have particle build up inside a fluid at the bottom of a drill shaft. We generalize the method of storing particle locations from the cellular automata based moded to apply the algorithms for collision detection and parallelization we developed to this new model.

OrthAssist: Towards an Actuated Upper Extremity Orthosis for Strength Augmentation and Rehabilitation
Alexandra Cirillo / Mechanical Engineering,
Marina Musicus / Mechanical Engineering,
Vani Rajan / Electrical and Computer Engineering,
Daniel Shope / Mechanical Engineering,
Andrew Strat / Electrical and Computer Engineering &
Heather Tomko / Mechanical Engineering
Advisor(s): James Antaki / Biochemical Engineering
Rangos 2 & 3 / Sigman Xi Group 5, 10:45am

Neuromuscular diseases affect the peripheral nervous system, which includes muscles, the nerve-muscle junction, peripheral nerves in the limbs, and the motor-nerve cells in the spinal cord. These disorders often result in an overall muscle weakness that hinders the

user from independently performing normal day-to-day activities. Thus we propose a safe, efficient and controlled strength augmentation device to assist the subject with daily lifting and mobility. The device will assist users with lifting and carrying objects beyond their natural capability.

Patterned Surfaces for Simple Multiplexed Rapid Point of Care Diagnostics
Justin Yi / Mechanical Engineering & Shelley Anna / Mechanical Engineering
Advisor(s): Stephen Garoff / Physics
Rangos 1 / 12-2:30

This research involves developing a new type of low-cost diagnostic tool that consists of a patterned surface that enables simple, rapid testing of multiple and varied reagents against a single drop of bodily fluid. This tool will ideally be used for priority global health conditions. When the appropriate amount of test fluid is placed in the center of the pattern, it will spread until it encounters the pattern's boundary: a difference in wettability of the surface. The uniform spread of the droplet will reach out to multiple satellite reagents spots, each forming its own individual reaction. Over the course of this past year I have been developing the shape of the pattern and methods of prototype manufacturing, improving techniques for creating different wettability in surfaces, and optimizing various parameters to effectively allow the central droplet to contact all reagent spots while avoiding cross contamination.

Pizza Consumption and Preference of CMU Undergraduate Students
Augmentation and Rehabilitation
Stafford Brunk / Self-defined,
Atishe Chordia / Mechanical Engineering,
SeungJin Park / Economics and Statistics,
Tony Poor / Computer Science &
Henry Wu / Mathematics
Advisor(s): Brian Junker / Statistics
Kirr Commons-1st Floor, Window side / 12-2:30

We are conducting a consumer survey of Carnegie Mellon students in order to learn about their pizza consumption behaviors. We have utilized a post-stratified random sample of 800 undergraduate students from the CMU directory, emailing them a Google Docs-powered survey (with the offer of an Amazon gift card raffle to increase the response rate). Our survey hopes to gain insight on the current consumption behaviors and motivations of CMU undergrads, including issues like when students generally want to order pizza, the impact of DineXtra or PlaidCa$h in their decisions, and what other

characteristics (cost, quality, quantity, location, etc.) are most important to them. These results may be used by local businesses and Carnegie Mellon dining venues, improving both their business and marketing abilities as well as the satisfaction of CMU students.

Pulley Drag Race: Building Intuition about Simple Machines
Ibuki Kamei / Mechanical Engineering,
Daniel Miller / Mechanical Engineering &
Nicolas Paris / Electrical and Computer Engineering
Advisor(s): Susan Finger / Civil and Environmental Engineering
Connan / 12:30-3

The goal of the Pulley Drag Race is to teach children the fundamental relation between pulley ratios and torque/speed tradeoffs. Drawing inspiration from the speed changing mechanisms found in drill presses and mills, we have created a car that allows children to discover how a change in pulley ratio results in a change of both torque and speed. In addition to seeing the effects of changing ratios on flat ground, children can run their cars on an inclined plane for a better understanding of the need for torque in the system.

RobOrchestra V
Rohan Aletty / Electrical and Computer Engineering,
Douglas Bernstein / Mechanical Engineering,
Jonathan Boerner / Mechanical Engineering,
Andrew Burks / Mechanical Engineering,
Gerald Carlson / Mechanical Engineering,
Katherine Coste / Mechanical Engineering,
Daniel Curhan / Mechanical Engineering,
Jaywoo Kim / Mechanical Engineering,
Michael Ornstein / Mechanical Engineering,
Michael Sandbothe / Computer Science &
Daniel Shope / Mechanical Engineering
Advisor(s): Roger Dannenberg / Computer Science
Wean Commons-1st Floor, Connan side / 12-2:30

The RobOrchestra project is dedicated to the creation of music using technology coupled with art. Now in its fifth year, RobOrchestra has created a number of robots with specific musical functions and generated meaningful ways for them to play together cooperatively. In previous years, this organization was dedicated to establishing a basis upon which a few instruments could play, but this year we plan to expand the number of instruments at our disposal and to bring out the “Orchestra” in RobOrchestra. In addition to building more instruments, expanding our reach to both the string and brass sections, we will also investigate creating methods for humans to interact with the robots’

performance. In this manner we will expose the connection between science and art by showing the mathematical complexity of music and the artistic possibilities of robotics.

Separation of Fibroblasts and Epithelial Cells From a Tumor Biopsy Using Chemotactic Gradients in a Microfluidic System
Marina Musicus / Mechanical Engineering
Advisor(s): Philip LeDuc / Mechanical Engineering
Rangos 1 / 12-2:30

In the testing of tumor biopsies with varying concentrations of chemotherapy drugs, it is necessary to grow out the original tumor biopsy to increase the confluency of cells. However, a tumor contains both fibroblast and epithelial cells, of which only epithelial cells can be tested for chemosensitivity. This project seeks to develop a microfluidic system to separate fibroblast and epithelial cells as they grow. Separation is based on differential cell motility in the presence of a chemotactic agent within a central chamber in the microfluidic system. Possible methods of inducing a chemical gradient were studied, including optimization of channel shape and size. Microfluidic methods for automatic cell feeding during growth were also studied. Both a one- and two-chamber system that relied on diffusion of the chemotactic agent to create a chemical gradient were developed and tested.

Sling Shot Safety Car
Joshua Johnson / Architecture,
Sarah Stroup / Mechanical Engineering &
Cecily Sunday / Mechanical Engineering
Advisor(s): Susan Finger / Civil and Environmental Engineering
Connan / 12:30-3:30pm

The Sling Shot Safety Car is designed to help children learn about the principle of energy conservation. In playing with this toy, the child first secures a Pringle potato chip inside a car by using various materials such as shredded paper, cotton balls, or packing peanuts. The child then places the car inside a sling-shot frame and releases it into a wall. After the collision, the child can check and see if his chip is still intact. This process can be performed multiple times until the child succeeds in securing the chip. The Sling Shot Safety Car is designed for children ages 7 and older and is safe enough for younger children to play with under adult supervision. The toy car is constructed out of laser-cut acrylic plastic while the sling shot frame is made out of wood and rubber bands. A critical attribute of this toy is the variability of the system. In addition to securing the Pringle with packing materials, children find that they can also protect the chip by moving the sling shot frame different

distances from the wall or by applying alternative forces to the sling shot. This activity allows children to explore the topic of momentum conservation by encouraging them to experiment with the relationship between stopping distance and collision force.

Tesla's Tiles
harles Ammerman / Drama,
James Mesmer / Mechanical Engineering &
Davin Murray / Mechanical Engineering
Advisor(s): Susan Finger / Civil and Environmental Engineering
Connan / 12:30-3:30pm

The goal of Tesla's Tiles is to engage younger students in learning the concepts of electricity and the completion of an electrical circuit. The game is a competition betweentwo students attempting to complete a circuit. The components of the game include a power source, playing board, numerous Tesla's Tiles and two indicator lights. The power source is a battery assembly to provide an electrical current to the indicator lights when the circuit is completed. Each student will earn Tesla's Tiles and have the opportunity to place these tiles in any arrangement they see fit to best achieve their goal of lighting their indicator light first. Students will learn the basic properties of completing a circuit by connecting the wire segments via the blocks and observing the fact that current will flow in any direction as long as a strong conductor is present. Varying shapes of the blocks will allow the students to use their active reasoning skills to make the most direct route to their indicator light. The game is over when the first student completes his or her circuit and their indicator light comes on.

Tetris Building Blocks
Reyes Flete / Mechanical Engineering,
Elizabeth Hohenstein / Civil and Environmental Engineering &
Richard Musgrave / Mechanical Engineering
Advisor(s): Susan Finger / Civil and Environmental Engineering
Connan / 12:30-3:30pm

Tetris Building Blocks are designed to introduce children to the basic principles of structures and geometry though modular building blocks in geometric shapes. Because of the shape of the blocks, children can learn about the forces and moments through building structures with overhangs. The Tetris shapes of the blocks allows for unbalanced forces and moments to develop and cause a tendency for these blocks to tip over. The blocks are made of cardboard which is a sturdy, but light material so children can pick them up and stack them into substantial structures.

The Magnetic Ink Sketch Pad
Kevin Chung / Mechanical Engineering,
Elisha Clayton / Mechanical Engineering &
Michael Lynes / Architecture
Advisor(s): Susan Finger / Civil and Environmental Engineering
Connan / 12:30-3:30pm

The Magnetic Ink Sketch Pad is a sketch board that lets children draw and write with magnets and ferromagnetic fluids. Children can learn about magnetism and fluid mechanics through experimentation, games, and interaction with the Magnetic Ink Sketch Pad. The device is a water-tight drawing board with a ferromagnetic fluid reservoir at the base. With the aid of powerful magnets, the ferromagnetic fluid can climb up and across the board from the reservoir as a result of the magnetic properties of the fluid and the magnets. When paper is inserted into the Magnetic Ink Sketch Pad, the ferromagnetic fluid leaves ink marks as it crosses the papers surface. Children control the magnets to manipulate the ferromagnetic fluid. Different types of magnets with varying strengths and sizes are available so the children can test and analyze how different magnets produce different reactions from the ferromagnetic fluid. The Magnetic Ink Sketch Pad allows children to move beyond pen and paper and to draw or write in an innovative manner. Different card stock templates can be inserted in order to offer a multitude of classic, competitive, and entertaining games, such as mazes, Mad Libs, and Tic Tac Toe.

The Super Spinner
Mukul Bhatt / Mechanical Engineering,
Zari Salimnejad / Design &
Wn Shim / Mechanical Engineering
Advisor(s): Susan Finger / Civil and Environmental Engineering
Connan / 12:30-3:30pm

The goal of the Super Spinner is to engage children's curiosity about pulleys and centripetal force through a game that allows them to freely explore variations in both concepts. There is a board on which children can arrange different pulley systems which attach to a centrifuge at the end of the board. The centrifuge is ringed with different colored lines, and a colored liquid fills the base of the centrifuge. The children need to arrange the pulleys in a way that allows them to spin the centrifuge fast enough to raise the liquid to a specific height. Children play with this toy through a process of free manipulation of parts and pieces. They learn by experimenting with these parts and pieces to acquire different results in the speed of the centrifuge and water level.

Tiny Tractable Trebuchet
Tyrone Celoza / Mechanical Engineering,
James Hresko / Mechanical Engineering &
Madeleine Stearns / Civil and Environmental Engineering
Advisor(s): Susan Finger / Civil and Environmental Engineering
Connan / 12:30-3:30pm

The Tiny Tractable Trebuchet is designed to engage children in learning about projectile dynamics, center of mass, gravity, and moment arms. Two to four people can play the trebuchet game. The goal is to use the trebuchet to launch a projectile and hit small castles at various distances from the trebuchet. The player must change the settings of the trebuchet in order to hit a specific target. The trebuchet can be manipulated in a way so that players can experiment with different settings to get the greatest distance, height, speed, or accuracy. Points are awarded whenever a player directly hits a castle, and more points are given for hitting castles farther away from the trebuchet.

Towards Simultaneous Location and Mapping (SLAM) for Mobile Robots in Indoor Dynamic Environments
Jonas Cleveland / Electrical and Computer Engineering,
Brett Harris / Computer Science &
Francisco Santiago / Mechanical Engineering
Advisor(s): John Dolan / Computer Science
Hoch Commons-2nd Floor, Rangos side / 12-2:30

We will tackle several obstacles in the field of mobile robotics by developing an inexpensive, reprogrammable platform for the development of indoor robotic applications. This platform will employ the capabilities required of a mobile robot in an indoor environment - traversal over objects such as stairs, movement in tight spaces, carrying of medium-sized payloads- in an inexpensive platform. Foremost, this platform will be equipped with a novel SLAM(Simultaneous Location and Mapping) algorithmic approach, which will allow it learn new environments, localize itself in a self-created map, and therefore easily traverse to a desired place or object.

Velcro Building Blocks
Sarah Habib / BHA,
Tristram Hogben / Mechanical Engineering &
James Hulley / Mechanical Engineering
Advisor(s): Susan Finger / Civil and Environmental Engineering
Connan / 12:30-3:30pm

Velcro Building Blocks, which are foam blocks covered in Velcro, are a variation on traditional building blocks. The Velcro adds another dimension to build in, that is, outwards. The blocks are available in an array of sizes and shapes enabling the children to make many typical and atypical structures and designs. Allowing children to "fasten" the blocks together will open a new realm of building possibilities that will encompass both standard towers and abstract structures. The soft and light material of the blocks and easy fastening mechanism also allows toddlers, whose fine motor skills aren't fully developed, to explore building blocks in a new way.

Water Droplets in Carbon Nanotubes
Gary Lee / Mechanical Engineering
Advisor(s): Alan McGaughey / Mechanical Engineering
Rangos 1 / 12-2:30

The physical and chemical properties of carbon nanotubes (CNT) suggest that flow through these nanostructured materials could be tuned to allow for several inspired applications, including CNT membranes for water desalination and drug-delivery devices. In this work, the density and diffusion characteristics of water droplets inside CNTs with diameters of 1.10 nm and 1.66 nm are examined using molecular dynamics (MD) simulations. Inside the 1.10 nm diameter CNT, water molecules assemble into a long-ranged one-dimensional structures aligned with the CNT axis. This behavior is in contrast to that of droplets inside 1.66 nm diameter CNTs, where the water molecules are disordered and the droplet has a density comparable to that of bulk water. The diffusion characteristics of the droplet are then characterized by calculating the mean-squared displacement of molecules inside each CNT. With decreasing droplet size, we find that molecular transport inside each CNT becomes increasingly ballistic and the diffusion coefficient increases. These results are important for the potential nanofluidic applications of carbon nanotubes.

Waterworld
Paul Kimball Jr. / Mechanical Engineering,
Eric Totong / Mechanical Engineering & Ethan Weil / Drama
Advisor(s): Susan Finger / Civil and Environmental Engineering
Connan / 12:30-3:30

The goal of the Water Sandbox is to actively engage children in learning about hydrodynamics and streamlines. The toy is designed to be like a sandbox, except with water instead of sand. It consists of a water table with a recirculating pump and include blocks, boats, sails, fans, and bridges to allow the children to explore different arrangements and to

learn about fluid flow and streams. Children are free to explore and tinker with the materials in the Water Sandbox in order to discover and learn on their own while also providing them with an immediate source of enjoyment.

XyloHero
Jacob Divone / Mechanical Engineering &
Mohiuddin Mohamad Ali / Civil and Environmental Engineering
Advisor(s): Susan Finger / Civil and Environmental Engineering
Connan / 12:30-3:30pm

The XyloHero is designed to give children an appreciation for music through the concept of synesthesia. The XyloHero creates both aural and visual outputs from the child's tactile input to a xylophone. The XyloHero is a fully functional xylophone with two octaves. When a key is pressed, a colored light is activated that corresponds to that note in an octave. This augmented sensory response enables children to see and hear the concept of an octave because the same note in two different octaves sound different but illuminate a single light. Children will be able to play songs that are either provided with the XyloHero or create their own tunes. The visual response of colored lights when notes are played takes advantage of synesthesia and gives children an appreciation for music in a 'different light'.

SELF-DEFINED

Opaque Glass: Thermally Activated Materials vs. Smart Glass
Yordanis Diez / Electrical and Computer Engineering, Deborah Gruner / Self-defined, Morgan Heskett / Materials Science Engineering, Jennifer Williams / Materials Science Engineering
Advisor(s): Nicholas Jones / Materials Science Engineering &
Michael McHenry / Mechanical Engineering
Hoch Commons-2nd Floor, Rangos side / 3-5

Materials which can become clear or opaque simply by providing heat or by running a current through them have a wide variety of applications: in professional settings such as offices, public restrooms, or, more commonly, in households. Materials which have this property can be used as windows or transparent doors in multiple places around a house (for example, the restroom). Such panes would essentially eliminate the need for items

such as window blinds, shower curtains and other such coverings, meaning the application of such technology could ultimately prove to be cost effective to consumers. We hope to test the energy and cost efficiencies of different materials and eventually determine which specimen is the best choice to fulfill these applications around one's home.

UNDECIDED

ASME EarthSaver: Autonomous Recycling Sorter
Jaime Bourne / Mechanical Engineering, Collin Buchan / Mechanical Engineering, Katherine Coste / Mechanical Engineering, Megan Dority, Mechanical Engineering, Steven Ford, Mechanical Engineering, Szu-Chieh Lu / Mechanical Engineering. Prerak Patel / Electrical and Computer Engineering. Michael Saitta / Undecided, Daniel Shope / Mechanical Engineering, David Stonestrom / Mechanical Engineering & Christopher Tomaszewski / Mechanical Engineering
Advisor(s): Cecil Higgs / Mechanical Engineering
Hoch Commons-2nd Floor, WIndow side / 3-5

Recycling is a growing industry accounting for more than 1.5 million jobs and $100 billion in revenue. More than 600 million metric tons of material is processed globally every year. Green initiatives have raised public awareness of recycling and other earth-conscious practices. This expansion has resulted in a demand for efficient and cost-effective means of processing recyclable waste. Material sorting is a costly step in the recycling process. Improperly sorted items slow down the process, reducing the monetary margin of recycling. To this effect the researchers have developed a household scale material sorter. The system autonomously sorts commonly recyclable items by material.

Design and Implementation of an Optimized Method of Solar Panel Charge Control
David Brombert / Electrical and Computer Engineering
Austin Bucan / Electrical and Computer Engineering
Rahee Ghosh / Electrical and Computer Engineering
Christopher Palmer / Undecided
Robert Wedler / Electrical and Computer Engineering
Advisor(s): Susan Finger / Civil and Environmental Engineering
Hoch Commons-2nd Floor, Rangos side / 12-2:230

Placing individual panels in a solar array in parallel has several advantages over the traditional way of connecting panels in series. Motivation for placing panels in parallel stems from safety considerations; series configurations result in systems with hazardously high voltages. In addition, when solar panels are placed in series, any part of the array that is compromised will cause a significant drop in total output. To use solar panels in parallel, improvements to the standard charge controller must be made. A typical charge controller operates by matching the impedance of the entire solar array, but when the panels are placed in parallel, the converter cannot match the impedance of more than one set of panels at a time. This raises the need for a design with multiple smaller charge controllers for each set of panels so that they can be individually optimized. The proposed research involves using CAD software to design a charge controller. Once the operation of the standard charge controller has been verified by physical construction and testing, multiple charge controllers will be designed with added functionality that enable them to operate in parallel.

Toy Plane Launcher
Jer-Chir Chuang / Design, Fedor Kleshchev / Undecided &
Daniel Rapoport / Architecture
Advisor(s): Susan Finger / Civil and Environmental Engineering
Connan / 12:30-3:30pm

Our goal for this project is to engage children in learning about the basic principles of momentum and kinematics. In pursuit of this objective, we have created a miniature airplane launcher consisting of a plywood base, PVC pipes, and foam plane bodies with interchangeable laser-cut balsa wood wing, tail and nose pieces. The launcher consists of a platform with an attached pair of strings. As the child pulls the strings apart, the platform slides forward until it hits a stopper, launching the plane forward. With this toy, the children will learn about aerodynamics through experimentation with the different interchangeable components of the toy planes and then launching them in competition against an opponent, with the ultimate goal of finding the best combination of wing, tail and nose pieces that allow the toy planes to travel the farthest and the fastest.

COLLEGE OF FINE ARTS

ARCHITECTURE

Advancing the Vertical Garden
Jared Friedman / Architecture
Advisor(s): John Folan / Architecture
Hoch Commons-2nd Floor, WIndow side / 12-2:30

With an increasing amount of the world's population moving towards urban areas, along with an increasing desire to grow ones own food, vertical gardening strategies have become a recent trend in cities across the world. While the idea of maintaining a vertical garden is appealing, the costs and aesthetics of many of the existing systems lack the same appeal. Through research and prototyping this project demonstrates how to utilize state-of-the-art technologies to create a vertical gardening system that is efficient, cost-effective, has the ability to be mass-produced, and isn't an eye-sore. Utilizing 7-axis robotic fabrication processes, molds are milled and then cast to create self-supporting, stackable concrete planters. The resulting aesthetic and texture of the planters when stacked is a direct result of the unique process and efficiencies designed into the system. Through the construction of a small portion of the wall, supplemented by research and depictions of large-scale implementation, the project will provide sufficient evidence of the advantages this system possesses over existing ones. The project will also prove how 7-axis robotic fabrication methods, typically restrained to the automobile industry, could be utilized for architectural and aesthetic purposes.

Digitally Fabricated Glass: Small-Scale Manufacture for a Craft-Based Technique
Jaclyn Paceley / Architecture
Advisor(s): Peter Ali / Architecture
Dowd / 12:40

Small-scale manufacture through digital design and production is becoming increasingly predominant within the realm of fine arts. Three-dimensional computer-based modeling has become the primary design tool of students and working professionals in a variety of disciplines, and as a result, new technologies to facilitate the translation of these designs from digitally represented objects to physical forms have developed. In contrast, glass

casting is a craft-based technique which relies on traditional processes to produce the resulting forms. The introduction of digital fabrication technology in the production of cast glass forms has the ability to modify a traditional handicraft to better fit the digital realities of current design technology.

Grey Water - Water Recycling and Recapturing Heat
Issac Kwon / Architecture, Celia Ludwinski / Chemical Engineering, &
Rebecca Willmott / Electrical & Computer Engineering
Advisor(s): James Schneider / Chemical Engineering
Hoch Commons-2nd Floor, Window side / 12-2:30

Gray water purification is used to take water from the shower, sink, dishwasher and washing machine and making it usable as toilet water or for watering plants. Standard gray water purification systems force gray water to flow through a sand filtration system, and then a simple plant filtration system before being re-used. On the other hand, commercial water treatment plants use a process called bioremediation to decompose the organic compounds in waste water, leaving the water more cleanly than had it been passed through a simple sand based filter. Bioremediation creates a by-product of heat, which can be harnessed to produce radiant heating, or to heat purified water. This, in turn, can help reduce the energy consumption of a household.

Public Parking
Zach Cohen / Architecture & Stephanie Newcomb / Architecture
Advisor(s): Jeremy Ficca / Architecture
Kirr Commons-1st Floor, Window side / 12-2:30

Throughout history, the prototypical American city has become increasingly reliant on the automobile as the foundation for its culture and urban development. Today, large parts of urban plans are sectioned off so that cars, not people, may dwell and have space to roam. Our reliance on the automobile and growing A car culture reflects our dependence on technology and our further devastation of both the natural and built environments. Furthermore, this phenomenon has resulted in a shifting role of the architect, who is being made to accommodate the increasing prevalence of technology more than the people that use it. We hope to address these cultural and artistic issues by turning locally to the presence of a car culture in Pittsburgh, in particular, how architecture is being used as a guise for the takeover of urban culture by the automobile.

Sling Shot Safety Car
Joshua Johnson / Architecture, Sarah Stroup / Mechanical Engineering & Cecily Sunday / Mechanical Engineering
Advisor(s): Susan Finger / Civil and Environmental Engineering
Connan / 12:30-3:30pm

The Sling Shot Safety Car is designed to help children learn about the principle of energy conservation. In playing with this toy, the child first secures a Pringle potato chip inside a car by using various materials such as shredded paper, cotton balls, or packing peanuts. The child then places the car inside a sling-shot frame and releases it into a wall. After the collision, the child can check and see if his chip is still intact. This process can be performed multiple times until the child succeeds in securing the chip. The Sling Shot Safety Car is designed for children ages 7 and older and is safe enough for younger children to play with under adult supervision. The toy car is constructed out of laser-cut acrylic plastic while the sling shot frame is made out of wood and rubber bands. A critical attribute of this toy is the variability of the system. In addition to securing the Pringle with packing materials, children find that they can also protect the chip by moving the sling shot frame different distances from the wall or by applying alternative forces to the sling shot. This activity allows children to explore the topic of momentum conservation by encouraging them to experiment with the relationship between stopping distance and collision force.

The Magnetic Ink Sketch Pad
Kevin Chung / Mechanical Engineering, Elisha Clayton / Mechanical Engineering & Michael Lynes / Mechanical Engineering
Advisor(s): Susan Finger / Civil and Environmental Engineering
Connan / 12:30-3:30pm

The Magnetic Ink Sketch Pad is a sketch board that lets children draw and write with magnets and ferromagnetic fluids. Children can learn about magnetism and fluid mechanics through experimentation, games, and interaction with the Magnetic Ink Sketch Pad. The device is a water-tight drawing board with a ferromagnetic fluid reservoir at the base. With the aid of powerful magnets, the ferromagnetic fluid can climb up and across the board from the reservoir as a result of the magnetic properties of the fluid and the magnets. When paper is inserted into the Magnetic Ink Sketch Pad, the ferromagnetic fluid leaves ink marks as it crosses the papers surface. Children control the magnets to manipulate the ferromagnetic fluid. Different types of magnets with varying strengths and sizes are available so the children can test and analyze how

different magnets produce different reactions from the ferromagnetic fluid. The Magnetic Ink Sketch Pad allows children to move beyond pen and paper and to draw or write in an innovative manner. Different card stock templates can be inserted in order to offer a multitude of classic, competitive, and entertaining games, such as mazes, Mad Libs, and Tic Tac Toe.

Toy Plane Launcher
Jer-Chir Chuang / Design, Fedor Kleshchev / Undecided & Daniel Rapoport / Architecture
Advisor(s): Susan Finger / Civil and Environmental Engineering
Connan / 12:30-3:30pm

Our goal for this project is to engage children in learning about the basic principles of momentum and kinematics. In pursuit of this objective, we have created a miniature airplane launcher consisting of a plywood base, PVC pipes, and foam plane bodies with interchangeable laser-cut balsa wood wing, tail and nose pieces. The launcher consists of a platform with an attached pair of strings. As the child pulls the strings apart, the platform slides forward until it hits a stopper, launching the plane forward. With this toy, the children will learn about aerodynamics through experimentation with the different interchangeable components of the toy planes and then launching them in competition against an opponent, with the ultimate goal of finding the best combination of wing, tail and nose pieces that allow the toy planes to travel the farthest and the fastest.

Unhealthy For Sensitive People: Meeting of the Minds
Adam Aviles / Architecture, Douglas Farrell / Architecture, Ellen Garrett / Architecture & Kaitlin Miciunas / Architecture
Advisor(s): Dee Briggs / Architecture
Kirr Commons-1st Floor, Window side / 3-5

The experimental installation project, Unhealthy for Sensitive People, proposes to aid the efforts of Braddock, Pennsylvania in its attempts to revitalize the neighborhood through art-related activity. These efforts intend to transform a city that has lost nearly 90% of its population and a large majority of its commercial and economic support by re-establishing a cultural and historical backbone. This includes Andrew Carnegie's first steel mill and public library, both of which remain standing today. The importance Braddock has on Pittsburgh's evolution as a post-industrial city has been overlooked. Mayor John Fetterman and Deputy Mayor Jeb Feldman use this historical context to reestablish pride in Braddock. Braddock's alarming abundance of vacancies has shown to be an ironically attractive characteristic to local artists. Along with an immediate attention to building renovation, artists are being invited to perform and display work that attracts those outside the

physical and cultural boundaries of Braddock by celebrating the city's derelict aesthetic. Collaboration between young building owners and artists to create experimental artwork sparks excitement in the community. Unhealthy for Sensitive People will, both in its conceptual and physical nature, play a significant role in establishing a framework within which the community has potential to evolve.

ART

Growing Downspout
Elise Walton / Art
Advisor(s): Bob Bingham / Art
Hoch Commons-2nd Floor, WIndow side / 3-5

Installed on a community center in Wilkinsburg, PA, my design project aims to find environmentally sound, inexpensive, and aesthetically pleasing ways to collect and use rainwater. The larger goals are to help raise the awareness of residents in Wilkinsburg regarding serious erosion in their community from flooding caused by poor infrastructure design. The installation offers ways that residents can combat the problems by utilizing rainwater. The system that I have designed channels water across the house, down a rain chain, and into window boxes with chambers to store water and hydrate the plants. In addition to showing many different ways rainwater can be rerouted and retained the installation is easy for others to make. Part of the goal for this project is to introduce local residents to sustainable living techniques. The project findings will be presented at the Hamnett Homestead Sustainable Living Center. A pamphlet demonstrating how to make different components of the installation will be published. Finally, workshops teaching people how to make rain chains will be conducted.

Mr. Sheep- A Short Film
Ryan Woodring / Art
Advisor(s): Lowry Burgess / Art
McConomy Auditorium / 11:45-12:15

Since summer 2008, when I spent two months working for my keep on a French sheep farm, I have developed and refined three fictional characters in my head: John, Brigit, and Gaston. I spent my fourth year as a Carnegie Mellon Fine Arts and French student writing a script titled Mr. Sheep in an attempt to export my memories of living on a sheep-cheese

farm to a format that appeals to human empathy. I used the money I received from a spring SURG award to build all of my sets and the time and money from my SURF to finish filming, animating and editing the 15 minute-long short film that will now be premiering as part of my fifth-year scholar project: The Faces of Globalization Student International Student Film Festival. The film can been seen in its entirety at ryanwoodring.com.

The Waffle Shop: A Reality Talk Show
Terry Boyd / Art
Advisor(s): Jon Rubin / Art
Kirr Commons-1st Floor, Window side / 3-5

Waffle Shop investigates the interface between reality, entertainment, and mass media. Focusing on the typical, Waffle Shop is transforming the everyday public space of a traditional waffle shop while also continuing the advancement of arts in the developing arts community of East Liberty. The Waffle Shop focuses on performance and popular culture, bringing in a diverse community for a brief flirtation with fame. More importantly, it provides a forum for individuals to share their opinions on local and personal issues. The Waffle Shop strives to stimulate meaningful questions for community growth, while also portraying the mundane as high art. Most significantly, artists will draw attention to the victories and defeats of everyday life, while forcing the audience to question the norms of both reality and art in Pittsburgh.

Understanding the Male Body
Andrea Meythaler / Art
Advisor(s): Andrew Johnson / Art
Peter / 12:00

Seminar on the Male Reproductive Anatomy

Unwanted Love Junk
Audra Wist / Art
Advisor(s): Bob Bingham / Art
Wright / 12-2:30

Using ideologies of fear and failure to combat themselves, I would like to examine the relationship between our self, our shadow self, and consumerism using alternative therapy in the form of excess. A space is revealed that intends to overload the senses and manipulate objects and their value to better define the self through 'unwanted love junk.' Paradoxes such as good versus evil, treasure versus trash, and logical versus illogical, among others make confusion and conclusion, negative and positive, one in the same.

Vivan las Fallas
Elizabeth Solomon / Art
Advisor(s): Andrew Johnson / Art
Wright / 3-5

While studying Spanish Language and Literature at the University of Valencia next spring, I propose to create and publish a graphic novel in response to las Fallas - a yearly festival that takes place in Valencia in which satirical figures are displayed for 5 days, and then cremated. As an Art and Hispanic Studies student, I am interested in the intersection of art and culture which las Fallas exemplifies. In the project, I aim to encapsulate the unique duality of Spanish culture, both its traditions and modernity, and to draw connections between sociopolitical regionalism Spain and in the United States. My artistic goal is to increase the lifespan of the characters presented in las Fallas and to add permanence to their messages.

WARWORN
Natalia Olbinski / Design & Robin Scheines / Art
Advisor(s): Andrew Johnson / Art
Wright / 12-2:30

It is undeniable as students and young adults that we are becoming more aware of global affairs everyday. Through the media we are alerted to current cultural conflicts that we are unable to ignore. In order to reconcile with these conflicts we propose to create a clothing line as a means to mediate between feuding groups through research of cultural clashes and identities. Clothing is a universal human need, and it holds significant meaning in ethnic traditions. Each culture has its own unique aesthetic histories. We aim to research these traditions in great detail to understand the importance of specific symbols and practices. With this information we will pull elements from each culture and fuse them with their rival culture into one overall costume; through this fusion we will achieve a symbiosis of the warring groups. For example, we plan to create garments using traditional American elements combined with Middle Eastern elements to symbolize the ongoing conflict between the west and the Middle East. The end products will serve as a mediation of the conflicts, promoting a discussion between opposing groups, as well as promoting an understanding of each others' cultures. We will exhibit the garments in various venues, and discuss them with members of those different cultures to gain insight. The shows and exhibitions will be accompanied with print materials including a booklet and a pamphlet informing the audience of our concept and details about the history of these disputes, shedding light on complex, and sometimes widely unknown issues.

DESIGN

Growing Downspout
Elise Walton / Art
Advisor(s): Bob Bingham / Art
Hoch Commons-2nd Floor, WIndow side / 3-5

Installed on a community center in Wilkinsburg, PA, my design project aims to find environmentally sound, inexpensive, and aesthetically pleasing ways to collect and use rainwater. The larger goals are to help raise the awareness of residents in Wilkinsburg regarding serious erosion in their community from flooding caused by poor infrastructure design. The installation offers ways that residents can combat the problems by utilizing rainwater. The system that I have designed channels water across the house, down a rain chain, and into window boxes with chambers to store water and hydrate the plants. In addition to showing many different ways rainwater can be rerouted and retained the installation is easy for others to make. Part of the goal for this project is to introduce local residents to sustainable living techniques. The project findings will be presented at the Hamnett Homestead Sustainable Living Center. A pamphlet demonstrating how to make different components of the installation will be published. Finally, workshops teaching people how to make rain chains will be conducted.

Battle Curling
Tammy Dvir / Mechanical Engineering, Kin Hang Leung / Mechanical Engineering & Brian Mizrahi / Design
Advisor(s): Susan Finger / Civil and Environmental Engineering
Connon / 12:30-3:30pm

The goal of the Battle Curling game is to teach children general laws of energy ranging from the idea of stored energy in a spring, to angular momentum and conservation of energy in collisions, to general laws of energy conservation. The game is played on a board with a player at each end. Each has a disc and a shooting mechanism, which is a spring in a box that can both rotate and move across the board. Each player chooses the position of the shooter and how far to compress the spring. The goal is to get as close to the center target as possible, while keeping your opponent out of the target. By playing

the game, children will learn principles of physics. Their curiosity may lead them to stretch the spring too far, or see what happens when the disc is aimed at one of the walls of the board.

Circuit City
Asa Berg / Mechanical Engineering, Charles Doomany / Design &
John Ni / Mechanical Engineering
Advisor(s): Susan Finger / Civil and Environmental Engineering
Connon / 12:30-3:30pm

Circuit City is an interactive game for children that teaches about circuits and electricity, while promoting collaboration and problem solving skills. Circuit City is a board game that is wired to allow connections between various electronic components, such as lights, motors and batteries. Using these components, which are on individual pieces, children will solve puzzles and explore many basic principles of electricity, including circuits and how to power multiple objects. The puzzles can be solved individually or in teams and will have varying levels of difficulty. The playing board and pieces will all be themed around a city, with the playing pieces designed to look like many different buildings. This game is a safe and fun way to teach about electricity.

Multi-Space perspectives
Luther Young III / Design
Advisor(s): Pablo Garcia / Architecture
Wright / 12-2:30

Through drawings, animations and diagrams I examined the ability to see multiple perspectives at the same time. These exercises were conducted to manipulate the ways in which people see space and construct these visual elements into one cohesive image.

Price per Bite
Lauren Von Dehsen / Design
Advisor(s): Stacie Rohrbach / Design
Wright, 3-5

Food is not typically priced by its natural unit: one piece. As consumers we price items by the ounce, gallon, pound, etc. However, these are not necessarily meaningful measurements. People do not typically eat in terms of ounces or gallons; they eat in terms of items. Therefore, it seems odd that we purchase our food based on these measurements when theoretically we should buy items based on units of consumption.

This project is aimed at identifying that discrepancy and presenting information in graphical form that can more accurately communicate and advise the customer on the value of their purchase. To do this, I have specifically collected and analyzed information regarding M&M's.

Tangible Audio Enhancement System
Charles Doomany / Design & Lukas Kambic / Design
Advisor(s): Mark Gross / Architecture
Wright / 12-2:30

We are demonstrating a speculative product concept that brings music visualization into the tangible realm. It consists of a modular system of sound-responsive objects that deform and change their quality of illumination according to ambient input.

The Super Spinner
Mukul Bhatt / Mechanical Engineering,
Zari Salimnejad / Design &
Won Shim / Mechanical Engineering
Advisor(s): Susan Finger / Civil and Environmental Engineering
Connan / 12:30-3:30pm

The goal of the Super Spinner is to engage children's curiosity about pulleys and centripetal force through a game that allows them to freely explore variations in both concepts. There is a board on which children can arrange different pulley systems which attach to a centrifuge at the end of the board. The centrifuge is ringed with different colored lines, and a colored liquid fills the base of the centrifuge. The children need to arrange the pulleys in a way that allows them to spin the centrifuge fast enough to raise the liquid to a specific height. Children play with this toy through a process of free manipulation of parts and pieces. They learn by experimenting with these parts and pieces to acquire different results in the speed of the centrifuge and water level.

Toy Plane Launcher
Jer-Chir Chuang / Design, Fedor Kleshchev / Undecided &
Daniel Rapoport / Architecture
Advisor(s): Susan Finger / Civil and Environmental Engineering
Connan / 12:30-3:30pm

Our goal for this project is to engage children in learning about the basic principles of momentum and kinematics. In pursuit of this objective, we have created a miniature airplane launcher consisting of a plywood base, PVC pipes, and foam plane bodies with interchangeable laser-cut balsa wood wing, tail and nose pieces. The launcher consists of

a platform with an attached pair of strings. As the child pulls the strings apart, the platform slides forward until it hits a stopper, launching the plane forward. With this toy, the children will learn about aerodynamics through experimentation with the different interchangeable components of the toy planes and then launching them in competition against an opponent, with the ultimate goal of finding the best combination of wing, tail and nose pieces that allow the toy planes to travel the farthest and the fastest.

Utility Field System
Lauren Beckwith / Design, Daniel Chow / Design & Kaeo Helder / Design
Advisor(s): Mark Baskinger / Design
Wright / 12-2:30

The primary objective of this project is to research and produce a working prototype of a utility field vest system specifically tailored for use by Entomologists (scientists studying insects). We are designing the system to give Entomologists faster access to necessary equipment as well as options for the arrangement of that equipment, and protected storage of samples in order to increase their efficiency and safety in the field.

WARWORN
Natalia Olbinski / Design & Robin Scheines / Art
Advisor(s): Andrew Johnson / Art
Wright / 12-2:30

It is undeniable as students and young adults that we are becoming more aware of global affairs everyday. Through the media we are alerted to current cultural conflicts that we are unable to ignore. In order to reconcile with these conflicts we propose to create a clothing line as a means to mediate between feuding groups through research of cultural clashes and identities. Clothing is a universal human need, and it holds significant meaning in ethnic traditions. Each culture has its own unique aesthetic histories. We aim to research these traditions in great detail to understand the importance of specific symbols and practices. With this information we will pull elements from each culture and fuse them with their rival culture into one overall costume; through this fusion we will achieve a symbiosis of the warring groups. For example, we plan to create garments using traditional American elements combined with Middle Eastern elements to symbolize the ongoing conflict between the west and the Middle East. The end products will serve as a mediation of the conflicts, promoting a discussion between opposing groups, as well as promoting an understanding of each others' cultures. We will exhibit the garments in various venues, and discuss them with members of those different cultures to gain insight. The shows and exhibitions will be accompanied with print materials including a booklet and a pamphlet

informing the audience of our concept and details about the history of these disputes, shedding light on complex, and sometimes widely unknown issues.

DRAMA

Collective Thresholds: A Social Sculpture
Molly McCurdy / Drama
Advisor(s): Michael Chemers / Art
McConomy Auditorium / 12:15-1:00

Collective Thresholds is guerilla theatre troupe that uses interactive performance and installation to bled the lines between myth and reality. Unsuspecting spectators are invited to participate in in mystical and outlandish rituals, ceremonies and games that challenge their faculties of criticism and judgment'. Ultimately, these social sculptures capitalize upon the importance of communication, civil interaction, the possibilities of creativity and the contingency of reality. The work stimulates a larger dialogue on the nature of performance and the role of culture and mythology in society, which is to increase an understanding and sensitivity as citizens.

PigPen - 2010
Arya Arabshahi / Drama, Alexander Falberg / Drama, Benjamin Ferguson / Drama & Ryan Melia / Drama
Advisor(s): Barbara Mackenzie-Wood / Drama
McConomy Auditorium / 1:00-1:45

A description of the work which went into creating PigPen's new show for the Playground Festival of new works.

Steel Dove: Stories of Art and Occupation
Alborz Ghandehari / Drama
Advisor(s): Jock Windley / Drama
McConomy Auditorium / 11:00-11:45

A meditation on what it means to make art in the context of military occupation and ongoing political strife, Steel Dove: Stories of Art and Occupation follows fleeting moments in the lives of a handful of Palestinian artists living in the occupied West Bank. A sculptor whose materials are bullets and tear gas bombs fired into his village, a theater troupe who expresses anguish and confusion through movement, and a filmmaker surrounded by the teeming landscape of a refugee camp, these people speak to us about their passion in

terms of exile, struggle, and solidarity as they imagine the future with their artwork. They introduce us briefly to their communities who collectively assert their voices everyday to overcome the impasse that continues to hamper their livelihoods and threaten their dignity. They grapple with what Palestine means to their artwork, and what their artwork means to Palestine; what their work means for the occupation and why the experience of occupation is inextricable from their work. If their thoughts can be materialized through the deft strokes of their paintbrushes, can they also be heard? These small stories forge a fragmented mosaic of daily life in the occupied territories.

Tesla's Tiles
harles Ammerman / Drama,
James Mesmer / Mechanical Engineering &
David Murray / Mechanical Engineering
Advisor(s): Susan Finger / Civil and Environmental Engineering
Connan / 12:30-3:30pm

The goal of Tesla's Tiles is to engage younger students in learning the concepts of electricity and the completion of an electrical circuit. The game is a competition betweentwo students attempting to complete a circuit. The components of the game include a power source, playing board, numerous Tesla's Tiles and two indicator lights. The power source is a battery assembly to provide an electrical current to the indicator lights when the circuit is completed. Each student will earn Tesla's Tiles and have the opportunity to place these tiles in any arrangement they see fit to best achieve their goal of lighting their indicator light first. Students will learn the basic properties of completing a circuit by connecting the wire segments via the blocks and observing the fact that current will flow in any direction as long as a strong conductor is present. Varying shapes of the blocks will allow the students to use their active reasoning skills to make the most direct route to their indicator light. The game is over when the first student completes his or her circuit and their indicator light comes on.

Waterworld
Paul Kimball Jr. / Mechanical Engineering,
Eric Totong / Mechanical Engineering & Ethan Weil / Drama
Advisor(s): Susan Finger / Civil and Environmental Engineering
Connan / 12:30-3:30

The goal of the Water Sandbox is to actively engage children in learning about hydrodynamics and streamlines. The toy is designed to be like a sandbox, except with water instead of sand. It consists of a water table with a recirculating pump and include

blocks, boats, sails, fans, and bridges to allow the children to explore different arrangements and to learn about fluid flow and streams. Children are free to explore and tinker with the materials in the Water Sandbox in order to discover and learn on their own while also providing them with an immediate source of enjoyment.

CROSS-COLLEGE

BCSA

AI Brushes: Applying flocking and goal seeking behavior to digital paintbrushes
Xiaoyuan Jiang / BCSA
Advisor(s): Andrew Johnson / Art
Wright / 12-2:30

This is a digital art program that applies a Boid-like flocking algorithm to the paintbrushes. It uses a Boid-like flocking algorithm to simulate the behavior of a swarm of flying insects. Each individual AI within the swam has its own unique behavior based on following the cursor and random wandering from the swarm. The program applies this behavior to several digital paint brushes. The AI movement behavior and size, color, and opacity of each brush can be customized individually or collectively. When the user paints, the lines drawn are actually the trails left behind by the swarming AIs, creating an effect that is not possible to create by hand.

BHA

Deliberative Theater
Shannon Deep / BHA
Advisor(s): Robert Cavalier / Philosophy
Hoch Commons-2nd Floor, Window side / 12-2:30

My Senior Capstone Project combines Deliberative Democracy and theatrical performance. Deliberative Democracy highlights the need for open and informed discussion of issues and one model of deliberative democracy uses a polling method in policy discussions that is more accurate and in depth than traditional phone polls, and unlike these traditional phone polls, actively engages participants by educating them on the issue at hand and encouraging deliberation, critical thinking, and discussion. In regular "deliberative polls" (developed by James Fishkin), participants are given a source

document with unbiased information about the topic intended for discussion. In Deliberative Theater, this source document is replaced by a short performance, and the rest of the poll is conducted the same. My project will develop a script for one such Deliberative Theater event on the topic of the controversial pornographic films that the Activities Board shows each semester on campus. By approaching the multifaceted issue of pornography in a dramatic context, the script seeks to present multiple, accessible viewpoints and to act as a catalyst for discussion.

Development of Children as Musical Beings: the benefits of Eurhythmics music education
Hyun Jeong (Helen) Kim / BHA
Advisor(s): Annabelle Joseph / Music
Pake / 2:00

Children learn music in a unique and different way in Eurhythmics classes. Instead of using sheet music or an instrument, they use their own bodies and senses. During this semester, I observed and recorded music learning of children in Eurhythmics classes. I noticed how Eurhythmics developed in children a sensitivity and the ability to analyze, to perceive, and to appreciate music. In my final presentation, I will show a series of video clips that demonstrate children's learning as they begin to listen and recognize internal beats, natural weight, phrases, and musical flow.

Dreams of Architecture: an exploration of understanding space and consciousness through dreams
Katherine Chin / BHA, Martin Prekop / Art
Advisor(s): Franco Sciannameo / BHA
Wright / 12-2:30

We have intimate relationships with our surrounding environment. In our dreams, our unconscious selves can express desires and fears that we disguise in our conscious lives. I will use the practice of lucid dreaming to explore the spaces and buildings that are depicted in my dreams to find deeper and hidden connections to my own self. These spaces and emotions will then be depicted in a series of pinhole photographs.

EarthArk to the Moon
Carolina Ramos / BHA
Advisor(s): Lowry Burgess / Art
Wright / 3-5

The "Tranquility Trek" team from Astrobotic Technology and Carnegie Mellon University are launching a rover to compete for the Google Lunar X Prize. The College of Fine Arts and The Center for Creative Inquiry have joined forces with this historic robotic expedition by developing an array of projects to reflect and expose the artistic, cultural and scientific

collaborative potentials available within this endeavor. These projects represent the first pieces of art on the moon not associated with any specifically sanctioned theme. Our team will be constructing a micron scale sculpture to transport water, DNA and carbon to the moon. Essentially, we are sending a map of life found on Earth. DNA sampling will be taken to capture the diversity and co-evolution of Earth's life forms. It will be placed along with the carbon and water samples from Earth's different physical extremes as well as the mouths of the world's 18 largest rivers. Carbon is fundamental for all life on this planet; hence that is why we use the term carbon based life. Therefore it is also indispensable to send it along with the water and DNA. Using micron scale fabrication techniques our team is building a micro fluidic vessel with single-crystal silicon. T Once completed, Earth Ark To The Moon does not contain the impressions of the members of this group but that of the entire planet. With water from all parts of the globe, carbon and diverse DNA sampling, it is a truly inclusive planetary project. We feel that this micro sculpture will integrate the expedition past the boundaries of a single people, species or culture.

Mathematical Strategy and Estimation in Individuals with High Functioning Autism
Sara Haas / BHA
Advisor(s): Robert Siegler / Pshychology
Dowd / 3:20

Sara Haas, a senior psychology major, is working with Dr. Robert Siegler to observe the differences in math learning and problem solving among typically developing children and children with autism. Efficient strategy selection is not only important when learning math, but it is also an essential skill for all types of problem solving. We are hoping that this research will serve as a basis for enhancing mathematical curriculums and help individuals with autism better develop proper mathematical strategy utilization. During the session, the child will be presented with simple addition and subtraction problems to complete. The researcher will ask the child how he or she solved the problems. Additionally, each child will be shown number lines, and asked to estimate where a particulate number falls on the number line. This study will help us learn more about how children with autism differ from typically developing children, so that further studies can be conducted with the aim of improving mathematical curriculums.

Music and Emotion
Tina Li / BHA
Advisor(s): Natalie Ozeas / Music
Hoch Commons-2nd Floor, Rangos side / 12-2:30

This project examines different ways in which people relate emotions to music. Through this study of the relationship of music and emotion, I hope to discover some correlations between them. The investigation of past research can lead us to develop practical applications for this relationship.

On Several Obsolete Notions in the Theater
Graham Swindoll / BHA
Advisor(s): Gregory Lehane / Drama
McConomy Auditorium / 1:45-2:00

The largest danger in the contemporary theater is its own obsolescence. The art form has become largely stagnant and has been slowly eclipsed as a popular form, greatly due to an insistence on clinging to old aesthetic values that result in celebrations of repetition. Taking influence from Alain Robbe-Grillet, Witkacy and Richard Foreman I have created a sequences of essays, texts, videos and performances that attempted to identify and isolate the most significant notions and values that have lead to this obsolete state, as well as propose possibilities for movement past them.

Summer Theater Collective: "The Conqueror Worm"
Graham Swindoll / BHA
Advisor(s): Gregory Lehane / Drama
McConomy Auditorium /2:00-2:15

Over the course of the summer of 2009, 11 Carnegie Mellon drama students formed together into a theatrical collective to conceive, rehearse and present a work generated through extensive rehearsal and improvisational techniques. The result was an experimental adaptation of a series of tales and poems by Edgar Allan Poe entitled "The Conqueror Worm" which utilized text, light, music, movement and an abandoned church. In this presentation, Director/Lighting Designer/Collective Organizer Graham Swindoll will outline the aesthetic motivations, techniques utilized and final results, as well as the place of collective and independent work in theater education.

Velcro Building Blocks
Sarah Habib / BHA, Tristram Hogben / Mechanical Engineering &
James Hulley / Mechanical Engineering
Advisor(s): Susan Finger / Civil and Environmental Engineering
Connan / 1230-330

Velcro Building Blocks, which are foam blocks covered in Velcro, are a variation on traditional building blocks. The Velcro adds another dimension to build in, that is,

outwards. The blocks are available in an array of sizes and shapes enabling the children to make many typical and atypical structures and designs. Allowing children to "fasten" the blocks together will open a new realm of building possibilities that will encompass both standard towers and abstract structures. The soft and light material of the blocks and easy fastening mechanism also allows toddlers, whose fine motor skills aren't fully developed, to explore building blocks in a new way.

BSA

Desire
Ana Kim / BHA
Advisor(s): Susanne Slavik / Art
Wright / 3-5

The human body has been the subject of artistic inquiries since the dawn of human history. Drawing and painting the human body allows artists to understand its structure and surface and to interpret it as a vessel and actor of human experience and desire. Such interpretations result from the artist's own bias or perspective as well as what the viewer brings. I started exploring the grotesque, uncanny and the abstract potential of the human body. I emphasized such aspects by distorting the human form and our point of view. The distortion was not invented, but actual. While I was painting, I found a common thread among my paintings, which was: desire.

SELF-DEFINED

The Mighty Palm
Rebecca Scully / Self-defined
Advisor(s): James Duesing / Art
Wright / 3-5

A family animation that teaches one to be open minded and flexible through the use of a palm tree, an oak tree, and birds.

ECONOMICS

CMU students' perceptions of the distribution of the mandatory fees across non- academic resources
Joseph Burgess / Information Systems, Alexandra Lecompte / Economics, John Lee / Economics & Benjamin McGrath / Economics
Advisor(s): Brian Junker / Statistics
Wean Commons-1st Floor, Connan side / 3-5

Carnegie Mellon University has compulsory activities fees as part of its tuition. However, the student's participation in deciding how to spend the funds is limited by institutional constraints. This research study will analyze CMU student's awareness and perceptions of how funds are distributed for non-academic resources. Moreover, the survey will evaluate to what degree CMU students might want to participate in the decision-making process. In order to make inferences about our target population most accurately, we will use the complete list of names of undergraduate students from the most recent copy of the student directory (C-Book) as our sampling frame. We will draw an SRS without replacement from this frame to form our sample.

CMU Undergraduate Satisfaction with UC Athletic Facilities
Siddhartha Gupta / Economics, Christopher Lee / Statistics, Jung Yub Lee / Business Administration, Sonam Rajpal / Economics & Swetha Reddy / Business Administration
Advisor(s): Brian Junker / Statistics
Kirr Commons-1st Floor, Window side / 3-5

Through this study, we hope to find out how CMU undergraduate students feel about the UC athletic facilities. Through their responses, we feel that they can be used to improve all aspects of the facilities. We selected our participants through a random selection of the CMU C-Book and sent out an online survey through a website called QuestionPro.com. We reached out to 1,320 undergraduate students, accounting for a 25% nonresponse rate. With these numbers, we hope to receive feedback from at least 341 students. We will then analyze our results in an attempt to improve our campus facilities.

Do Zoning Ordinances Effect the Distribution of Housing?
Engin Altinoglu / Economics
Advisor(s): Dennis Epple / Economics
Class of '87 / 12:00

In his 1975 paper in Urban Affairs, Bruce Hamilton wrote about how his extension of the Tiebout model of housing predicts the institution of zoning ordinances effect the distribution of housing. However, not much is known about how well Hamilton's predictions explain real world data. It is often assumed that the implementation zoning ordinances has the desired effect of producing individual communities characterized by a range of lot sizes, but few empirical studies have been conducted examining if this is true, or if an effect of their implementation on the distribution of housing really exists. This study examines data collected from Arizona's Maricopa County to see if the implementation of minimum lot size zoning in ten of its largest municipalities has an effect on the distribution of housing, and if so, the nature of the effect. Using the Hamilton's paper as a guide, the researcher's hypothesis is that the zoning restrictions have a significant effect on the distribution of housing, resulting in bunching of housing near the minimum lot sizes within each municipality and a high ratio of variance across municipalities to variance within municipalities. The data included information about all lots in each municipality including lot size, property type, municipality to which it belongs, and property value. The results were somewhat mixed, but overall, the analysis suggests that the zoning restrictions have little, if any, effect on the distribution of housing. To summarize the important results, we do not see bunching of housing near the minimum lot size values in each municipality. The method of decomposition of variance indicated that, for certain regressions, the variance across municipalities is much smaller than that within municipalities. In conclusion, there is not sufficient evidence to conclude that the implementation of minimum lot size zoning has any effect on the distribution of housing in Maricopa County.

Finding Nash Equilibria in Asymmetric Auctions with Resale: Numerical and Analytical Developments
Richard Katzwer / Economics
Advisor(s): Isa Hafalir / Economics
Pake / 12:00

This paper was written as a Tepper School of Business Senior Honors Thesis in Economics. The paper discusses new methods for solving for Nash equilibria bid-functions in several different types of related auctions: first-price auctions, first-price auctions with resale,

first-price auctions with reserve prices, first-price auctions with reserve prices and resale, and second-price auctions. Particular emphasis is placed on the new methods for solving auctions with a post-bidding resale stage. The first section details the game theory underlying the Nash equilibria in each auction type discussed. The next section compares and contrasts the author's auction solving software, AuctionSolver, with previous contributions. Specifically, discussion is given to the numerical methods employed in solving auctions with resale. The penultimate section discusses several numerical examples and results in support of several conjectures made by the author as well as Isa Hafalir and Vijay Krishna. Special attention is paid to revenue comparisons between differing auction mechanisms. The last section discusses future avenues of improvement for AuctionSolver. The theoretical motivation for the work here is primarily given by prior research on resale auctions by Dr. Hafalir and Dr. Vijay Krishna.

UN Millennium Development Education Goal: How Much Have India and China Achieved?
Aneesha Deshpande / Economics
Advisor(s): Carol Goldburg / Economics
Class of '87 / 1:20

Development economics is a field of economics that analyzes aspects of the development process such as poverty in low-income countries. The Millennium Development Goals (MDGs) are a major part of development economics. In 2000, the largest meeting of world leaders adopted the UN Millennium Declaration, essentially, a global partnership to reduce extreme poverty by 2015. This was an important step in providing aid to developing countries because it was the world's first time-bound and quantified targets for addressing extreme poverty. One of the most important aspects of a nation's development and its progress is education, both elementary and secondary. Education is vital to a country's development because of the fact that it both affects and is affected by a nation's economic and social growth. India and China are two major countries in the world whose contribution to achieving the MDGs is crucial for the international achievement of the goals. The fact that together, India and China, comprise close to two fifths of the world's population illustrates how important the developments, such as increases in economic growth, in these countries can be to the rest of the developing world. This paper examines the steps that India and China are taking to achieve the education goal by the 2015 deadline.

What's in Your Future? An Analysis of Post-Graduation Plans of Carnegie Mellon Undergraduate Class of 2010
Brianna Agyemang / Economics, Nia Austin / Psychology, Jaimie Lee / Statistics & Kristine McPherson / English
Advisor(s): Brian Junker / Statistics
Wean Commons-1st Floor, Connan side / 3-5

Not surprisingly the members of the graduating class of 2010 will begin some impressive careers after graduation. But what exactly do these graduates plan to do? And how did they decide? The post-graduation plans of seniors are important to study, because we can reveal trends in the direction(s) today's students are heading immediately following graduation, and how their major comes into play. Furthermore, by studying how seniors come to a conclusion about their plans, we can better understand who or what has the greatest influence on the decision making process. We used a questionnaire to analyze the plans of graduating seniors as well as the motives behind their decisions. The Career Center is a likely client for this survey, since they can use the findings to better tailor their programming and advising techniques.

ECONOMICS & STATISTICS

Modeling the Price Dynamics of Catastrophe Bonds
David Taylor / Engineering and Statistics
Advisor(s): Benoit Morel / Engineering and Public Policy
Peter, 1:00

This work modifies the assumptions of Burnecki, Kukla, and Taylor's paper "Pricing of Catastrophe Bonds" to build a pricing model for indemnity-based catastrophe bonds, allowing for the possibility of partial default.

Pizza Consumption and Preference of CMU Undergraduate Students
Stafford Brunk / Self-defined, Atishe Chordia / Mechanical Engineering, SeungJin Park / Economics and Statistics, Tony Poor / Computer Science & Henry Wu / Mathmatics
Advisor(s): Brian Junker / Statistics
Kirr Commons-1st Floor, Window side / 12-2:30

We are conducting a consumer survey of Carnegie Mellon students in order to learn about their pizza consumption behaviors. We have utilized a post-stratified random sample of 800 undergraduate students from the CMU directory, emailing them a Google Docs-powered survey (with the offer of an Amazon gift card raffle to increase the response rate). Our survey hopes to gain insight on the current consumption behaviors and motivations of CMU undergrads, including issues like when students generally want to order pizza, the impact of DineXtra or PlaidCa$h in their decisions, and what other characteristics (cost, quality, quantity, location, etc.) are most important to them. These results may be used by local businesses and Carnegie Mellon dining venues, improving both their business and marketing abilities as well as the satisfaction of CMU students.

Tax Returns & Charitable Contributions
Lindsey Reese / Economics and Statistics
Advisor(s): Roberto Weber / Social and Decision Sciences
Class of '87 / 12:40

Economists expect people to make rational decisions with respect to consumption, and that individuals will be solely interested in profit and utility maximization. Social norms have evolved within our society that lead people to behave "irrationally" from an economic perspective. One social norm is the practice of donating to charity. Most donations can lead to tax breaks, but economists would view a charitable donation as irrational since self-interest is lacking. Possible explanations as to why people still make donations are associated with an individual's utility function. The increase in utility could be the result of the individual feeling good for making the donation and participating in pro-social behavior, countering a fear of dissonance he/she may experience if a social norm is broken, or wanting people to notice their contribution. It is important to understand what factors lead individuals to donate more to charity. Throughout the last decade, attention has been drawn to the success of the new tax return form in the UK. This form has increased charitable donations by allowing for donations to be made directly from tax returns through their form. While a similar method exists in the US, it has not been nearly as successful. This Senior Honor Thesis will examine ways to increase donations by means of a tax refund.

ENGLISH

City of Bridges
Allison Seger / English
Advisor(s): Joseph Dicey / Design & Jane McCafferty / English
Dowd / 12:20

Presentation of senior thesis: a children's book about Pittsburgh. Written, illustrated published and now read, to you, here.

Death Of A Lover
Brian Burdulia / English
Advisor(s): James Daniels / English
Hoch Commons-2nd Floor, Window side / 12-2:30

A Novella.

Funny Looking Kids: An Autobiography of Growing Up with a Disabled Sister
Francesca Halleman / English
Advisor(s): Sharon Dilworth / English
Class of '87 / 2:00

A collection of essays about growing up with a disabled sister that discusses societal fears, peer pressure, and discovering true acceptance.

Journal of a 21 year old
Aliesha Jones / English
Hoch Commons-2nd Floor, Window side / 3-5

I travelled and recorded my time spent in India for four weeks, documenting how life is different for an American college student in a new culture. Here is what I learned.

Pilot and Teleplay Writing in Various Genres
Anthony Paletta / English
Advisor(s): Sharon Dilworth / English
Pake / 4:00

I have written 5 different pilots and two sequential television episodes with the hopes of creating a sustainable TV series. I have also kept a brief log of my writing process over the past year.

Sensational Women: Gender and Morality in Victorian Sensation Novels by Ellen Wood and Wilkie Collins
Amanda Cole / English
Advisor(s): Jon Klancher / English
Class of '87 / 4:00

Victorian sensation novels often focus on women as central characters, but their portrayals are not always positive. This paper explores both positive and negative portrayals of women and analyzes the reactions to the actions of women in two novels, The Woman in White and East Lynne. It analyzes the characters through the lens of domestic morality, which includes ideas of behavior suggested by Victorian conduct literature as well as an adherence to accepted gender roles. By examining the portrayals of women in these novels, we can begin to see how women and their changing roles in society were viewed in the 19th century. Ideas explored include women as wives and mothers, women's place in society and the household, and variations in accepted gender roles both within and outside of marriage.

The Making of Nytethorn
Daniel Archer / English
Advisor(s): Jane McCafferty / English
Pake / 4:20

"The Making of Nytethorn" will feature a reading of a selection from the project, the novel "Nytethorn", followed by an explanation of the creative process involved, and a Q&A with the attendees regarding the work and its creation.

The Portrayal of Juvenile Delinquents in Films (1988-1997)
Chris Franzi / English
Advisor(s): Steven Schlossman / History
Class of '87 / 4:20

The thesis explains the typical characteristics of the most successful (i.e., most money earned) juvenile delinquency films between 1988 and 1997.

The Rhetoric of the Financial Crisis: Examining 2007-2009 Federal Open Market Committee Statements
Robert Perrone / English
Advisor(s): Andreea Deciu Ritivoi / English
Class of '87 / 4:40

In the financial world, words move markets. Rhetoric played a significant role in the recent financial crisis, but communications from the crisis have received little attention in rhetorical scholarship.This paper examines 2007-2009 statements from the Federal Open Market Committee (FOMC), a powerful body within the Federal Reserve. Through a critical discourse analysis of the texts and a thorough consideration of historical context, a cogent explanation of the FOMC's rhetorical impact emerges. Since financial texts often produce immediate, quantifiable results in markets, this paper also attempts to motivate further research in financial rhetoric.

What's in Your Future? An Analysis of Post-Graduation Plans of Carnegie Mellon Undergraduate Class of 2010
Brianna Agyemang / Economics, Nia Austin / Psychology, Jaimie Lee / Statistics & Kristine McPherson / English
Advisor(s): Brian Junker / Statistics
Wean Commons-1st Floor, Connan side / 3-5

Not surprisingly the members of the graduating class of 2010 will begin some impressive careers after graduation. But what exactly do these graduates plan to do? And how did they decide? The post-graduation plans of seniors are important to study, because we can reveal trends in the direction(s) today's students are heading immediately following graduation, and how their major comes into play. Furthermore, by studying how seniors come to a conclusion about their plans, we can better understand who or what has the greatest influence on the decision making process. We used a questionnaire to analyze the plans of graduating seniors as well as the motives behind their decisions. The Career Center is a likely client for this survey, since they can use the findings to better tailor their programming and advising techniques.

Where the Homeless Make Love: A Collection of Poetry
Elliot Smith / English
Advisor(s): Yona Harvey / English
Class of '87 / 3:40

In 'Where the Homeless Make Love', a range of poems wonder and wander in various poetic forms through a unique and musical sort of sound architecture. This collection attempts to show the reader how to see the unthinkable, dream the invisible and think the undreamable. In this collection, generations past and present meet by chance and depart as everything and everyone eventually does, in this world or any other.

ETHICS, HISTORY & PUBLIC POLICY

Asian Americans: Creating an Identity and a Voice
Amy Chi / Ethics, History, and Public Policy
Advisor(s): Donald Sutton / History
Hoch Commons-2nd Floor, Window side / 12-2:30

We often assume that familiar terms such as "African American" or "Latin American" have always existed in our lexicon. But in reality, identity terms have a history behind their formation and application. Thus, the term "Asian American" appeared during the politically-charged '60s and '70s, a time when many organizations and movements in the United States sought justice and demanded equal rights. In seeking social change, Chinese, Japanese, Filipino, Korean and other ethnic groups from East Asia began to develop a sense of identity, describing themselves for the first time as "Asian Americans." In my presentation, I will use first-hand sources to explore the relationship between the appearance of this new identity and the struggles for equality and human rights.

Does it Work? The need for randomized evaluations in microfinance and the unobserved potentials of interest rate manipulation and group meetings.
Amy Chi / Ethics, History, and Public Policy
Francesco Coco / Ethics, History and Public Policy
Advisor(s): Jay Aronson / History
Dowd / 1:00

The reach of microfinance has exploded in the last decade as more and more people aim to help the global poor by giving them access to financial services. However, the data and the research on this topic, while copious, do not paint a clear picture of its effectiveness.

I will review the available data and research and show why it is important that random evaluations of microfinance be implemented to a much greater degree.

HISTORY

Flight 93 Memorial: Memory to Monument
Laura Thoren / History
Advisor(s): Scott Sandage / History
Pake / 12:20

As human beings, and citizens of the United States, we often turn to monuments and memorials as physical places to remember past events and people. With each passing generation, however, many of these plaques and statues become invisible to the passerby. "Flight 93: Memory to Monument" focuses upon the evolution of memorials and how this development reflects society's views on existence. Through research and interviews with the Flight 93 Memorial architect Paul Murdoch, American documentary filmmaker Ken Burns, and other benefactors of monuments on The Mall, my thesis strives to prove that only memorials that have some sort of interactive feature -- either physical or emotional -- will stand the test of time.

Leveraging Lies - The Impact of Egyptian Radio Propaganda during the 1967 Arab-Israel War
Nicholas Sciannameo / History
Advisor(s): Laurie Eisenberg / History & Naum Kats / History
Pake / 3:20

Egyptian radio broadcasting services played critical roles in the 1967 Arab-Israel conflict. Before, during, and after the war of June 5-10, 1967, broadcasts served to inform and misinform the populous. From the development of the leadership's obsession with meticulous media control and the pre-conflict run up, to the day-to-day action of the war, and finally to the collapse of Egyptian radio credibility, radio played a pivotal role in the Egyptian and, ultimately, the Israeli interpretation of the conflict, as well as the future perspective toward the media. The language usage exaggerated victories and promoted celebration, but the reality was anguish and scathing defeat.

Love in the Time of Globalization: Understanding Indian and American National Identity through Cinematic Romance the 1967 Arab-Israel War
Hannah Rosen / History
Advisor(s): Scott Sandage / History
Pake / 1:00

Thanks to movies like Slumdog Millionaire, Americans are becoming more connected to Indian culture, specifically Indian cinema. Increasingly, Hollywood producers and actors are becoming more involved in the Indian film industry, a.k.a. Bollywood. Many of them are working towards creating new audiences for Bollywood films within the United States. In a globalized world, Americans need to be aware that Bollywood movies, like American movies, come with specific cultural contexts that do not necessarily conform to American ideals This project attempts to track the different messages each respective industry's movies reveal about American and Indian national identity. Using recurring romantic couples (onscreen couples that made more than one movie together), this project tracks changing formulas in Hollywood and Bollywood romances throughout the 20th century.

Untitled
Leslie Coletti / History
Advisor(s): Lisa Tetrault / History
Peter / 12:20

By 1990 the military felt the influence of a change in civilian culture and it began accepting women into more roles than ever before. Thiswas due to a number of factors, but especially crucial had been the women's movement. However, even though the military accepted women, they did little to change the internal military culture, one rooted in stereotypical ideas of masculinity and based on an influential structure of power. In the early '90s, reports surfaced about the rampant sexual abuse of U.S. military women by their fellow service men. The scandals at Tailhook and Aberdeen Proving Ground in the 1990s proved a clash between civilian culture and the internal military culture. Although the armed forces recognized the rampant sexual violence as an issue, their responses were not effective since they did not recognize their internal culture as the source of the problem.

INFORMATION SYSTEMS

CMU students' perceptions of the distribution of the mandatory fees across non- academic resources
Joseph Burgess / Information Systems, Alexandra Lecompte / Economics, John Lee / Economics & Benjamin McGrath / Economics
Advisor(s): Brian Junker / Statistics
Wean Commons-1st Floor, Connan side / 3-5

Carnegie Mellon University has compulsory activities fees as part of its tuition. However, the student's participation in deciding how to spend the funds is limited by institutional constraints. This research study will analyze CMU student's awareness and perceptions of how funds are distributed for non-academic resources. Moreover, the survey will evaluate to what degree CMU students might want to participate in the decision-making process. In order to make inferences about our target population most accurately, we will use the complete list of names of undergraduate students from the most recent copy of the student directory (C-Book) as our sampling frame. We will draw an SRS without replacement from this frame to form our sample.

DocDiscuss
Wei Yang Danny Tan / Information Systems
Advisor(s): Amanda Gunawardena / Computer Science
Rangos Hallway, 2nd Floor / 3-5

Document annotation has always been familiar to paper based knowledge materials. Findings have shown that annotating a document while reading promotes better comprehension of the material. As we enter digital age, more documents are made available in digital formats. Such formats found in Microsoft Word and Adobe Acrobat focus primarily on enabling users with tools for annotations. There have been several projects that leverage the Internet allowing users to annotate their documents online, but none seem to have gained wide acceptability as a general and useful tool.

The first prototype development of DocDiscuss was conceived and developed based on the premise that for annotations to be useful, and be able to visualize annotations in a classroom context. Since its inception, DocDiscuss has drawn a great deal of interest and feedback from a few pilot classes that it was delivered in, but users have found several limitations of the existing system. Limitations ranged from complexities of the user interface to the inability to clearly visualize viewpoints based on the user annotations. DocDiscuss 2.0 embarks on the further development of DocDiscuss 1.0 to support a wider spectrum of goals, such as to introduce better global visualizations for document annotations in order to provide better understanding of user perspectives and community reaction to materials. The guiding principle set out for Salon 2.0 is to "learn social structures through textual annotation", focusing on simplifying the existing interface to increase usability and achieve a broader acceptance of the platform. With the understanding that many collaborative review platforms encroaches along similar ideals of DocDiscuss 2.0, the team hopes to stand out by first understanding the main rationale behind Salon participation, and then providing added value to users through incentives that would attract masses by building an interactive, close-knitted Salon community.

Japanese and American Computer Crime Policy: A Comparative Study
Ryan Handerhan / Information Systems
Advisor(s): Jeria Quesenberry / Information Systems
Hoch Commons-2nd Floor, Window side / 12-2:30

This study is a part of the Senior Honors Thesis project of Ryan Handerhan, a fourth-year Information Systems and Japanese student. The purpose of the study is to compare and contrast the United States' Computer Fraud and Abuse Act with the Japanese Unauthorized Computer Access Law. The study should address in what areas each policy is achieving its goals, and in what areas is each falling short. In addition, results will be compared and analyzed for the purposes of developing policy recommendations to improve the effectiveness of policy aimed at deterring computerized crime.

Set Operations with FAWN-KV
Daniel Weis / Information Systems
Advisor(s): David Andersen / Computer Science & Charlie Garood / Computer Science
Wean Commons-1st Floor, Connan side / 12-2:30

This presentation will outline the design of set operations on top of FAWN-KV and the resulting implementation. Additionally, it will highlight the implementation's performance characteristics and describe the trade offs that were made along the way.

Transactive Memory Systems in Undergraduate Information Systems Student Project Groups
Lauren Taglieri / Information Systems
Advisor(s): Jeria Quesenberry / Information Systems
Hoch Commons-2nd Floor, Rangos side / 3-5

Today, group collaboration is becoming more and more vital in the workplace. Hence, undergraduate curriculums must be updated to include group project courses that help to prepare students for their post-graduation work. This research focuses on how the theoretical foundation of transactive memory systems (TMS), or the collective awareness of the group's specialization, coordination, and credibility, influences a group's overall performance. These influences were analyzed through the use of focus groups, a TMS survey, and follow-up interviews with student groups in an undergraduate Information Systems project course (67-373). It was found that although determining the strength of a student group's TMS provides a small window into how that group is working together, TMS does not provide the whole picture of group collaboration. In order to be successful as a group, student groups must recognize the importance of the group formation process and understand that a group is a living organism that needs constant management over time. Therefore, if student groups focus on developing a group structure that fits their initial needs and continually update this structure based on changes that occur over time, they will be more prepared to effectively collaborate on their project.

LINGUISTICS

History Sells
Ateret Reisner / Linguistics
Advisor(s): Barbara Johnstone / English
Hoch Commons-2nd Floor, Rangos side / 12-2:30

Using a critical discourse analysis of Coca Cola advertisements in printed media from 1904 to 1978, I assess the norms for Coca Cola advertising as well as the changes to them. Through changes in those norms I am able to see moments in history that affected the overall advertising structure. While much research has been done both linguistically and visually into the structure of advertising and the persuasive strength of the advertisement,

there has been little researched about the reflection of history in advertising. Advertising has the ability to inform us of our history just as history had the ability to inform the advertisements themselves.

The '@' Effect: Twitter's Social Language
Joseph DeGolia / Linguistics
Advisor(s): Barbara Johnstone / English
Wean Commons-1st Floor, Connan side / 12-2:30

Twitter may be younger than a preschooler, but that doesn't mean it hasn't already been a success. In fact, you might argue that it's changed our technological world; It nutured the communicative embers of a raging revolution in Iran and already experienced an integer overflow, the latter otherwise known as the "Twitpocalypse." Why is the 140-character message one of the most popular forms of communication? Why Twitter, when the short form has existed for nearly 200 years since the invention of the telegraph? The short form didn't gain the popularity it has today until the widespread use of text-messaging. However, there is something about Twitter that distinguishes it from any other short form - the '@' symbol.

This project examines the patterns used in Twitter, namely involving the '@' symbol, that contribute to Twitter's signficant sociolinguistic experiences. It assesses how the language is used to function for different communicative .
purposes - especially the distinction between public conversation and personal broadcast. Public conversation is simply public communication between explicitly designated (linguistically and socially) parties and can especially be considered "high contact" communication. Personal broadcast is similar in that it is also public communication and the parties are explicitly designated linguistically. However, there is no explicit social designation of the parties involved. Instead, the message is intended as a broadcast for the public, but more especially focused, implicitly, on certain parties - those linguistically designated. This is explained with the use of the '@' symbol to converse with [reply to] or mention a Twitter user publically; The special use of "mentions" using the '@' symbol in Twitter suggest the existence of a unique form which often performs effectively as a personal broadcast. The important and interesting part of this project is the exploration of the relationship between linguistically encoded content and the implicit features of anguage. More specifically, the academic implication of the use of the '@' symbol could involve a thinning boundary between the semantic (or explicit) message and the pragmatic (or implicit) message. Since Twitter is so young and widespread, there are

also immense social implications that are associated. Several years from now, there will be a generation that not only doesn't know a world without the Internet, but also doesn't know a world without easy access to a viral and short method of communication. This may also have a great impact on the features and functions of the English language - written and spoken.

The Semantics of Prepositions
Todd Snider / Linguistics
Advisor(s): Mandy Simons / Linguistics
Kirr Commons-1st Floor, Window side / 3-5

This thesis begins from the observation that the English prepositions at and to can often be used in the same linguistic contexts, but with subtle differences in meaning. Consider for example the difference between the a. and b. versions of the sentences below:
(1) a. Bill threw the ball to Sue.
b. Bill threw the ball at Sue.
(2) a. Bill talked to Sue.
b. Bill talked at Sue.
The goal of the thesis is to provide a characterization of the semantic contributions of to and at so as to explain the difference in meaning between pairs of sentences showing the at/to alternation, as well as different usages of each of these prepositions. The central claim of the thesis is that to can serve to introduce two types of event participants, what I call participatory goal and non-participatory goal, while at introduces only the latter. I explain some core differences between different uses of to in terms of this distinction, and explain the special "punitive" sense of at, illustrated in (1b.) and (2b.) above, as a narrowing of the meaning of at in environments where its core meaning overlaps with that of to.

MODERN LANGUAGES

Alternative Break - Dominican Republic
Nathan Frank / Modern Languages & Liana Rosenberg / Social & Decision Sciences
Advisor(s): Kenya Dworkin y Mendez / Modern Languages
Dowd / 1:20

Alternative Break is a student-managed organization that provides service-learning opportunities to the Carnegie Mellon student community. Alternative Break accomplishes this goal by planning national or international trips that involve identifying a partner service organization, pre-departure educational and logistical sessions, traveling and participating in experiential service-learning activities, an option to earn academic credit for producing a reflexive final project, and outreach sessions to share these experiences with the larger campus and regional community. Alternative Break exemplifies the benefits of service-learning as part of the university experience. In this presentation, we would like to share the personal and academic benefits of service learning, background on the history of service-learning in the U.S., the recent trend in America for colleges and universities to support this type of learning, and ultimately, Alternative Break's role at Carnegie Mellon. Furthermore, we would like to present our most recent experiences through a short video and power point display, and interactive cultural items like food and music for the audience. For this year's trip, 15 CMU students went to the Dominican Republic to teach English in local schools for one week. There were also opportunities to live and work in the local orphanages. The non-profit organization that hosted us was Orphanage-Outreach. Not only were we able to share much of ourselves and our talent during this one week Spring Break trip, but we also learned a great deal from the Dominican people and the dynamic culture in which they live.

Mario Versus the Lich King- How Culture Affects American Consumers' Preferences for American or Japanese Video Games
Katherine James / Modern Languages
Advisor(s): Keiko Koda / Modern Languages
Kirr Commons-1st Floor, Window side / 12-2:30

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PHILOSOPHY

Cultural and Sociolinguistic Features of the Black Deaf Community
Andrea Solomon / Philosophy
Advisor(s): Barbara Johnstone / English
Hoch Commons-2nd Floor, Rangos side / 3-5

Considering the newness of the field of Deaf studies, it is not surprising that there has been relatively little research to date on the experience of ethnic minorities with the Deaf community. Members of the Black Deaf community are unique in that they embody a triple heritage that puts them at risk of discrimination in a number of ways. This study looks to obtain a better understanding of the issues surrounding the Black Deaf community by examining the cultural and sociolinguistic features of this community that differentiate it from the larger Deaf community. An exhaustive literature review was conducted; the primary topics explored were segregated deaf schools, linguistic features of Black Deaf signing, and cultural characteristics of the Black Deaf community. Ceil Lucas's work (Lucas, Reid, Bayley, & Wulf, 2001) proved to be the foundation for this background research. Her method of personal interviews conducted in American Sign Language was used as a model for this study. In the present study, four deaf African American participants were asked a series of interview questions in order to assess their experience within the Black Deaf community as well as their observations concerning Black Deaf signing. The majority of interviewees were students or alumni of Gallaudet University, an education that proved instrumental to them in identifying the racial divide within the Deaf community. It was hypothesized that in accordance with previous research black signers would utilize more

traditional signs, using a larger signing space and more two-handed signs. On the contrary, these interviews suggested that Black Deaf signing is becoming more similar to Black English, adapting common phrases like “I feel you” and “my brother.” This may have been a result of the age of the participants (early to late 20s). Culturally, participants identified a divide between the black and mainstream Deaf communities similar to the one that exists within the hearing community. It would appear that a shared difficulty in communication does not imply shared experiences in regard to discrimination. While the prominence of signing styles characteristic of the segregated schools for the Deaf may be waning, the racial attitudes that prompted this divide seem to be ever-present. For further research, it would be useful to interview members of the older generation of Black Deaf, learning about their experiences as well as linguistic observations. This paper complements previous work on Black signing because it reveals its evolution, changing from a method resulting from segregation from the mainstream Deaf community to a reflection of present-day Black English. Results of this study indicate that Black signing is no longer solely characteristic of Southern communities, but rather of the larger Black Deaf community. This recognition of signing variation provides further support for the establishment and promotion of Black Deaf organization like the National Alliance of Black Interpreters (NAOBI) and the National Black Deaf Advocates.

Imperfect Expression: A creative exploration of miscommunication
Courtney Sutter / Philosophy
Advisor(s): Jane Bernstein / English & Barbara Johnstone / English
Pake / 12:40

Language isn’t perfect. People who use language aren’t perfect. Mistakes are bound to happen. This collection of short nonfiction stories explores the linguistic misunderstandings, mistakes, and missteps members of the Carnegie Mellon community have experienced. These stories demonstrate the pervasiveness of miscommunication in our daily lives and showcase the various tactics people use to alleviate some of the sting often associated with less-than-perfect linguistic encounters.

PSYCHOLOGY

Assessing "Fat-ism": Reinforcement and Reduction of the Overweight Stereotype
Lauren Giesey / Psychology, Cynthia Peng / Psychology & Science and Humanities Scholars,
Maureen Satyshur / Psychology & Alyssa Sellitti / Psychology
Advisor(s): John Creswell / Psychology
Rangos 2 & 3 / Sigman Xi Group 7, 10:30am

Stereotypes and prejudices towards overweight people have a prominent role in socially acceptable Western attitudes. We aimed to reduce these stereotypes and prejudices via counter-stereotypic strategies. Participants were assigned to one of three experimental conditions: stereotypical, counter-stereotypical, and neutral, and watched videos portraying overweight individuals as such in each condition. Participants then completed both implicit and explicit measures of attitudes towards overweight people. We found that we were successful in reducing negative attitudes towards overweight persons for those in the counter-stereotypical condition in our implicit measure. We found trends towards significance in reducing negative attitudes towards overweight individuals in our explicit measures. This study highlights the malleability of stereotypes as well as the influential role of the media in portraying the overweight stereotype. Successful reduction methods could bring forth less negative attitudes overall towards overweight individuals in Western society.

Attention Moderates the Impact of Expectations on Hedonic Experience
Emily Garbinsky / Psychology
Advisor(s): Carey Morewedge / Social and Decision Sciences
Dowd / 3:00

Research on expectations demonstrates that even though they are typically formed unconsciously, expectations can alter experienced events. For example, researchers have shown that participants who expect to enjoy an event rate it as significantly more pleasurable than those who lack expectations. This effect can be either positive or negative, depending upon the nature of the prior expectation. For this reason, researchers have concluded that objectively similar events can be experienced in different ways if one possesses expectations. Although expectations can affect experiences, cognitive and social

psychologists believe that the extent of this effect varies. It has been proposed that this variation is dependent upon whether individuals notice a discrepancy between their expectation and the actual experience. Since the ability of an expectation to affect an experience depends on whether a discrepancy is detected, it is hypothesized that attention moderates the impact of expectations on hedonic experience and that the effect of expectations depends on the cognitive resources available. In other words, having sufficient cognitive resources allows people to compare their expectation to the experience while they are having it, thus giving them a greater chance of noticing that a discrepancy exists. Alternatively, if one's cognitive resources are being allocated elsewhere, they are less likely to notice that a discrepancy exists between their expectations and the actual experience. Using a modified version of the procedure used by Wilson, et al. (1989), participants were asked to rate the humor of a set of unfunny cartoons. By varying the amount of cognitive resources available in addition to priming them with different expectations about the cartoons, humor ratings were assessed. It was predicted that when a discrepancy existed between the cartoons and participant expectations, they would fail to notice only in conditions when they were given another task that occupied more, rather than fewer, attentional resources.

Communication About Goals and Relation to Health: A Pilot Study
Erin Honcharuk / Psychology
Advisor(s): Vicki Helgeson / Psychology
Hoch Commons-2nd Floor, Window side / 3-5

The relationship between parents and adolescents can affect adolescents' transition into adulthood and ultimately their mental and physical health. Past research has focused on how parent-adolescent communication about problems affect these outcomes, but little is known about how parent-adolescent communication about goals might affect the transition and health. Communication about problems might differ from communication about goals. In addition, having a child with a chronic illness, such as diabetes, might influence communication about problems and communication about goals. It is possible that communication and caregiving change depending on whether it is a problem or goal being discussed. Finally, the amount of problems versus goals discussed for adolescents with diabetes could also be different from healthy adolescents. My aim for this summer fellowship is to explore these questions through a pilot study in which parents and adolescents are videotaped discussing a problem and a goal. These videotapes will be coded for communication styles. We also will assess aspects of the parent-adolescent relationship, communication styles, and psychological and physical wellbeing through questionnaires.

Comparing inhibitory control in toddler and adults
Brittney Krieger / Psychology
Advisor(s): Anna Fisher / Psychology
Hoch Commons-2nd Floor, Rangos side / 12-2:30

As an extension of coursework completed in Research Methods of Developmental Psychology, this project looks at the differences among semantic inhibitory control responses between 3 year old children, 4 year old children and adults.

Early Effects of Environment: A Comparison of Prenatal Care in South Africa and the United States
Allison Piper / Psychology
Advisor(s): Sharon Carver / Psychology
Wean Commons-1st Floor, Connan side / 3-5

Prenatal development has a critical impact on a child's life and is strongly affected by environmental factors, especially quality of prenatal care and home environment. Data was gathered in a South African village and a United States city through interviews, photojournalism, and archival data. A total of 14 women (10 South African, 4 American) were interviewed about their prenatal care and pregnancy experiences, and 12 were photographed in their surrounding environment. The photographs serve as a visual and emotional complement to the paper. The project showed that the extended family in South Africa provides a strong social support system for pregnant women, which serves to mitigate much of the lack of resources in the environment. In the United States, prenatal care typically assumes much of the education and social monitoring role, due to the smaller role of the American extended family and the cultural value placed on biomedical care. While the two environments are different, mothers and newborns in both environments generally have the necessary prenatal support.

Exploring Individual Differences in Cognitive Control
Janelle Higa / Psychology
Advisor(s): Anna Fisher / Psychology
Kirr Commons-1st Floor, Window side / 12-2:30

Executive function is an essential part of cognition that allows humans to regulate and control cognitive processes. It is involved with goal-oriented behavior, working memory, emotional regulation, cognitive flexibility, and many other abilities. Cognitive control is a part of executive function that allows people to adapt their behavior to the changing demands of the environment. Past studies have shown that low cognitive control is

correlated with adverse behaviors such as drug use and alcohol consumption (Ayduk, Mendoza-Denton, Mischel, Downey, Peake, & Rodriquez, 2000; Wulfert, Block, Santa Ana, Rodriguez, & Colsman, 2002). Although much research has been done in the area of cognitive control, little is known about specific social factors that may be linkedto its development. This study explores several factors that may contribute to young children's individual variation in their development of cognitive control.

Hemispheric Differences in Face and Word Processing: Modular vs. Distributed Perspectives
Cynthia Peng / Psychology
Advisor(s): Marlene Behrmann / Psychology
Rangos 2 & 3 / Sigma Xi Group 7, 10:45

What is the process by which our brains recognize faces and words? What are the mechanisms underlying the processing of these two very important real-world stimuli, and what are the implications for human behavior? We are interested in exploring the extent to which face processing and word processing are independent functions or parallel actions. To do so, two experiments test for competition and cooperation across hemispheres. We examine interhemispheric interaction by asking the subject to decide whether a target face is presented in the left or right visual field. We compare the accuracy and reaction time for a same visual field presentation to an across visual field presentation to determine hemispheric gradation for these two classes of stimuli.

Inductive Inference in Infants
Rosanna Breaux / Psychology
Advisor(s): David Rakison / Psychology
Kirr Commons-1st Floor, Window side / 3-5

Human beings use inductive reasoning whereby they observe individual objects and make generalizations about a larger group of things, or the population. Recent evidence suggests that infants have the ability to make inductive inferences based on limited data. Xu and Garcia (2008) demonstrated that 8-month-olds were able to make inferences about the population based on exposure to a sample. Conversely, the infants were able to extrapolate information about a small population to make inferences about the sample. A recent study conducted by Lawson and Rakison (2009) studied at what age infants are able to use base-rate information to predict the sample of a population. They found that 12- and 13-month-old infants can successfully use base-rates of 1:2, 1:4, and 1:6 to predict a sample, whereas 8- and 9- month-old infants cannot successfully use base-rates of 1:2 and 1:4 but

may be able to use a 1:6 base-rate to predict a sample from a population. In this study infants were habituated to 1 red ball and 4 blue balls falling into one box and 4 red balls and 1 blue ball falling into another box. In the test trials, again the balls fell into a container and were either consistent with the base rate, a blue ball coming out of a mostly blue sample, or inconsistent with the base rate, a red ball coming out of a mostly blue sample. It is of interest to discover how infants begin to use base-rate information to make predictions about a sample, and to see if infants are capable of applying this ability to a real life application. This will be tested by using both a habituation paradigm as well as a hands-on self-training experience prior to the habituation paradigm with 4- and 5-month-olds, as well as giving 8- and 9-month-olds an opportunity to select either a high or low odd condition box to gain a reward. I will also explore if even younger infants, 4- and 5- month-olds, can make such inferences after they have the benefit of a sticky mittens training experience. Finally, I will examine whether 8- and 9-month-olds and 12- and 13-month-olds display inductive reasoning in a real-life application.

Language Cues and Its Relations to General Learning
Jiping He / Psychology
Advisor(s): Erik Thiessen / Psychology
Wean Commons-1st Floor, Connan side / 12-2:30

Recent theories propose that language acquisition arises from domain-general learning mechanisms, suggesting that the strategies we use for language-learning can be generalized to learning in other domains. There is evidence that infants use statistical and stress cues to find word boundaries during language learning (Thiessen & Saffran, 1996). My research seeks to understand what environmental cues is used for parsing large streams of input into components by exploring whether we use statistical and stress cues in other types of learning. Several visual stimuli composed of moving shapes will be used on adults, tested on three conditions. I will either find that adults use statistical cues, or stress cues, or do not use any environmental cues in visual learning. I predict adults will use statistical cues for learning when stress cues are not present, and will use stress cues when they are present. Results of this study may provide ways to improve education, most specifically in the teaching and learning of a Second Language.

Learning by Comparing: Effects of Direct Instruction and Discovery Comparison
Pasha Gill / Psychology
Advisor(s): David Klahr / Psychology
Wean Commons-1st Floor, Connan side / 3-5

Previous research on analogy has suggested that asking subjects to compare two instructional examples promotes analogical transfer. However, one disadvantage in having subjects engage in unguided comparison is that they may unintentionally abstract irrelevant relationships across instructional examples. The present experiment is designed to test the efficacy of directly instructing participants about common relational structure between analogous problems. Subjects are either directly told how two story problems are similar (direct comparison), or they are asked to abstract common relationships between two story problems on their own (discovery comparison). In two control conditions, subjects are provided with the same story problems without instructions to compare, and are either asked to summarize each story (discovery no-comparison) or they are directly provided with a summary of each story (direct no-comparison). Subjects' analogical reasoning is operationalized as their ability to solve a relationally similar target problem which requires mapping of relevant concepts from the two base problems. We predict that analogical transfer will be strong for both comparison conditions, and that direct instruction will lead to more efficient use of instructional time.

Minority on Minority Discrimination: Impact of Majority Social Norm Perception
Christine Chen / Psychology
Advisor(s): Chante Cox-Boyd / Psychology
Kirr Commons-1st Floor, Window side / 12-2:30

There has been little research about minority to minority prejudice despite the fact that minorities represent the majority of America's workforce. Therefore, there is a need to address the issue of racial prejudice, not just in the context of majority to minority discrimination, but also in regards to the less obvious minority to minority relations. This experiment studied minority group member discrimination against members of other minority groups when asked to perform activities with a group composed of either all racial majority (White/Caucasians) individuals, all racial minority individuals of the participant's own race, or an equal mix of White/Caucasians and racial minority individuals. It is expected that participants are less likely to evaluate another racial minority group member (one's own group or not) favorably when in the presence of a White/Caucasian group than in any of the other conditions (mixed group or racial minority group). The findings of this study can help explain the existence and occurrence of minority to minority discrimination; specifically, how the perception of social norms and the environment plays a role in discrimination among minorities.

Scene Categorization and Individuation in Human Extrastriate Cortex
Cynthia Peng / Psychology
Advisor(s): Sharon Carver / Psychology
Dowd / 3:40

The recognition of visual scenes, mediated by the Parahippocampal Place Area (PPA) of the brain, is an integral part of human experience. Here, we explore how PPA categorizes and individuates scenes and how scene representations evolve along the visual hierarchy from early visual cortex (EVC) to PPA. Participants viewed 96 color, full-screen scene images while performing a fixation task in an fMRI scan. The stimuli were selected according to three fully-crossed dichotomies of open vs. closed, natural vs. manmade, and near vs. far. Multi-voxel pattern analyses revealed that the PPA tends to categorize scenes as open vs. closed. Further, we found that the pattern of response in PPA could also be used to discriminate individual scenes. In contrast, while the pattern of response in EVC could also be used to individuate scenes, this region tended to group scenes according to near vs. far. Overall, these findings provide important insights into how our brain perceives and interprets the visual world and how the representations of scenes are transformed during visual cortical processing.

Temperament and its Effects on How Children View Emotional Faces
Sarah Shade / Psychology
Advisor(s): Anna Fisher / Psychology
Kirr Commons-1st Floor, Window side / 3-5

This study intended to investigate the effects of temperament on visual attention to emotional faces. In order to investigate this research question, a sample of 48 children ages 3 to 9 viewed faces depicting either angry, fearful, happy, or neutral emotions, an eye-tracking computer. This visual attention data was combined with parent report of temperament in order to determine correlations between the two. Results showed no statistically significant correlations between temperament and looking behavior, despite these correlations being significant when the same tasks were administered to adults. Overall, these results suggest that the participants did not display temperament effects in visual attention of emotional faces, thus implying that this pattern may emerge later in life than the tested population.

The Consequences of Fatigue in Patients Diagnosed with Hepatobiliary Carcinoma
Jennifer Hammond / Psychology
Advisor(s): Marlene Behrmann / Psychology
Wean Commons-1st Floor, Connan side / 12-2:30

Background: Fatigue is one of the most common and distressing symptoms of patients diagnosed with cancer. However, few treatments have been developed to alleviate the symptoms of cancer-related fatigue. The aims of the present study were to prospectively (1) examine the consequences of fatigue on patients' physical and psychological functioning, and (2) begin to explore the underlying biological mechanisms associated with fatigue in patients diagnosed with hepatobiliary carcinoma. Method: One hundred and one patients diagnosed with hepatobiliary carcinoma were administered a battery of questionnaires that included the Functional Assessment of Cancer Therapy-Hepatobiliary and Fatigue modules as well as the Center for Epidemiological Studies-Depression scale prior to the initiation of treatment and at 2- and 4-months post-treatment. Granulocyte colony stimulating factor (G-CSF; a glycoprotein that regulates production of neutrophils within the bone marrow and affects neutrophil progenitor proliferation), white blood cell (WBC) and neutrophils were measured in the patients' sera at approximately the same time points as fatigue. Descriptive statistics, cross-lagged panel analyses, and Analysis of Variance (fixed and random effects) were employed to examine the relationship between variables. Results: Fatigue was found to be significantly associated with quality of life at all time points ($p=0.001$) and depressive symptoms at baseline ($p=0.05$). Fatigue was correlated with pain at baseline ($p = 0.018$) but not at two months ($p = 0.09$) or four months ($p = .127$) Prior to treatment, there was a trend towards significance for the association between fatigue and abnormal levels of GCSF (Mann-Whitney $U = 454.5$, $p = 0.061$). Fatigue was significantly associated with abnormal levels GCSF at both two months (Mann-Whitney $U = 49.0$, $p = 0.009$) and four months (Mann-Whitney $U = 4.00$, $p = 0.008$). Conclusions: Consistent with prior research, fatigue is associated with decreased quality of life and depressive symptoms. The association between fatigue and abnormal levels of GCSF may be important as treatments are considered for patients experiencing symptoms of cancer-related fatigue.

The effect of color on cognition
Jennifer Olsen/ Psychology
Advisor(s): Roberta Klatzky / Psychology
Wean Commons-1st Floor, Connan side / 3-5

Two experiments explored the hypothesis that colors produce different cognitive learning motivations: red produces an avoidance motivation and blue produces an approach motivation. The avoidance motivation results in better performance on detail-oriented tasks, and the approach motivation results in better performance on creative tasks. To test this prediction, the first study used a signal detection task manipulating word valence and color to independently measure (a) the ability to discriminate previously seen words from new

words and (b) response bias. The second study used process dissociation, a method that separates conscious recollection from unconscious memory, to measure the effect of color and divided vs. full attention on a word-stem completion task. In both studies the effect of color was found to be non-significant while the secondary effects (word valence in the first study and attention in the second study) were found to be significant. These studies call into question the idea that color strongly influences cognitive task performance.

The Effect of Secure Base Support During a Challenging Independent Activity
Lauren Giesey / Psychology, Christine Jones / Biological Sciences &
Laura Pacilio / Psychology
Advisor(s): Brooke Feeney / Psychology
Kirr Commons-1st Floor, Window side / 12-2:30

Our study addressed the question: How does encouragement from one's spouse or lack thereof influence self perceptions, perceptions of one's partner, and performance while engaging in a challenging independent activity? Our sample was composed of forty married couples recruited from the Pittsburgh area. For the activity of interest, after the couple members completed background questionnaires and played a short game together, one couple member (called the "Explorer") was asked to work on a challenging puzzle activity on their own, while their partner worked on an easier task in a separate room. Spousal support was manipulated as follows: Immediately prior to working on the puzzle activity, the Explorer received a note written in their partner's handwriting containing either an encouraging, discouraging, or neutral message. A no-note control condition was also included. The Explorer was then videotaped during the challenging activity, and those tapes will be coded for performance on the activity, as well as the amount of excitement, engagement, and frustration shown during the activity. Following the challenging activity, the Explorer completed several questionnaires assessing their feelings about the activity, their feelings about their partner, and their self-perceptions. We hypothesized that Explorers who received encouraging notes from their partners would perform better on the activity, report more positive feelings about the activity, report more positive feelings about their partner, and report more positive self-perceptions compared to Explorers who received discouraging or neutral notes. Our study will help shed new light on the effects of secure base support on self perceptions, perceptions of the partner, and performance on a challenging independent activity. It will also help to inform professionals in the field who help others build stronger and healthier relationships.

The Transition to College for Adolescents with Type 1 Diabetes.
Erin Honcharuk / Psychology
Advisor(s): Vicki Helgeson / Psychology
Dowd / 4:00

The transition to college leads to changes in relationships with family and friends, psychological well-being, and health behaviors. Somechanges include moving away from home, a decrease in health behaviors, such as less nutritious meals and increased alcohol consumption, and increased stress. These changes can be problematic for adolescents with diabetes as they could affect how they take care of their disease and their metabolic control. Because adolescents with diabetes know that poor health behaviors, such as drinking alcohol and poor diet, are harmful to their health, they may not engage in these behaviors to the extent that other college students do. While past research has focused on changes in relationships and health behaviors for students entering college from the general population, few studies have focused on adolescents with diabetes. Therefore, the goals of this study are to determine if there are differences in relationships and health behaviors between freshman college students with and without diabetes; determine whether relationships, health behaviors, self-care behaviors, and metabolic control change from senior year of high school to freshman year of college, and examine whether relationships, health behaviors, and self-care behaviors predict changes in metabolic control among those with diabetes.

What's in Your Future? An Analysis of Post-Graduation Plans of Carnegie Mellon Undergraduate Class of 2010
Brianna Agyemang / Economics, Nia Austin / Psychology, Jaimie Lee / Statistics & Kristine McPherson / English
Advisor(s): Brian Junker / Statistics
Wean Commons-1st Floor, Connan side / 3-5

Not surprisingly the members of the graduating class of 2010 will begin some impressive careers after graduation. But what exactly do these graduates plan to do? And how did they decide? The post-graduation plans of seniors are important to study, because we can reveal trends in the direction(s) today's students are heading immediately following graduation, and how their major comes into play. Furthermore, by studying how seniors come to a conclusion about their plans, we can better understand who or what has the greatest influence on the decision making process. We used a questionnaire to analyze

SELF-DEFINED

CMU Dining: For better or for worse?
Sally Cheung / Statistics, Hee Won Chi / Statistics, Jisu Kim / Self-Defined & Tianjiao Qi / Science and Humanities Scholars
Advisor(s): Brian Junker / Statistics
Hoch Commons-2nd Floor, Window side / 12-2:30

Dining has always been a hot topic at Carnegie Mellon University (CMU). Even though many changes have already taken place last year, improving the quality and the selection of foods, we would like to once again investigate to see how satisfied students who are on the meal block system now are with the current dining options. We have spoken to a representative from the student senate and they are still constantly looking for updates to see how satisfied students are with the dining system, therefore one potential client of our survey would be to conduct a study to see the student satisfaction of the dining system and pass these results to the student senate for potential changes to take place. Carnegie Mellon requires first year students to be on a meal plan, so these changes would be highly relevant for years to come. Being able to constantly improve dining services on our campus can motivate students to eat at certain dining places more. Also, although new additions have been made, are people aware of such changes and how do they feel of these changes? We would like to focus mainly on Freshmen who are on the meal plan because they are the ones who are most familiar with the dining places at school. Through this survey, we hope to find answers to questions such as places that students like the most and least and why and possibly how the places could continue to improve.

Factors in the Drop in US Infant Mortality, 1900-1940
Rose Goff / Self-defined
Advisor(s): Karen Clay / Economics
Wean Commons-1st Floor, Connan side / 3-5

This paper examines the causes of the steep drop in United States infant mortality, 1900-1940. It considers the country's national experience, as well as the local experience of Pittsburgh. Section One presents historical evidence on potential factors in the infant mortality drop. Section Two estimates fixed effects regressions modeling the contribution

of several factors to the infant mortality drop. In a last section, the econometric findings and historical evidence are discussed.

Pizza Consumption and Preference of CMU Undergraduate Students
Stafford Brunk / Self-defined, Atishe Chordia / Mechanical Engineering, SeungJin Park / Economics and Statistics, Tony Poor / Computer Science & Henry Wu / Mathmatics
Advisor(s): Brian Junker / Statistics
Kirr Commons-1st Floor, Window side / 12-2:30

We are conducting a consumer survey of Carnegie Mellon students in order to learn about their pizza consumption behaviors. We have utilized a post-stratified random sample of 800 undergraduate students from the CMU directory, emailing them a Google Docs-powered survey (with the offer of an Amazon gift card raffle to increase the response rate). Our survey hopes to gain insight on the current consumption behaviors and motivations of CMU undergrads, including issues like when students generally want to order pizza, the impact of DineXtra or PlaidCa$h in their decisions, and what other characteristics (cost, quality, quantity, location, etc.) are most important to them. These results may be used by local businesses and Carnegie Mellon dining venues, improving both their business and marketing abilities as well as the satisfaction of CMU students.

Unraveling the myth: the specious social mobility of the Israeli woman soldier following the 1967 Six Day War
Amelia Nichols / Self-defined
Advisor(s): Laurie Eisenberg / History
Pake / 1:40

During the 1948-49 Israeli War of Independence, highly publicized incidences of female casualties on the battlefront established a pervasive and long-lasting myth that women in the Israel Defense Forces [IDF] continued serving shoulder-to-shoulder with their male counterparts. However, by the outbreak of the 1967 Six Day War, women were neither serving on the front line nor contributing in a significant way in the background. While the 1967 Israeli victory created an environment that had the potential to positively impact the status of women in the Israeli military, traditions and attitudes in Israeli society amplified by the post-war atmosphere limited change and served to further marginalize female soldiers both within and outside of the IDF. The aim of this paper is to unravel the internationally recognized myth of the Israeli female soldier and utilizes interview material from the very women who experienced the post-war environment to understand the extent to which equality and upward mobility remained a lesser priority during the aftermath of the Six Day War.

SOCIAL & DECISION SCIENCES

Alternative Break - Dominican Republic
Nathan Frank / Modern Languages & Liana Rosenberg / Social and Decision Sciences
Advisor(s): Kenya Dworkin y Mendez / Modern Language
Dowd / 1:20

Alternative Break is a student-managed organization that provides service-learning opportunities to the Carnegie Mellon student community. Alternative Break accomplishes this goal by planning national or international trips that involve identifying a partner service organization, pre-departure educational and logistical sessions, traveling and participating in experiential service-learning activities, an option to earn academic credit for producing a reflexive final project, and outreach sessions to share these experiences with the larger campus and regional community. Alternative Break exemplifies the benefits of service-learning as part of the university experience. In this presentation, we would like to share the personal and academic benefits of service learning, background on the history of service-learning in the U.S., the recent trend in America for colleges and universities to support this type of learning, and ultimately, Alternative Break's role at Carnegie Mellon. Furthermore, we would like to present our most recent experiences through a short video and power point display, and interactive cultural items like food and music for the audience. For this year's trip, 15 CMU students went to the Dominican Republic to teach English in local schools for one week. There were also opportunities to live and work in the local orphanages. The non-profit organization that hosted us was Orphanage-Outreach. Not only were we able to share much of ourselves and our talent during this one week Spring Break trip, but we also learned a great deal from the Dominican people and the dynamic culture in which they live.

Chilean Water Policy: Transaction Costs and the Importance of Geography
Elisabeth Madden / Social and Decision Sciences
Advisor(s): Silvia Borzutzky / Social and Decision Sciences
Dowd / 2:00

In 1981, the military government of Chile passed a new water code, based largely on the principles of neoliberal economics that had guided the formation of a new constitution a year earlier. The idea behind the new water code was that if the government enabled a free market for water rights, water resources would eventually be allocated to their most valued use. This hypothesized efficiency, however, has failed to come to fruition in many parts of Chile, as evidenced by many empirical analyses of fieldwork in different river basins. I argue that this failure was caused in large part by the transaction costs inherent in an unconstrained market, and also by the natural variance in geography and rainfall throughout Chile.

Mental accounting and ill-gotten gains
John Ray / Social and Decision Sciences
Advisor(s): Carey Morewedge / Social and Decision Sciences
Class of '87 / 3:00

Mental accounts are budgets consumers form to allocate their financial resources. Many consumers, for example, allow themselves to spend within roughly specified limits on food, clothing, etc. In this way, budgeting is useful self-regulation against misspending ones earnings. However, sometimes the assignment of emotional value to earnings can influence their role in mental accounting. For example, consumers who acquired money "under negative circumstances" were more likely to "consume virtuously" to alleviate their guilt. Our studies sought to determine if "mental laundering" would mediate that emotional influence.

Motivation in Foreign Language Learning
Jaclyn Bernard / Social and Decision Sciences & Science and Humanities Scholars
Advisor(s): Julie Downs / Social and Decision Sciences
Pake / 3:40

In the study of academic motivation in a language-learning setting, motivation has traditionally been considered an independent variable. The present study treats it as both a dependent function of classroom activities and an independent predictor of study time, expected grade, and whether a student will continue to study the language. Six distinct motivational types are discussed: motivation about the language, motivation about the class, confidence, external motivation, whether the class feels required, and self-reported motivation. Motivation about the language is found to be of particular importance in predicting outcomes, along with fun activities and activities that promote language use about students' own lives and interests.

Optimization & Use of ELISpot & Proliferation Assays:
Characterizing a CD4+ T-cell Immune Response to C. trachomatis in Adolescent Women
Sarah Nelson / Social and Decision Sciences
Advisor(s): Gordon Rule / Social and Decision Sciences
Wean Commons-1st Floor, Connan side / 12-2:30

Chlamydia trachomatis (CT) genital infection is the most prevalent bacterial sexually transmitted infection (STI) worldwide (WHO, 2001), with the highest rates of infection reported among adolescent females. Infection induces mostly short-term immunity that is serovar specific, which increases both the risk of re-infection and tissue damage (Patton, 1989). Although Chlamydia infection can be treated effectively with antibiotics, infections are often insidious and may persist asymptomatically to damage tissue even when appropriate antimicrobial therapy is administered. In addition, early treatment of infections may inhibit the development of protective immune responses, and promote an increased prevalence of infection (Brunham, 2005b). The development of treatment strategies to prevent infection and the associated reproductive pathology requires a better understanding of the CD4+ T cell immune responses to Chlamydia infection. Recently published studies in humans suggest that Interferon--producing CD4+ Th1 cells play a protective role against incident C. trachomatis infection (Hoplland, 1993). In contrast to IFN- production, Interleukin-10-producing CD4+ Th2 cells have shown to prevent protection against Chlamydia infection, and may even increase genital tract bacterial load by inhibiting protective Th1 responses (Brunham, 2005b). Furthermore, recently discovered Interleukin-17-producing CD4+ Th17 cells have shown to be powerful inducers of tissue inflammation, preventing CD4+ regulatory T cells from performing their role as inhibitors of tissue inflammation (Bettelli, 2008). In a study with a small cohort of adolescent women (13 Mage 25) at high-risk for Chlamydia infection, optimized experimental assays will allow us to measure CD4+ T-cell proliferation and cytokine (IFN-, IL-10, & IL-17) secretion that correlates and contributes to either protective immunity or disease pathogenesis. Furthermore, results from experimental assays will allow us to determine the diagnostic accuracies of experimental assays in comparison to standardized PCR diagnosing methods for Chlamydia infection.

STATISTICS

Classifying Patients' Need for and Use of Pain Relief Medication
Chan Kim / Statistics, Elaine Lee / Mathematics &
Vishash Verma / Science and Humanities Scholars
Advisor(s): Brian Junker / Statistics & Cosma Shalizi / Statistics
Wean Commons-1st Floor, Connan side / 12-2:30

Data was collected on post-operation patients who used patient-controlled analgesics and statistical analyses were performed on this data to determine whether the patients fell into distinct clusters based on their pattern of pain across time; to determine whether there was a difference between the patients who used hydromorphone and those who used morphine; to devise a method for predicting the total amount of analgesic a new patient will use after being operated on. The methods and concepts used were hierarchical clustering, curve clustering, multidimensional scaling, and hidden Markov models. Based on the analyses, the patients seem to fall into between four and six clusters based on their pattern of pain across time and there does seem to be a difference between the hydromorphone and morphine patients.

CMU Dining: For better or for worse?
Sally Cheung / Statistics, Hee Won Chi / Statistics, Jisu Kim / Self-Defined &
Tianjiao Qi / Science and Humanities Scholars
Advisor(s): Brian Junker / Statistics
Hoch Commons-2nd Floor, Window side / 12-2:30

Dining has always been a hot topic at Carnegie Mellon University (CMU). Even though many changes have already taken place last year, improving the quality and the selection of foods, we would like to once again investigate to see how satisfied students who are on the meal block system now are with the current dining options. We have spoken to a representative from the student senate and they are still constantly looking for updates to see how satisfied students are with the dining system, therefore one potential client of our survey would be to conduct a study to see the student satisfaction of the dining system and pass these results to the student senate for potential changes to take place. Carnegie Mellon requires first year students to be on a meal plan, so these changes would be highly relevant for years to come. Being able to constantly improve dining services on our campus can motivate students to eat at certain dining places more. Also, although

new additions have been made, are people aware of such changes and how do they feel of these changes? We would like to focus mainly on Freshmen who are on the meal plan because they are the ones who are most familiar with the dining places at school. Through this survey, we hope to find answers to questions such as places that students like the most and least and why and possibly how the places could continue to improve.

CMU Undergraduate Satisfaction with UC Athletic Facilities
Siddhartha Gupta / Economics, Christopher Lee / Statistics, Jung Yub Lee / Business Administration, Sonam Rajpal / Economics & Swetha Reddy / Business Administration
Advisor(s): Brian Junker / Statistics
Kirr Commons-1st Floor, Window side / 3-5

Through this study, we hope to find out how CMU undergraduate students feel about the UC athletic facilities. Through their responses, we feel that they can be used to improve all aspects of the facilities. We selected our participants through a random selection of the CMU C-Book and sent out an online survey through a website called QuestionPro.com. We reached out to 1,320 undergraduate students, accounting for a 25% nonresponse rate. With these numbers, we hope to receive feedback from at least 341 students. We will then analyze our results in an attempt to improve our campus facilities.

Correcting Aperture Bias for Star Formation History Estimates
Da Jeong Ha / Mathematics, Hyemin Lee / Statistics & Kunho Lee / Mathematics
Advisor(s): Brian Junker / Statistics & Cosma Shalizi / Statistics
Wean Commons-1st Floor, Connan side / 12-2:30

The method of using spectra to estimate various star formation history (“SFH”) parameters for distant galaxies is often insufficient for usage in astronomical research. For some galaxies, the spectral aperture is smaller than the angular extent of the galaxy, meaning that the spectrum will fail to capture some of the galaxies’ light. In this case, the SFH parameters measured using such spectra will often be inaccurate, and such discrepency between the true SFH parameters and their spectral estimates is called aperture bias in SFH estimates. In this project, we present a method that corrects aperture bias in three SFH estimates: the current star formation rate of each galaxy, the average ages and the

their aperture bias. We use the spectral SFH estimates and the Sloan Digital Sky Survey photometry from a sample of 50,000 galaxies.

Improving Writing Assessment with Statistical Techniques
Jason Hwa / Statistics, Belle Peng / Buisness Administration, Antonios Tavlarakis / Mathematics & Samuel Ventura / Mathematics
Advisor(s): Cosma Shalizi / Statistics
Wean Commons-1st Floor, Connan side / 3-5

Due to the excessive demand of learning English in China, English teachers and professors find themselves overwhelmed by classroom size. This makes it difficult for them to provide each individual student with quality feedback and in turn limits the student's ability to learn. Dr. Kaufer, a professor of English at Carnegie Mellon University, has helped develop a text-analysis software called DocuScope to aid teachers in providing quick feedback to their students. Currently, DocuScope reads in a collection of writing assignments and categorizes the words into 40 different dimensions. Using these dimensions, our tasks are to automate the use of statistical techniques to highlight how the students write similarly, how they are unique, and how they compare to a benchmark of standard English writing. An additional goal of ours is to make our analysis interpretable for teachers and students untrained in statistics. Using a training set of 98 essays written by Dr. Kaufer's Chinese students, we explored various clustering, classification, outlier detection, and dimension reduction techniques.

Teaching Assessment of Fourth and Fifth Grade Teachers
Emily Butler / Statistics, Argi Harianto / Statistics & Christopher Makris / Statistics
Advisor(s): Brian Junker / Statistics & Cosma Shalizi / Statistics
Wean Commons-1st Floor, Connan side / 12-2:30

In today's society, urban schools often do not have academic programs as strong as non-urban schools. We believe that this can be attributed to the quality of teachers' assignments. A sufficient way of measuring teachers' ability is by analyzing the assignments they give to their students; however, we must decide on how many assignments must be collected to assess each teacher. Along with the students' assignments, each teacher must also take time to submit required paperwork. In order to receive optimal participation, it is important to collect only the appropriate number of assignments from each teacher. Additionally, we must also determine the amount of raters needed to assess the assignments. Because the collection of assignments and use of raters is both costly and time consuming, we would like to minimize the number of assignments and raters needed while also maximizing the

accuracy of our estimate of the teachers' effectiveness. To do so, we use generalizability theory on our data to generate results that allow us to predict the reliability of any combination of assignments and raters. By analyzing these results, we found that it would be optimal in future studies to collect approximately seven or eight assignments from each teacher while having only two raters. We believe this to be the best model as it requires the least amount of raters and assignments, saving both time and money, while also allowing the researcher to attain quality results.

What's in Your Future? An Analysis of Post-Graduation Plans of Carnegie Mellon Undergraduate Class of 2010
Brianna Agyemang / Economics, Nia Austin / Psychology, Jaimie Lee / Statistics & Kristine McPherson / English
Advisor(s): Brian Junker / Statistics
Wean Commons-1st Floor, Connan side / 3-5

Not surprisingly the members of the graduating class of 2010 will begin some impressive careers after graduation. But what exactly do these graduates plan to do? And how did they decide? The post-graduation plans of seniors are important to study, because we can reveal trends in the direction(s) today's students are heading immediately following graduation, and how their major comes into play. Furthermore, by studying how seniors come to a conclusion about their plans, we can better understand who or what has the greatest influence on the decision making process. We used a questionnaire to analyze the plans of graduating seniors as well as the motives behind their decisions. The Career Center is a likely client for this survey, since they can use the findings to better tailor their programming and advising techniques.

BIOLOGICAL SCIENCES

A New Outlook on Student Health: Student Engagement Through Effective Visual Communication Tools
Katherine Fu / Biological Sciences
Advisor(s): Paula Martin / Self-defined
Dowd / 12:00

This project's objective is to assess how information distributed by Student Health Services can be better designed to communicate most effectively students' health-related needs. This will be achieved by consolidating the literature used in Student Health Services, specifically those distributed by Peer Health Advocates (PHA), and designing a new and more engaging set of resource cards. The question to be answered is how does design play a role in whether students will pick up and presumably read the information? An initial survey of undergraduate students' opinions of current Student Health literature will aid the design and content format for these new cards. The number picked up by students at designated student community areas will quantify their success along with measure the cards' usefulness, usability, and desirability. Along with potentially providing better means of communication between students and educators, this project can also bring an identity to Student Health as well as PHAs (Peer Health Advocates) on campus, an identity that will provide groundwork for future outreach programs and emphasize self-health to the current and future student body.

Analysis of Double Null APC Clonal Distribution in Normal and p35 Wings
Amy Fuller / Biological Sciences
Advisor(s): Brooke McCartney / Biological Sciences
Rangos 2 & 3 / Sigma Xi Group 1, 10:00am

Adenomatous polyposis coli (APC) is a human tumor suppressor, which can cause colon cancer when mutated. APC is a negative regulator of the Wnt signaling pathway and acts, along with Axin and Zeste-White3, to target ß-catenin for destruction by a proteosome.

There are two APC genes, APC1 and APC2 (APC), which compensate for each other if one is mutated, requiring a double null clone to be generated in order to prevent the function of APC. Preliminary experiments have suggested that while the APC double null clones occur in equal frequency throughout the larval stage, the clones in the adult Drosophila have a distorted distribution throughout the wing, with more clones appearing in the blade and less in the hinge. Therefore, we predicted that certain clones went through apoptosis during development. We tested this hypothesis by mutating APC to contain p35, which will block cell death in the clones. The adults containing p35 were compared to adults without the mutation in order to determine if apoptosis occurs during development in APC double null clones. We predicted that the clones containing p35 will not be capable of apoptosis and will survive throughout development. Therefore, we will see an even distribution of clones in the adult Drosophila wing similar to that of the distribution in the larvae.

Assessment of the Environmental Risks of Nano-Silver
Tim Helbig / Biological Sciences &
Advisor(s): Stephen Tonsor / University of Pittsburgh
Dowd / 1:40

Artificial nanomaterials, or designed chemical structures having dimensions on the scale of nanometers (10^-9 m), are being produced in larger and larger amounts due to the discovery of new applications for them and demand for those applications. This increased production has led to their accidental and purposeful release into the environment, but due to the novelty of these materials, little is known about the implications of this. Attempts have been made to assess the overall risk of these new nanomaterials, but this has proven difficult because very small changes in the size, shape or composition of these materials has been shown to greatly alter their environmental impacts. Thus, the purpose of this project was to interpret and synthesize all of the current knowledge known about one particular class of nanomaterials, nano-silver, to get a broader sense of the viability of the risk assessment process and to elucidate important informational gaps for this new class of materials. The examination of nano-silver has revealed many pathways by which release of this chemical product could adversely impact microbial communities of economic and health-related importance including the bacteria of the intestinal flora, the anaerobic microbes of river sediments and the nitrogen fixing rhizobia of plant roots. It is hoped that this assessment will not only serve to assist policy-makers, students and researchers in learning the intricacies of nano-silver, but that it will also be a template for how an environmental risk assessment can be done for any present or future nanomaterial of interest.

Characterizing Cortical Actin Dynamics in the Drosophila Syncytial Blastoderm
Orr Rozov / Biological Sciences
Advisor(s): Brooke McCartney / Biological Sciences
Rangos 2 & 3 / Sigma Xi Group 2, 10:30am

In the Drosophila syncytial blastoderm, proper nuclear division is highly dependent on a number of coordinated cytoskeletal rearrangements including actin organization. During interphase, accumulation and organization of cortical actin into caps helps to align and space nuclei. In metaphase, these caps rearrange into rings, and localized actin polymerization drives the ingression of a pseudocleavage furrow, facilitating proper nuclear division. High-resolution time-lapse imaging can be used to assess dynamic actin behavior in syncytial embryos. Movies generated from wild type embryos display interphase actin caps with number of interesting dynamic morphological features, including filopodia-like projections. In contrast, movies generated from embryos mutant for proteins known to affect actin organization exhibit vastly different phenotypes. In analyzing morphological features of these actin caps, we hope to assess and characterize their behavior in order to better understand the mechanisms that underlie these developmental dynamics.

Detecting Gene Conversion Events in Multidomain Proteins
Tamar Melman / Biological Sciences
Advisor(s): Dannie Durand / Biological Sciences
Rangos 2 & 3 / Sigma Xi Group 6, 11:00am

The goal of my project is to study gene conversion events in multidomain proteins. Gene conversion is an abnormal DNA repair process that copies one sequence onto another closely related sequence. Unrecognized gene conversion events can cause evolutionary-tree-building algorithms to infer incorrect gene trees. I investigated whether this results in the homogenization of repeated domains in multidomain proteins, specifically focusing on the PDZ domains of the Membrane-associated Guanylate Kinases (MaGuKs). I used GeneConv, a program that takes in a sequence alignment and outputs possible gene conversion events, to detect gene conversion among the MaGuk family and looked at the effect of using the nucleotide sequence alignment over the amino acid alignment. My results lead to a better understanding of the evolution of the MaGuK gene family.

Development of an Intracellular Fluoromodule using the scFv K7 and Dimethylindole Red
Katherine Chen / Biological Sciences
Advisor(s): Peter Berget / Biological Sciences
Hoch Commons-2nd Floor, Rangos side / 12-2:30

The development of new biosensors that can be linked to proteins to track the protein's location and activity is still an ongoing area of research. In this project, an existing protein biosensor that is expressed on the cell-surface is manipulated so that it can be expressed inside of a cell. Once inside of a cell the biosensor can be used to mark any desired molecule for visualization. The biosensor consists of a protein and a dye molecule that only fluoresces when the dye binds to the protein. The protein component is a single chain variable fragment (scFv), which consists of regions of the variable heavy (VH) and variable light (VL) chains of an antibody, IgG. ScFvs are ideal protein components of biosensors because the VH and VL chains of IgG provide the molecule with an antigen recognition region. This region then allows the scFv to tightly bind specific molecules. The dyes used in this biosensor were selected because they only fluoresce when bound to a protein, such as an scFv. This research focuses on the scFv, K7-DIR, and the fluorogen, dimethylindole red (DIR). The binding of K7-DIR and DIR, cause DIR to fluoresce red, allowing for K7-DIR to be easily visualized. Additionally, K7-DIR is a particularly interesting scFv due to its ability to bind and cause several fluorogenic dyes to fluoresce varying colors.

Developmental Differences in Response of Arabidopsis thaliana to Thermal Stress
Tim Helbig / Biological Sciences
Advisor(s): Stephen Tonsor / University of PIttsburgh
Rangos 2 & 3 / Sigma Xi Group 2, 10:00am

Due to the likely increase in the frequency of days with extremely high maximum temperatures caused by anthropogenic climate change, there have been great efforts in trying to biochemically modify, through genetic alteration, crop plants to be thermally tolerant. However, this has proven to be far more difficult than initially intended with most attempts resulting in negligible outcomes; one likely reason for this is that, when modification is done, the developmental complexity of plants is frequently ignored. The physiological change that occurs within a plant that switches from vegetative to reproductive growth can be as profound as that experienced by a tadpole when it morphs into a frog, so this must be considered when trying (with costs in the range of millions of dollars) to alter the physiology of plants for our own benefit. Thus, the purpose of this project was to elucidate the physiological differences, if any, of the plant thermal stress

response at the selected stages of pure vegetative growth, bolting, flowering and fruit ripening and how stress at any of these stages might impact the overall fitness of the plant. This was done by exposing different strains of Arabidopsis thaliana to a set temperature deemed a thermal stress in growth chamber conditions at the selected developmental stages specified above and quantifying final plant size, yield of seed produced, total protein content following the heat stress and total Hsp101 content, a particular protein associated with the thermal response. While most quantitative measures are currently still being collected, there is preliminary evidence of substantial differences in how the plants respond to thermal stress at different life-stages and how it impacts their overall fitness.

Exploring Molecular Correlates of Primary Visual Cortex Development
Karen Akasaka / Biological Sciences
Advisor(s): Justin Crowley / Biological Sciences
Wean Commons-1st Floor, Connan side / 12-2:30

Collapsin Response Mediator Proteins (CRMPs) have been detected by the Crowley lab in two-dimensional differential gel electrophoresis screens exploring the spatio-temporal proteomic organization of primary visual cortex and the lateral geniculate nucleus (LGN). Based on these data, our hypothesis is that the CRMPs play a role in the development of the specific neural circuitry patterns such as ocular dominance columns, compartmentalization of the neocortex into areas and perhaps the lamination of the primary visual cortex. In order to explore this hypothesis we sought to determine the spatio-temporal distribution of CRMP2. CRMP 2 is known to play a role to guide axonal growth and to influence the dynamics of neuronal connections. Since ocular dominance columns have been noted to be detectable by about postnatal day 16 (P16) animals bracketing these ages were be used. Immunohistochemical staining was used to localize CRMP2 in these brain tissues and to visualize their expression patterns in situ. The images taken were used to reconstruct a three dimensional structure of staining in the brain to visualize CRMP2 expression patterns relative to the anatomical structures of the visual cortex. The reconstruction models were further quantified and analyzed to build a working model of the temporal expression pattern of CRMP2 in the developing brain.

Exploring the Structure and Function of an RNA-Editing Enzyme
Sefa Kploanyi / Biological Sciences, Amy Wang / Biological Sciences
Advisor(s): Mark Macbeth / Biological Sciences
Hoch Commons-2nd Floor, Window side / 12-2:30

The Macbeth lab studies the RNA-editing enzyme, adenosine deaminase that acts on RNA (ADAR) and the mechanism by which it catalyzes the deamination of specific adenosines in double-stranded mRNA (messenger RNA) substrates. mRNA is transcribed from DNA and serves as an intermediary template that travels out of the nucleus into the cytoplasm of the cell for protein synthesis. The product of the deamination reaction is inosine, which is read by ribosomes during translation as the nucleotide guanosine. The deamination of inosine to guanosine by ADARs is therefore a form of RNA-editing. There are many different types of RNA-editing that occur after transcription that results in a mature mRNA such as an addition of a poly-adenosine tail, guanine cap, and RNA splicing. The mechanism by which ADARs target certain adenosines for deamination is unknown; however, the lack of common sequence motifs among the known ADAR substrates suggests that the mechanism is dependent on structural characteristics of the RNA.

Lemon Draw - Ink Based drawing tool for tablet-pc
Rupinder Khandpur / Biological Sciences
Advisor(s): Ananda Gunawardena / Computer Science
Rangos Hallway, 2nd Floor / 12-2:30

Ink Based drawing application for small group collaborations on Tablet-PC. Under the supervision of Prof. Ananda Gunawardena , we have designed & developed a custom multi-Client framework, where users can share & collaborate drawings & sketches within their own group across an internet/intranet network. Transforming Lemon Draw to a distributed application for real-world scenario; where multiple students can access, share and collaborate in Lemon Draw over different networks. Lemon Draw is built in .NET framework 3.5 using Windows Presentation Foundation (WPF) as front-end and networking infrastructure uses Windows Communication Foundation(WCF)

Pen-It: An Online Collaboration Application Study
Honray Lin / Biological Sciences
Advisor(s): Roberty Kraut / Human Computer Interaction Inst.
Rangos 2 & 3 / Sigman Xi Group 7, 11:15am

Every day, millions of people around the world log into social networking websites to post about their lives, get in touch with friends, and connect with new people. However, there has been a lack of research on the specific features of online social collaboration that make such forms of interaction enjoyable. To do so, I have collaborated with a professor in the Human-Computer Interaction department to create Pen-It, an online collaborative

Facebook application that will seek to answer this question. In order to make any relevant research conclusions, the application needs a large sample of actively participating users. To this end, I will be showcasing the application and its features, in addition to posing several relevant research questions that could be explored with this application.

Plasti BoneTM: A Faster Way to Heal Bone and Cartilage in a Rabbit Radial Defect Model at 8 Weeks in Life
Brian Kim / Biological Sciences
Advisor(s): Sean McBride / Biomedical Engineering
Rangos 2 & 3 / Sigma Xi Group 2, 10:15am

Synthetic bone substitutes that provide adequate degradability, bone biocompatibility, and mechanical properties are greatly needed. Ideally, a bone substitute should provide sufficient mechanical stability and augment new bone formation by promoting osteoblast formation, cell attachment, proliferation, and mineralization. In addition, a bone substitute and its degradable byproducts should be non toxic. Two different types of poly(lactide-co-glycolide) (PLAGA) based scaffolds, conventional and fibrous monolith, were assessed in this study. Four experimental groups were created in which each scaffold was either left untreated or treated with the growth factor, Bone Morphogenic Protein-2 (BMP-2), known to induce bone formation. It was hypothesized that the scaffolds alone or in conjunction with BMP-2 would better induce bone formation in the implant site of a rabbit radius. Rabbit specimens were processed histologically and analyzed for key bone-implant biocompatibility factors such as cortical bone integration, implant degradation, and osteophilicity. It was found that fibrous monolith methods of preparing scaffolds displayed more extensive medial growth of new cancellous bone and cortical bone integration than those of the conventional scaffolds. Moreover, the BMP-2treated counterparts for both types of scaffolds showed better bone biocompatibility properties in nearly all areas of analysis. Furthermore, BMP-2 treated and untreated fibrous monolith scaffolds outperformed the conventional cohorts in many areas of biocompatibility, giving the impression that fibrous monolith scaffolds make for a better synthetic bone substitute.

Post-transcriptional gene silencing using siRNA delivered from Star Nanostructured Polymers
Joanna Hong / Biological Sciences
Advisor(s): Abiraman Srinivasan / Biomedical Engineering
Rangos 2 & 3 / Sigma Xi Group 2, 10:30am

BMP is pivotal for bone regeneration, as well as heterotopic ossification (HO). Knocking-down mRNA expression of osteoblast differentiation transcription factors, Runx2 and Osx, using anti-Runx2 and anti-Osx short interference Ribonucleic Acids (siRNAs) delivered into cells using degradable nanostructured star polymers to inhibit BMP induced osteoblast differentiation. The objective is to deliver siRNAs using nanostructured star polymers into osteoblast cells to inhibit BMP-2 induced osteoblast differentiation. We synthesized biodegradable cationic nanostructured star polymers with GRGDS moiety were prepared. MC3T3 cells were cultured in á-MEM and tested for cell cytoxicity. 10ìM of FITC conjugated control scrambled or Runx-2/Osx siRNAs were encapsulated into 15mg of degradable nanostructured star polymers. siRNA complexation with the nanostructured polymers were measured using zeta potential analysis. FITC conjugated control siRNA or Runx-2/Osx siRNAs encapsulated polymers were incubated with cells for 15min to 4 days and analyzed for transfection efficiency using FACS analysis, confocal imaging. Runx2 and Osx protein expression were analyzed using Western blot to determine mRNA knock down. The results of the Live/Dead cell staining and LDH assay showed degradable nanostructured star polymers were biocompatible and non-toxic. Zeta potential measurements showed siRNA complexation with cationic nanostructured star polymers. FACS and confocal imaging showed >95% transfection efficiency of nanostructured star polymers. Runx2 and Osx protein expression was significantly inhibited in MC3T3 osteoblast cells transfected with anti-Runx2/Osx siRNAs when compared to controls that received BMP-2 only.

Protein Kinase C Dependent Modulation of Dendritic Spine Dynamics
Shih-Dun Liu / Biological Sciences
Advisor(s): Justin Crowley / Biological Sciences
Rangos 2 & 3 / Sigman Xi Group 1, 10:15am

The protein kinase C (PKC) pathway has been identified as one of the many complex mechanisms involved in memory encoding. Artificial activation of PKC has been shown to produce effects similar to those observed during learning, in some cases leading to improved memory longevity or recall ability. Dendritic spine plasticity has been shown to play an important role in such effects. Increased dendritic spine plasticity may facilitate the formation of long-term memory by providing structural storage. We studied hippocampal area CA1, which is associated with learning and memory as well as synaptic plasticity, and primary visual cortex (V1), which is a primary sensory area and a model system for activity dependent plasticity. Our preliminary results suggest that similar

effects of PKC activation are present in mouse CA1 and V1 explored in vivo and in vitro. We are currently assessing the influence of simultaneously modulating neuronal activity as well as inhibiting PKC activation. To gather information on dendritic spine changes in neurons, we employ organotypic slice cultures from Thy1-eGFP transgenic mice. The slices are kept alive for 2 hours with sterile culture techniques for in vitro manipulations of PKC activity by its activator bryostatin, as well as neuronal activity. In vivo, bryostatin is injected on a regular schedule into the peritoneal cavity. In both cases, the fixed sections are imaged with two-photon microscopy to obtain images of pyramidal neurons in CA1 and V1. 3-D image datasets of the dendrites are reconstructed and annotated for dendritic spine locations to calculate spine density. Our preliminary in vitro results show that bryostatin increases dendritic spine density in both CA1 and V1. The GABA antagonist bicuculline increases neuronal activity level and dendritic spine density in CA1. Surprisingly, the PKC inhibitor Ro increases dendritic spine density in V1. Finally, our in vivo results suggest strong gender-and-age-specific effects on dendritic spine formation.

Putative regulation of NF2 gene product Merlin through PPM1B and PIP2
Prashanth Swamy / Biological Sciences
Advisor(s): Christina Lee / Biological Sciences
Rangos 2 & 3 / Sigman Xi Group 1, 10:30am

The neurofibromatosis type 2 (NF2) gene encodes the tumor suppressor merlin. Merlin is thought to oppose cell proliferation through integration of growth inhibitory signals and suppression of growth activators. Unpublished data in the Ip lab has shown that the merlin-PIP2 interaction is necessary for the membrane raft localization and growth suppressive functions of merlin. Furthermore, dephosphorylation at serine 518 leads to merlin's growth suppressive form. This study investigated the correlation between merlin serine 518 dephosphorylation and PPM1B, a putative merlin phosphatase. A secondary goal of this study was to support previous research in this lab by analyzing wild type and non-PIP2 binding mutant merlin using live-cell confocal microscopy. These results showed that PPM1B is a merlin serine 518 phosphatase, and that S518 dephosphorylation does correlate with PPM1B expression levels. Additionally, the live-cell confocal imaging supports previous data suggesting that PIP2 binding is most likely the basis of the membrane localization of merlin.

Studying the Effects of Site-Directed Mutants of APC2 in Drosophila Development
Fangyuan Zhouzheng / Biological Sciences
Advisor(s): Brooke McCartney / Biological Sciences
Rangos 2 & 3 / Sigman Xi Group 1, 10:45am

The Wnt pathway is a cellular signaling pathway that is present in numerous animals (humans and Drosophila included) and is involved in bodily processes such as embryogenesis and cancer. APC2, part of the destruction complex of the Wnt pathway, negatively regulates ß-catenin (Armadillo in Drosophila) and is mutant in 80% of colon cancer patients. In Drosophila, the regulation of ß-catenin is important for developmental processes such as denticle and wing formation. The similarities between Drosophila and human APC proteins and the relative ease of studying Drosophila development make Drosophila APC2 an ideal model system for studying the basic cellular functions of APC proteins. My project involves studying the effects of mutating and deleting various parts of APC2 on Drosophila survival rate and cuticle phenotypes. Our lab created homozygous transgenic flies that carry mutant versions of APC2 and has expressed these mutant forms in a genetic background completely mutant for APC2 or a genetic background mutant for both APC2 and APC1. Using functional assays during embryogenesis, we are asking whether these mutant forms retain wild type APC2 function, and if so, how much. The goal of this project is to determine which domains and specific amino acids of APC2 are necessary for proper Wnt signaling and Drosophila development.

Synthesis of a PNA with the Goal of Targeting Pu48, a Section of the Promoter Region of PDGF-A
Charles Miller / Biological Sciences
Advisor(s): Bruce Armitage / Chemistry
Dowd / 4:40

Platelet Derived Growth Factor-A (PDGF-A) is a gene overexpressed in numerous diseases and cancers. A recent paper found that a promoter region of PDGF-A, Pu48, forms a G-quadruplex structure spontaneously. Peptide Nucleic Acids (PNAs) have been previously found to specifically (and favorably) target these structures, and are believed to inhibit the activity of the DNA sequence they bind to. The goal of this project was to synthesize a PNA which would specifically bind to Pu48, and inhibit its activity (although this in vivo testing is outside the scope of this project, it is considered as a logical continuation of the project later on). The process of synthesis, as well as the resulting study of the binding specificity and strength of the synthesized PNA, are discussed.

The Effect of Adenomatous Polyposis Coli Disruption on Drosophila Pupal Wing Development
Kellie Kravarik / Biological Sciences
Advisor(s): Brooke McCartney / Biological Sciences
Rangos 2 & 3 / Sigma Xi Group 1, 11:15am

Adenomatous Polyposis Coli (APC) is a negative regulator of the Wnt signal transduction pathway and a tumor suppressor whose mutation is implicated in 50-80% of human colon cancers. To better understand the effects of APC inactivation in tissue morphogenesis and colon cancer development, the McCartney Laboratory examines patches of APC mutant tissue, known as APC null clones, in the developing Drosophila melanogaster wing. APC null clones undergo diverse changes in tissue shape and proliferation throughout wing development. Surprisingly, we have also shown that clone frequency is significantly higher in the larval disc than in the adult wing. To ask if programmed cell death is responsible for a loss of APC mutant tissue during pupal development, I am assaying for apoptotic tissue using terminal dUTP nick-end labeling (TUNEL). I am also continuing a characterization of APC null wing tissue throughout the pupal stage to determine if these cells are undergoing an epithelial to mesenchymal transition, and what relationship this may have to cell death. Finally, I am continuing an assessment of the role of ectopic Wnt signaling in producing the APC null tissue phenotype by independent molecular manipulation of the pathway. This comprehensive characterization of the loss of APC in the pupal wing epithelium will contribute to our understanding of tissue morphology and help us to understand the cellular changes that may accompany the development of colon cancer.

The Effect of Secure Base Support During a Challenging Independent Activity
Lauren Giesey / Psychology, Christine Jones / Biological Sciences &
Laura Pacilio / Psychology
Advisor(s): Brooke Feeney / Psychology
Kirr Commons-1st Floor, Window side / 12-2:30

Our study addressed the question: How does encouragement from one's spouse or lack thereof influence self perceptions, perceptions of one's partner, and performance while engaging in a challenging independent activity? Our sample was composed of forty married couples recruited from the Pittsburgh area. For the activity of interest, after the couple members completed background questionnaires and played a short game together, one couple member (called the "Explorer") was asked to work on a challenging puzzle activity on their own, while their partner worked on an easier task in a separate room. Spousal support was manipulated as follows: Immediately prior to working on the puzzle activity, the Explorer received a note written in their partner's handwriting containing either an encouraging, discouraging, or neutral message. A no-note control condition was also included. The Explorer was then videotaped during the challenging activity, and those tapes will be coded for performance on the activity, as well as the amount of excitement, engagement, and frustration shown during the activity. Following the challenging activity,

the Explorer completed several questionnaires assessing their feelings about the activity, their feelings about their partner, and their self-perceptions. We hypothesized that Explorers who received encouraging notes from their partners would perform better on the activity, report more positive feelings about the activity, report more positive feelings about their partner, and report more positive self-perceptions compared to Explorers who received discouraging or neutral notes. Our study will help shed new light on the effects of secure base support on self perceptions, perceptions of the partner, and performance on a challenging independent activity. It will also help to inform professionals in the field who help others build stronger and healthier relationships.

The role of the heat-shock protein Hsp27 on programmed cell death in Drosophila melanogaster
Elizabeth Young / Biological Sciences
Advisor(s): Jonathan Minden / Biological Sciences
Kirr Commons-1st Floor, Window side / 12-2:30

Apoptosis, or programmed cell death, is an essential process responsible for eliminating extraneous cells during development, and limiting the progression of tumors in the adult. Failures in these processes can cause developmental defects, and could ultimately result in cancer. Therefore, a complete understanding of the molecular mechanisms of apoptosis is crucial. The molecular mechanisms of the apoptotic pathway are fairly well conserved across species, including Drosophila. This conservation of the signaling cascade in Drosophila, coupled with the myriad genetic tools available in this model organism, makes the fruit fly an ideal system to study this process in greater detail. While the apoptotic pathway in Drosophila is well understood, several unanswered questions remain. Foremost, an understanding of apoptotic pathway activation and regulation remains incomplete. To provide additional insights into the details of apoptotic signaling, our lab performed a proteomic screen to identify protein changes that occur when embryonic cell death is increased. We identified that an isoform of the pleiotropic heat shock protein Hsp27 is increased when cell death is upregulated. siRNA-mediated knock-down of Hsp27 in embryos lead to a lack of cell death as visualized by Acridine Orange (AO) staining. While our findings from the proteomic screen and siRNA knockdown of Hsp27 indicate that Hsp27 plays a pro-apoptotic role during development, previous reports have shown that Hsp27 can play both anti- and pro-apoptotic roles in vitro. To address how Hsp27 functions in vivo, I have engaged in studies of Hsp27.

Towards the Understanding the Dye Activating Mechanism of Fluorescence Activating Proteins (FAPs)
Natalie Straight / Biological Sciences
Advisor(s): Peter Berget / Biological Sciences
Rangos 2 & 3 / Sigma Xi Group 2, 10:45am

Fluorescence activating proteins (FAPs) bind and activate a fluorogenic dye that is otherwise nonfluorescent in solution. Because of the wide variety of dyes to which they bind and their ease of manipulation, FAPs are used as platforms to engineer in vivo sensors for cellular events. While these have proven to be powerful research tools, we have yet to elucidate the exact mechanism of fluorescence activation. By determining exactly which amino acids in the protein are responsible for dye binding and activation, we should be able to better understand this mechanism. Furthermore, we may be able to alter these residues in such a way to maximize the FAPs affinity for its dye and subsequent quantum yield.

Understanding the Role of Protein DRS1 in Ribosome Assembly
Lynley Doonan / Biological Sciences & Anna Park / Biomedical Sciences
Advisor(s): John Woolford / Biological Sciences
Hoch Commons-2nd Floor, Window side / 3-5

To further expand our knowledge of ribosome assembly in Saccharomyces cerevisiae we are focusing on the protein Drs1. Drs1 is a nucleolar DEAD-box protein and a ribosomal assembly factor essential for the production of 60S ribosomal subunits. To understand the function of Drs1 in ribosome assembly we are taking a genetic approach. We will perform a synthetic lethal (sl) screen to look for mutations that, in concert with mutant drs1 alleles, cause lethality. By looking for mutants that are sl with drs1, we are hoping to characterize the role of Drs1, which we believe to be an RNA-dependent ATPase, while also further understanding its role in ribosome biogenesis. To conduct the sl screens we will create mutants using UV irridation to exaggerate the phenotype of the yeast cells of interest through a colony color assay. These mutants will then be screened using various selective media to confirm the presence of a synthetic lethal mutant. Bona fide mutants will be characterized by several tests to identify the gene product from which they originate. Growth assays, spotting tests, and sucrose gradients will also be conducted on the mutants in order to determine if the mutants are cold-sensitive, temperature-sensitive, and if the sl mutation has an effect on ribosome assembly. We will repeat these procedures until we have saturated our search for mutations synthetically lethal with mutations in DRS1.

CHEMISTRY

An investigation of the neutral and charged detection limits for the MALDI-TOF ionization of protein ions and their fragments using an energy sensitive cryodetector
George Leonard / Chemistry
Advisor(s): Mark Bier / Chemistry
Rangos 2 & 3 / Sigma Xi Group 3, 10:15am

We have investigated the metastable fragmentation of ions by isolating the neutral species produced in the flight tube during the MALDI-TOF process by applying a deflection voltage post-source. Because the neutrals are formed post-source, they maintain the same velocity and time of flight as their charged counterparts, so mass spectra of only the neutral species of an analyte molecule can be obtained. These neutrals-only spectra have been obtained for several high mass proteins and are contrasted with their respective complete spectra.

Antisense Oligonucleotide Approach in Targeting Toxic CUG Repeat in Myotonic Dystrophy1
Hyemin Yoo / Chemistry
Advisor(s): Danith Ly / Chemistry
Rangos 2 & 3 / Sigma Xi Group 2, 11:00am

Myotonic Dystrophy 1(DM1) is the most common neuromuscular disease in adults. In addition to muscle weakness and mental retardation, congenital form of DM1 makes it a serious disease. DM1 is caused by an extended CUG repeat RNA transcribed from CTG repeat in DMPK gene, which binds to an alternative splicing factor, MBNL1. This complex sequesters in the nucleus, prohibiting the normal function of the MBNL1. Previous studies showed that reversing this sequesteration may alleviate the symptoms of DM1 through antisense oligonucleotide approach. We synthesized series of PNAs as an antisense oligonucleotide to target the toxic RNA and releasing the MBNL1 for its normal function. Through melting studies, we found an optimal PNA that gives the best affinity towards a toxic RNA and showed that this PNA worked successfully as an antisense oligonucleotide to release the MBNL1 from the complex.

Atmospheric Pressure Thermal Dissociation of Protein Using Electrospray Ionization Mass Spectrometry
Suhl A Choi / Chemistry
Advisor(s): Mark Bier / Chemistry
Hoch Commons-2nd Floor, Rangos side / 3-5

A protein is a group of amino acids linked together by peptide bonds. Conventional protein analysis by mass spectrometry (MS) requires protein digestion using enzymes to catalyze the cleavage of specific peptide bonds to generate smaller fragments of the protein prior to the analysis. These fragments are then analyzed by a MS or Edman degradation. Although this analysis method works well in most conditions, the current method requires a long degradation time. The degradation might take couple hours to couple days. This proposed research project is the continuation of a study directed at a new protein- synthesis method that generates protein fragments without using enzymes for the protein degradation reaction. This top-down analysis of proteins by mass spectrometry involves the addition of positive charges on the protein molecules, fragmentation, and the mass analysis of the protein fragments in the gas phase. Thus, the top- down analysis is a thermal dissociation approach, where a protein is ionized by electrospray ionization (ESI) and sprayed into a stainless steel tube that is electrically heated to induce fragmentation. The fragments at the atmospheric pressure enter the mass spectrometer for m/z (mass to charge) analysis. This methodology will be further developed to provide information on protein identification, protein modification, metal content, and three- dimensional structures.

Characterization of Carbon Nanotubes for Transparent Electrodes
Jane Herriman / Chemistry
Advisor(s): Lisa Porter / Chemistry
Hoch Commons-2nd Floor, Rangos side / 3-5

Future solutions to global energy needs will require a variety of alternative energy conversion devices, such as organic photovoltaics (OPVs), which are being pursued as a versatile and inexpensive energy source. In current OPVs indium-tin-oxide (ITO), is the primary material used for the electrodes. Important characteristics of materials for OPV electrodes include transparency, low resistivity, resistance to mechanical failure, and low cost. While ITO is transparent and conductive, it is relatively brittle and expensive. Single-walled carbon nanotubes (SWNTs) are an alternative transparent electrode material. A carbon nanotube is essentially a single atomic layer of graphite (graphene) in the form of a cylinder. In this research we are characterizing electronic and optical properties of SWNTs that have been prepared in the form of thin film networks or aerogels. Our results on optical

transparency measured using UV-vis spectroscopy and four-point probe resistivity measurements will be presented. In future studies we plan to investigate the contact resistance of SWNT networks when incorporated in OPV-related devices, to determine whether SWNTs can serve as more efficient, cost-effective, and durable electrodes.

Emission Properties of sexithiophene Monomers and Aggregates
Hye Yun Han / Chemistry
Advisor(s): Linda Peteanu / Chemistry
Hoch Commons-2nd Floor, Rangos side / 12-2:30

In this research, I will be examining the emission properties of sexithiophene which have a property of conductivity. Technology has been developed in the field of organic electronics to improve the performance of electronics and other optical devices. Compared to traditional electronics which use inorganic semiconductors, organic electronics are composed of conductive polymers, which are cheaper, thinner, and more flexible. To improve the quality of organic electronics, the development of molecules that can perform better than common inorganic semi-conductors is fundamental. Thus, investigating conductive polymers with high chemical and electrochemical stability is important in order to understand what types of molecules and chemical behaviors work optimally in organic electronics. Once properties and chemical behavior of the conductive polymers are understood, the other organic molecules with similar behaviors and aggregation type can be further explored. Due to its chemical stability, polythiophene is one of the important components in organic electronics. By studying the chemical properties of sexithiophene, an oligomer of polythiophene with less defects, the quality of organic electronics can be improved and other conducting polymers can be further developed.

Endocytic Drug Delivery by a Chloroquine Derived Oligomer
Sheldon Cheung / Chemistry
Advisor(s): Danith Ly / Chemistry
Rangos 2 & 3 / Sigma Xi Group 3, 10:30am

There are many drugs that have the potential for solving many of today's genetic disorders left without answers. However, their scientific progression has been hindered by their inability to enter cells and get to their target destination. It has been discovered that polyarginine enters cells through endocytosis and is trapped in the endosomes. Yet, once inside, it cannot escape these endosomes. This project hopes to elucidate whether the addition of a oligomer with a chloroquine derivative will help it escape the endosomes. The acidic nature inside the lysosomes can be buffered by the chloroquine. This will destabilize

the endosome and rupture it, allowing the drug to escape. This project entails synthesis of the monomers with chloroquine derivative, synthesis of the oligomers, and in vitro analysis.

Inkjet Printing of Organic Semiconductors and Metalizing Inks for use in Fabricating Electronic Devices
Jacob Mohin / Chemistry
Advisor(s): Tomasz Kowalewski / Chemistry
Rangos 2 & 3 / Sigma Xi Group 4, 11:00am

The potential benefits of printed electronics are varied and exciting, considering the vastly increasing consumer market for electronics in every corner of daily life. Inkjet printed electronics offer a cheap, decentralized and environmentally friendly way to produce electronics that can be flexible, disposable, and easily made. Modern electronics require both semiconductors and fully conducting wires and contacts, both of which are being developed for printed applications at Carnegie Mellon University in the form of semiconducting organic polymers and metalizing inks. The optimization of these compounds for process control, performance, and feasibility of inkjet printing has not yet determined, a hole this research seeks to fill.

Investigation of Cr3+-doped cesium aluminum sulfate crystals as an internal standard for electron paramagnetic resonance spectroscopy
Andrew Weitz / Chemistry
Advisor(s): Michael Hendrich / Chemistry
Hoch Commons-2nd Floor, Window side / 3-5

Electron Paramagnetic Resonance (EPR) spectroscopy is a valuable tool in analyzing the electronic structure of metal containing enzymes. The signal intensity is proportional to the concentration of the sample being studied. The ability to accurately measure species concentrations directly from EPR spectra is of fundamental importance. This requires the use of a standard of known concentration to provide a quantitative relation between the signal strength and sample concentration. In addition, this same standard can be used to calibrate instrumental temperature, provided that the standard and sample can be measured simultaneously. The use of an internal standard will greatly reduce uncertainties in determinations of species concentrations and sample temperatures. In this project, several potential standards are grown as crystals, with evidence suggesting that Cr3+ doped in a Zn(Maleate)2•4H2O will prove to be an ideal choice.

Optical Properties of Dye-Labeled DNA Gold Nanoparticle Constructs
Honesty Nam / Chemistry
Advisor(s): Linda Peteanu / Chemistry
Rangos 2 & 3 / Sigma Xi Group 3, 10:45am

The proximity of metallic nanoparticle surfaces to dye molecule has become a great deal of interest in order to enhance or quench fluorescence intensity of dye molecule. Especially, gold nanoparticles(AuNPs) have gained widespread attention due to their dimensional similarities with biological molecules. Gold nanoparticles have been chosen among many metallic nanoparticles due to its large extinction coefficients(105cm-1M-1), stability, unfluctuating signal intensities, and resistance to photobleaching. Two different schemes of AuNP bioconstructs were prepared by attaching AuNP to the opposite ends, 5' and 3' ends, of ds DNA with a same sequence. The distance between AuNP and dye for 5' and 3' samples are 44.2A and 125.8A respectively. It has been hypothesized that 3' sample will demonstrate better quenching efficiency compared to 5' sample. The gold nanoparticle used in the experiment is Au25 which has two peaks, 650nm and 450nm and gives a good energy transfer results with dyes. Four different dyes, YOYO-1, YOYO-3, TOTO-3, and Click4 were used in order to check the fluorescence of the samples. The emission spectrum of 5' and 3' samples which indicate the location of 5nm AuNP showed that the quenching efficiency of 5' and 3' samples were 30.7% and 21.3% respectively. The quenching data using Au25 was not as good as expected since Au25 was fairly small (~1nm).

Reinventing Alchemy: Novel Metalizing Inks for Use in Printed Electronics Fabrication
Rebecca Potash / Chemistry
Advisor(s): Richard McCullough / Chemistry
Rangos 2 & 3 / Sigma Xi Group 4, 10:00am

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Strategic Gene Targeting and Phenotypic Assessment of Telomerase Enzyme Gene in Plasmodium Berghei
Suet Yin Sarah Fung / Chemistry
Advisor(s): Kausik Chakrabarti / Chemistry
Rangos 2 & 3 / Sigma Xi Group 1, 11:00am

Plasmodium berghei Telomerase is a ribonucleoprotein that controls the synthesis of telomeric repetitive ends of chromosomes in Malaria parasites of Thicket rats. Telomeres, the natural ends of eukaryotic chromosomes, are essential for the protection of chromosomes from end-to-end fusions, recombination, and shortening. These telomeric caps are thus responsible for enhancing genomic stability of the human malaria parasites. In this project, a double homologous recombination method had been used to knock-out a specific gene sequence that coded for telomerase enzyme in Plasmodium berghei. This procedure is beneficial because it only requires one digestion and ligation step. Two sequences upstream and downstream of the telomerase gene were amplified using Polymerase Chain Reaction (PCR) into one fused product that would be inserted into B3Dred vector. This vector also coded for a fluorescent protein that would help monitor parasite growth in its cell cycle once it had been transfected. Once the telomerase gene had been successfully knocked-out, it would be possible to understand more clearly regarding the significance of telomerase's role in Plasmodium berghei gene expression, cell growth and survival by doing phenotypic assays for the telomerase gene knockout parasites.

Synthesis and Analysis of Branched Nucleic Acids
Julian Kessler / Chemistry
Advisor(s): Subha Das / Chemistry
Kirr Commons-1st Floor, Window side / 3-5

Branched RNA is a mimic of the lariat intron that is produced during RNA splicing. This project is to develop methods to synthesize and analyze synthetic branched RNA and DNA. The use of a nucleotide analogue that contains a 2'-O-protecting group that is photolabile will permit solid phase synthesis of a branch following UV deprotection of the photolabile

group. The UV deprotection and characterization of the branched RNA (and DNA controls) will be performed via HPLC and gel electrophoresis.

Synthesis and Analysis of Gold Nanoclusters
Kathryn LIvingston / Chemistry
Advisor(s): Linda Peteanu / Chemistry
Hoch Commons-2nd Floor, Rangos side / 12-2:30

This will be a presentation on the synthesis, characterization, and analysis of gold nanoclusters.

Telomerase RNA in Trypanosoma Brucei
Min-A Park / Chemistry
Advisor(s): Kauski Chakrabarti / Chemistry
Rangos 2 & 3 / Sigma Xi Group 2, 11:15am

Trypanosomatid parasite infections have a devastating impact on human health. Little is known about the requirements for parasite growth during any state of their complex life cycle. Telomeres are specialized RNA-protein complexes that stabilize chromosome ends, protecting them from nucleolytic degradation and illegitimate recombination. These structures might have critical roles in enzyme catalysis in Typanosoma brucei. The hypothesis of the project is that if RNAi gene silencing mechanism successfully silences the telomerase RNA expression, the telomerase can no longer function to cap telomeres and consequently the length of telomeres will shorten by time. Therefore, the parasite will lose their antigenic genes (VSG) located at chromosome ends and eventually the infectivity and survival of the parasite will be at risk. The telomerase RNA was recently mapped using Rapid Amplificatin of Complementary DNA ends (RACE) technique. Based on the map, RNA interference (RNAi) was designed and prepared to successfully knockdown telomerase RNA in Trypanosoma brucei. To prepare RNAi vectors, DNA fragments specifically designed for RNAi were cloned into pZJM vector. The RNAi vector was transfected into the parasite and the consequence will be be analyzed within few weeks.

Why Buggy?: Documentary Film Project
Erin Gantz / Chemistry
David Kinskey-Lebeda / Civil and Environmental Engineering &
Advisor(s): Timothy Haggerty / Undecided
McConomy Auditorium / 10:00-11:00

Buggy is a longstanding tradition on Carnegie Mellon's campus, inspiring students to awaken on weekends before the sun rises to send individuals racing up and down hills in a vehicle that resembles a torpedo on wheels. The question that those not involved in the activity must ask, is "why?" We created a video documentary on the subject of Buggy, focusing on one specific organization, the Carnegie Involvement Association. No documentary has been presented on Buggy thus far, and this video narrative will show viewers not only what Buggy is, but give them an appreciation for why students become so dedicated to this sport which combines athleticism with science and technology.

MATHEMATICS

Ceiling Shower Orifice Plate
Margaret Cruickshanks / Mathematics, Morgan Heskett / Materials Science Engineering & Celia Ludwinski / Chemical Engineering
Advisor(s): James Schneider / Chemical Engineering
Hoch Commons-2nd Floor, Rangos side / 12-2:30

In recent years, society has become fixated on the attempt to stop the overuse of natural resources, such as fresh water. However, many people do not wish to give up luxuries, even those as mundane as a high-pressure shower. It is our hope to create a shower that uses plates with orifices of varying size in order to provide people with the water pressure of their choice while using the same volume of water. This would not only help the environment and the budgets of consumers, but would still maintain their expectations for an enjoyable shower. We also hope to integrate this design into the ceiling of the bathroom for multiple reasons. Not only could all users experience a more natural shower imitating that of a waterfall, but residents of taller builds could more comfortably utilize the appliance.

Ceiling Shower Orifice Plate
Margaret Cruickshanks / Mathematics, Morgan Heskett / Materials Science Engineering & Celia Ludwinski / Chemical Engineering
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Hoch Commons-2nd Floor, Rangos side / 12-2:30

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Correcting Aperture Bias for Star Formation History Estimates
Da Jeong Ha / Mathematics, Hyemin Lee / Statistics & Kunho Lee / Mathematics
Advisor(s): Brian Junker / Statistics & Cosma Shalizi / Statistics
Wean Commons-1st Floor, Connan side / 12-2:30

The method of using spectra to estimate various star formation history ("SFH") parameters for distant galaxies is often insufficient for usage in astronomical research. For some galaxies, the spectral aperture is smaller than the angular extent of the galaxy, meaning that the spectrum will fail to capture some of the galaxies' light. In this case, the SFH parameters measured using such spectra will often be inaccurate, and such discrepency between the true SFH parameters and their spectral estimates is called aperture bias in SFH estimates. In this project, we present a method that corrects aperture bias in three SFH estimates: the current star formation rate of each galaxy, the average ages and the average metallicities of the stars within the galaxy. Specifically, we model each SFH parameter that was estimated from the spectrum as a function of the four photometric colors measured in the region seen by the spectrum. Using this model, along with the photometric colors of the light missed by the spectrum, we correct the SFH estimates for their aperture bias. We use the spectral SFH estimates and the Sloan Digital Sky Survey photometry from a sample of 50,000 galaxies.

Improving Writing Assessment with Statistical Techniques
Jason Hwa / Statistics, Belle Peng / Buisness Administration,
Antonios Tavlarakis / Mathematics & Samuel Ventura / Mathematics
Advisor(s): Cosma Shalizi / Statistics
Wean Commons-1st Floor, Connan side / 3-5

Due to the excessive demand of learning English in China, English teachers and professors find themselves overwhelmed by classroom size. This makes it difficult for them to provide

each individual student with quality feedback and in turn limits the student's ability to learn. Dr. Kaufer, a professor of English at Carnegie Mellon University, has helped develop a text-analysis software called DocuScope to aid teachers in providing quick feedback to their students. Currently, DocuScope reads in a collection of writing assignments and categorizes the words into 40 different dimensions. Using these dimensions, our tasks are to automate the use of statistical techniques to highlight how the students write similarly, how they are unique, and how they compare to a benchmark of standard English writing. An additional goal of ours is to make our analysis interpretable for teachers and students untrained in statistics. Using a training set of 98 essays written by Dr. Kaufer's Chinese students, we explored various clustering, classification, outlier detection, and dimension reduction techniques.

Intelligible Collapse of Formal Proofs and Computer Support for Informal Proof Construction
Adam Conkey / Mathematics
Advisor(s): Wilfried Sieg / Philosophy
Hoch Commons-2nd Floor, Window side / 12-2:30

Establishing the legitimacy of a theorem from within a formal system is done by means of a formal proof. Such proofs, however, can be lengthy and enigmatic, making them impractical in an educational context. My research is directed towards developing an effective mode of proof presentation by exploring how informal proofs can be formulated systematically to reflect the structured presentation of formal proofs, and how formal proofs can be made more intelligible by the introduction of informal rules and lemmata. My research is applied directly to proofs in axiomatic set theory and is pursued within the framework of The AProS Project, where researchers are developing a Proof Lab, an electronic learning environment for students to construct proofs interactively, and AProS, an automated theorem prover for first-order logic and set theory. My discoveries will be implemented in the lab so that students can formulate clear and concise arguments, and in AProS so that generated proofs are intelligible to those reading them. In particular, my results will be applied to the formal derivation of the Cantor-Bernstein theorem, for which an automated proof in AProS is currently being pursued.

Modeling Ultrasound Imaging in Cardiovascular Tissue
Sona Akopian / Mathematics
Advisor(s): Mansoor A. Haider / North Carolina University
Kirr Commons-1st Floor, Window side / 3-5

Existing clinical imaging procedures for detection of atherosclerosis in humans are invasive and expensive. Experimentalists are investigating a new, noninvasive method based on ultrasound imaging to detect atherosclerosis in its earlier stages. This method involves focusing an Acoustic Radiation Force Impulse (ARFI) at a target location in the arterial wall tissue and observing the propagation of the resulting wave. Because a plaque region in an artery has a greater stiffness as compared to normal tissue, propagation of the ARFI induced pulse (e.g. shape, propagation, speed etc.) is affected. In this project, computational models for elastic wave propagation in ARFI imaging were developed based on use of finite difference methods for the wave equation. Several types of inhomogeneities that model the presence of an atherosclerotic plaque were considered. The models were used to analyze experimental data and to determine the extent to which material parameter maps can enhance detection of atherosclerosis. Research was done in Summer 2009 at North Carolina State University, in collaboration with Caitlin E. Iles (Bryn Mawr College), William R. Woodruff (Morehouse College), Dr. Mansoor Haider (NCSU faculty, mentor), Kimberly Spayd (NCSU graduate assistant).

Pizza Consumption and Preference of CMU Undergraduate Students
Augmentation and Rehabilitation
Stafford Brunk / Self-defined,
Atishe Chordia / Mechanical Engineering,
SeungJin Park / Economics and Statistics,
Tony Poor / Computer Science &
Henry Wu / Mathematics
Advisor(s): Brian Junker / Statistics
Kirr Commons-1st Floor, Window side / 12-2:30

We are conducting a consumer survey of Carnegie Mellon students in order to learn about their pizza consumption behaviors. We have utilized a post-stratified random sample of 800 undergraduate students from the CMU directory, emailing them a Google Docs-powered survey (with the offer of an Amazon gift card raffle to increase the response rate). Our survey hopes to gain insight on the current consumption behaviors and motivations of CMU undergrads, including issues like when students generally want to order pizza, the impact of DineXtra or PlaidCa$h in their decisions, and what other characteristics (cost, quality, quantity, location, etc.) are most important to them. These results may be used by local businesses and Carnegie Mellon dining venues, improving both their business and marketing abilities as well as the satisfaction of CMU students.

Testing Partially Ordered Knowledge Structures from Student Response Data
Stephanie Sharick / Mathematics
Advisor(s): Brian Junker / Statistics
Hoch Commons-2st Floor, Window side / 3-5

We have an algorithm to construct partially ordered knowledge structures from simulated student test data. Given a set of questions requiring a specific set of skills, we can use these structures to predict the relationships among questions. In particular, we want to know which questions serve as prerequisites for other questions. This information is useful in predicting student test scores based on previous performance and in determining weak areas in which further tutoring is required. It has been determined that the algorithm behaves better under certain conditions related to student skill sets. We examine under what conditions the algorithm functions efficiently and under what conditions it fails.

PHYSICS

Applications for Highly Uniform Micro-Cavity Arrays in Flexible Elastomer Film
Shaun Swanson / Physics
Advisor(s): Shelley Anna / Mechanical Engineering
Hoch Commons-2st Floor, Window side / 3-5

Simple experiments were designed to answer key scientific questions regarding the viability incorporating micro-cavity arrays into Dye-sensitized Solar Cells (DSSC) and Polymer-Dispersed Liquid Crystal (PDLC) Displays. The micro-cavities were intended to improve red-light absorption in DSSCs through the use of whispering-gallery modes, while the PDLC's properties were to be enhanced through the mono-dispersity that liquid crystal-filled arrays could provide.

Diffusion of enzyme into DNA nanopatches occurs from the side of the patch
Anastasia Kurnikova / Physics
Advisor(s): Dr. Matteo Castronovo / Temple University
Rangos 2 & 3 / Sigma Xi Group 3, 10:00am

DpnII restriction enzyme reactions within DNA nanostructures on flat gold films were studierd by atomic force microscopy (AFM). Patches of DNA self assembled monolayers (SAMs) were lithographically fabricated within alkylthiol SAMs by AFM nanografting. The technique involves applying a force to a region of the monolayer to displace alkylthiol molecules while in a solution of thiolated ssDNA, and then later hybridizing the DNA. The packing density of DNA within a patch was controlled by the grafting parameters, specifically the number of iterarions of applying a force over a given area, or the concentration of DNA in solution during grafting. The reaction of the enzyme was accessed by considering the height profile of the DNA patches before and after reaction. DpnII is a restriction enzyme that functions to cut a hybridized DNA strand at the restriction site. For this study, DpnII-active DNA strands of 44 base pairs had a single restriction site at one half the height of the strand, therefore reaction with the enzyme was observed as a reduction in the height of the patch. A previous study has shown that enzyme activity is inhibited at high packing density; specifically the reaction can proceed only in the range in which the space between adjacent DNA molecules is larger than to the size of the enzyme. This study establishes that the reaction is inhibited for a low density patch in a high density surrounding structure of control segments, which demonstrates that the enzyme can diffuse into the patch from the side but not from the top, likely due to steric effects. Additionally, the reaction is inhibited by a highly packed structure even at a small width of 30nm, demonstrating that the rate of diffusion through a highly packed structure is arrested dramatically or completely.

Effects of the Bioflavinoids Genistein and Daidzein on DOPC Lipid Membrane Structure and Interactions
Yuriy Zubovski / Physics
Advisor(s): Stephanie Tristam-Nagle / Physics
Rangos 2 & 3, Sigma Xi Group 1, 11:30am

Phospholipids form lipid bilayers which are the underlying structure of every plant and animal cell membrane. In this work we studied one phosphatidylcholine lipid, DOPC (diC18:1PC). DOPC was x-rayed using synchrotron radiation at CHESS (Cornell) with varying concentrations of bioflavinoids. In addition to a specific interaction with estrogen receptors, it was shown that genistein, but not daidzein, dramatically increases ion channel lifetimes and their rates of formation (Biochemistry 42:13646 (2003)) especially when there is a hydrophobic mismatch between the membrane and the channel. In that work it was suggested that genistein alters the bending modulus of lipid membranes. By using liquid-crystal theory analysis in the Nagle Lab, I determined the bending modulus, Kc, and

the compressibility modulus, B, for DOPC as a function of concentration of bioflavonoid (5, 10, 15, 20 mole%). I also determined the form factor for DOPC with each bioflavonoid at 20 mole%, and entered it into the H2 computer fitting program to determine the electron density profile of DOPC with genistein or daidzein. I found that while daidzein tends to localize at the phosphate group, genistein penetrates deeper to the glycerol-carbonyl region of the headgroup. This structural difference could account for daidzein's ability to lower KC (increase bending) to a greater extent than genistein.

Formation Control in a Low-Cost Robot Colony
Jaime Bourne / Mechanical Engineering,
Austin Buchan / Electrical & Computer Engineering,
Megan Dority / Mechanical Engineering,
Emily Hart / Electrical & Computer Engineering,
Christopher Mar / Electrical & Computer Engineering,
Evan Mullinix / Electrical & Computer Engineering,
Bradford Neuman / Computer Science,
Nicole Paris / Electrical & Computer Engineering,
David Schultz / Physics,
John Sexton / Electrical & Computer Engineering &
Bradley Yoo / Electrical & Computer Engineering
Advisor(s): George Kantor / Robotics Institute
Rangos 2 &3 / Sigma Xi Group 5, 10:00am

Formation control, as it applies to the field of mobile robotics, is having robots maintain a certain distance and orientation between each other as they move as a group throughout an environment. This can be a simple and effective method of coordinating the movements of multi-robot systems and has several applications. Through this proposed research, the Colony Project will investigate how the principles of formation control apply to a colony of low-cost robots. In an attempt to develop a flexible research platform for formation behaviors, we will explore how formation control can enhance the movement and sensory capabilities of our robot colony. This work is a continuation of previous Colony Project research and will serve as a foundation for future research within the Robotics Club

The Entropy of Tilings Representations of Quasicrystals
Maxwell Hutchinson / Physics
Advisor(s): Michael Widom / Physics
Rangos 2 & 3 / Sigma Xi Group 3, 11:15am

Quasicrystals can be modeled as rhombic tilings of octagonal spaces in two dimensions. The size of the state-space of tilings is related to the entropy of the quasicrystal, making their enumeration of valid tilings as relevant as it is challenging. Various computational techniques yield improvement in pre-existing algorithms, exposing previously intractable problem sizes. The entropy density converges in the limit of large tilings of constant shape, allowing the practical application of these techniques to large systems. The relationship of the entropy density to the shape is found to be approximately Gaussian with respect to the logarithm of the ratio of edge lengths.

SCHOOL OF COMPUTER SCIENCE

COMPUTER SCIENCE

Advantages and Disadvantages of a Garbage Collection-Aware Kernel
Kevin Murphy / Computer Science
Advisor(s): Greg Ganger / Electrical and Computer Engineering
Rangos Hallway, 2nd Floor / 12-2:30

Garbage collection is a technique that moves the responsibility of memory management from the programmer to the runtime system. My research explores whether or not there are any significant gains or losses in performance if an operating system's kernel takes part in the decision of when to run a garbage collection cycle in garbage collected applications. Garbage collection is usually a time-consuming process, and the kernel knows more about whether memory is running short. My experiments measure the performance of Python, a garbage collected scripting language, on a MINIX operating system with and without kernel awareness of garbage collection.

Allowing Node Failures in a Fast Array of Wimpy Nodes (FAWN)
John Ferris / Computer Science & Amar Phanishayee / Computer Science
Advisor(s): David Andersen / Computer Science
Rangos Hallway, 2nd Floor / 3-5

FAWNKV is a energy efficient distributed key-value store. Nodes form a ring of overlapping chains of redundancy. My project involved designing and implementing a protocol to allow a node to leave the ring while leaving the cluster in a consistent state and maintaining replicated copies of all the data stored on the failing node.

An Efficient and Flexible Framework for Implementing Distributed Systems
Alexander Gartrell / Computer Science
Advisor(s): David Andersen / Computer Science
Hoch Commons-2nd Floor, Window side / 3-5

Networked services are most often implemented as userland processes, which make system calls into the kernel to read from and write to resources like network and storage. This abstraction provides the programmer with a tremendous amount of safety and programmability at the cost of superfluous data copies and system call overhead. The alternative is implementation as a kernel module or driver, which is a performance wins, but presents many challenges from a design and implementation standpoint. In this work, we propose a framework to simplify the implementation of Distributed Systems in the Linux kernel. The framework does this by both providing a framework for event-based Network IO as well as providing library functions for efficient reading and manipulation of kernel datastructures. By providing these powerful abstractions as well as the freedom to directly manipulate other kernel resources, we provide the flexibility necessary to correctly balance simplicity and efficiency. The resulting kernel module can then be inserted into an existing Linux host running an unmodified kernel on commodity hardware.

Authority in Online Environments
David Bunker / Computer Science
Advisor(s): Robert Kraut / Human Computer Interaction Inst.
Rangos Hallway, 2nd Floor / 12-2:30

As online environments become more complicated, understanding the effects of social influence will become more important to those seeking to succeed. The purpose of this project was to determine the effect of social interaction on the probability an editor of Wikipedia would be promoted to administrator status. The promotion decision was analyzed based on the editors the prospective administrator chose to interact with and the calculated authority metrics of those editors. Statistical and machine learning techniques were used to determine how different embodiments of authority effected the promotion process.

Automatic Contact Resolution for Motion Retargeting
Kristin Siu / Computer Science
Advisor(s): Jessica Hodgins / Robotics Institute
Rangos Hallway, 2nd Floor / 3-5

One of the restrictions of using motion capture data for animations is that captured data is cannot be easily reused with new characters that have different skeletal structures. One method of resolving this is using motion retargeting, whereupon motions from one character's skeleton are transferred to that of another character by solving an optimization problem. This research involves adapting the motion retargeting algorithm to resolve a particular set of motions where contacts with the environment or self occur, as these are effects that are often not preserved when the general retargeting algorithm solves for a new motion. This is achieved through a two-step process. First, the algorithm automatically determines where contacts in the original motion occur. Next, constraints are set up to ensure that these contacts are carried over correctly when a new motion is optimized and solved. Using this, even subtle actions with contacts such a character scratching its head or rubbing its hands together can be preserved.

Autonomous Operation of Mobile Robots via the Efficient Implementation of Sensor Fusion Algorithms
Jakub Poznanski / Computer Science & Itai Stein / Materials Science Engineering
Advisor(s): Hagan Schempf / Robotics Institute
Hoch Commons-2nd Floor, Window side / 3-5

Explosive Ordnance Disposal, or EOD, is a critical application of robotics in today's world. EOD is a good example of an application where mobile robots are presently used along- side human operators, but could operate more effectively without humans if they were autonomous. The reason why many mobile robots cannot operate autonomously is because they cannot make decisions efficiently enough to guide themselves on their own, therefore requiring an operator to make these decisions for them. To allow mobile robots to make decisions more efficiently, allowing autonomy, we propose research into increasing the speed and efficiency of several sensor fusion algorithms, the effect of different implementations of these algorithms on their efficiency, and whether the sensor fusion algorithms can be simplified to operate on a barebones system without losing their efficiency and accuracy. To attempt to answer these questions, we will build a mobile robot, and then subject it to experiments that incorporate real world conditions, and finally race the mobile robot in the CMU Mobile Robot competition to evaluate the enhancements resulting from our novel implementation of sensor fusion algorithms.

Calcite: Completing Code Completion for Constructors using Crowds
Mathew Mooty / Computer Science
Advisor(s): Andrew Faulring / Human Computer Interaction &
Brad Myers / Human Computer Interaction
Wean Commons-1st Floor, Connan side / 12-2:30

Calcite is a new Eclipse plugin that helps address the difficulty of understanding and correctly using an API. Calcite finds the most popular ways to instantiate a given class or interface by using code examples. To allow the users to easily add these object instantiations to their code, Calcite adds items to the popup completion menu that will insert the appropriate code into the user's program. Calcite also uses crowdsourcing to add to the menu instructions in the form of comments that help the user perform functions that people have identified as missing from the API. In a user study, Calcite improved users' success rate by 40%.

Compiler Implementations for Dynamically-Typed and Gradually-Typed Plaid
Mark Hahnenberg / Computer Science
Advisor(s): Jonathan Aldrich / Computer Science
Rangos Hallway, 2nd Floor / 12-2:30

Object-oriented programs are inherently stateful. However, programmers are currently forced to encode this state implicitly in the programs they write. Even with proper encapsulation, the implicit nature of program state can lead to developers making mistakes and incorrectly using provided interfaces or protocols. Plaid is a new programming language being developed at Carnegie Mellon to solve this problem by making state and state transitions explicit through the notion of typestate. This poster focuses on the implementation of a compiler for dynamically-typed Plaid as well as the beginnings of a type system for gradually-typed Plaid with a special focus on runtime casts. One of the challenges encountered while working on the compiler for dynamically-typed Plaid included implementing nominal pattern matching in the Plaid-to-Java translation by adding several AST nodes to the compiler and generating the correct Java code. Another challenge, this one related to the gradual type system, was finding and implementing a satisfactory blame-tracking calculus for runtime casts. We are nearing completion of the first version of the compiler for dynamically-typed Plaid and are getting under way with adding a gradual type system with permissions to enable typestate verification which will aid developers in reasoning about state.

Compiling, Testing, and Optimizing LDP for networks of Blinky Blocks
Robert Prochnow / Computer Science
Advisor(s): Seth Goldstein / Computer Science
Rangos Hallway, 2nd Floor / 3-5

The Claytronics project is exploring programmable matter by designing, constructing, and programming millions of millimeter-scale robotsto cooperate and form larger scale machines. To this end, the group has developed LDP (locally distributed predicates), a programming language to provide a simpler approach to programming large swarms of robots. Additionally, the group has created a number of prototype "blinky block" robots for testing and demonstration of distributed programming. My thesis project involves targeting LDP to the blinky block hardware (while observing key hardware restrictions), measuring the performance of LDP on the blinky blocks with respect to other alternatives, and optimizing the LDP compiler/runtime to maximize this observed performance.

Contextualized Perceptual Grouping Using Bayesian Methods.
Steven Hansen / Computer Science
Advisor(s): David Touretzky / Computer Science
Rangos 2 & 3 / Sigma Xi Group 6, 11:15am

Recognizing visual concepts requires a flexible combination of top-down and bottom-up processes. This semester I tried exploring ideas from machine learning and Gestalt perception in order to construct an architecture with the capability to recognize a few basic concepts, and extend them two distinct ways, by either fixing problems with an instance of the concept, or by adding another concept instance in an appropriate place. I believe that the heart of this work lies in discovering how one can build a representation of an image such that the key aspects of the image are capable of being expressed and extended, while the contextual extraneous elements are ignored. In this broad phrasing, it is likely that the majority of computer vision researchers are already working on some aspect of this question; the uniqueness of this project lies in the details. For while most vision research focuses on some aspect of vision in a noisy, three dimensional setting, possibly with additional constraints such as shadowing, color, motion, real-time processing, etc., we plan to study it under its most ideal conditions, thus allowing us to reach deeper into the core issue of the construction of visual representation. Our key assumption is that what we do in our idealized world can play a role in vision systems with fewer constraints. So, even if future projects require additional complexity, the core concepts should be the same.

Creating Word Corpora with Human Computation
Jonathan Chu / Computer Science
Advisor(s): Anthoney Tomasic / Language Technologies Inst. &
Luis A Von AHh / Computer Science
Rangos Hallway, 2nd Floor / 12-2:30

Given a word within a sentence, how can a computer determine the meaning of that word? If there is only one given definition of the word, the solution can be easily determined. If multiple definitions exist however, this problem becomes magnitudes more difficult. The open problem of Word Sense Disambiguation, hereafter referred to as WSD, has yet to be adequately solved. The applicability of Machine Learning to this problem is obvious. However, the major issue with such an approach is a lack of data with which we can train a Machine Learning Algorithm that we develop. Our solution to this issue is to use Human Computation to generate a corpus of hand tagged sentences and definition. We will create a game that will generate the data we need, in the form of (word, sentence) pairs that we can feed to a Machine Learning Algorithm in order to train it. Thus, an effective solution to WSD can be created.

Cultural Attitudes Towards Computer Science: How do they Affect Women's Representation in the Field?
Elizabeth Kemp / Computer Science & Anthony Velazquez
Advisor(s): Carol Frieze / Computer Sciences & Jeria Quesenberry
Rangos Hallway, 2nd Floor / 3-5

This study is based on the premise that gender differences do not provide a satisfactory explanation for the low participation of women in computer science (CS) and that we need to look at factors other than gender differences. We propose a CREU study that will investigate cultural attitudes towards computer science. We will try to compare the localized culture of a CS department with some broader cultural attitudes. To investigate the localized culture of a CS department the study will build on previous research which examined the attitudes and perceptions of undergraduate students at Carnegie Mellon University (including a previous CREU research study). Post 1999 studies (2002, 2004 and 2005) revealed that Carnegie Mellon had developed a culture and environment in which women felt they fit and could contribute to the CS culture alongside their male peers. We will begin our study by finding out if this still holds true. We will try to identify the cultural factors that currently prevail and assess whether or not they have changed since the last studies. To investigate some broader cultural

attitudes we will pay close attention to the perspectives and attitudes of non-US students and faculty. Carnegie Mellon has a sizable number of faculty and students (especially graduate students) from other countries and cultures. At the same time we understand that in some countries and cultures women are well represented in computer science. With this in mind the perspectives and observations of our non-US faculty and students could be very illuminating. We will also tie in what we learn from discussions, interviews and focus groups, with literature searches to see what cultural factors have already been identified as contributing to better representation of women in CS. Ultimately, we aim a) to assess attitudes and perceptions towards CS to identify some specific cultural factors that are already contributing to the increased participation of women in computer science, and b) to ask how we can apply this information to improve our strategies for change.

Designing and Testing an Authoring Environment for Tablet Math Whiz
Daniel Chen / Computer Science
Advisor(s): Ananda Gunawardena / Computer Science
Hoch Commons-2nd Floor, Window side / 12-2:30

Tablet Math Whiz is a pen-based computing system for managing math classrooms. In this research we will be developing a specific authoring system for Algebra that allows teachers to author their own problems into the Tablet math Whiz database. Then teachers will be able to develop specific Math activities that students can solve. Student scratch work is captured and teacher can filter them to test various hypothesis. System will be tested with Math teachers from CMU-Qatar in Spring 2010

Detecting People in Indoor Environments
Tudor Achim / Computer Science
Advisor(s): Siddhartha Srinivasa / Robotics Institute
Kirr Commons-1st Floor, Window side / 12-2:30

We present the results of using a supervised machine learning algorithm to detect people in camera images. An existing approach that uses very low-level features combined with intelligent dimensionality reduction is applied to the problem of detecting people in indoor environments, which can have widely varying lighting conditions. We also give preliminary results on adapting the algorithm to automatically recognize people that it has previously detected.

Digital Music Stand
Ryan Caloras / Computer Science
Advisor(s): Roger Dannenberg / Computer Science
Class of '87 / 1:40

Research and develop software allowing a laptop or tablet PC to be used as a digital music stand. Functionality should include loading sheets of music from images, cropping and annotating sheets, as well as turning pages on command. The software should provide an interface allowing the digital music stand to use (external) audio matching to sync the display and loading of systems of music along with a live performance.

Displaying Relationships Between Academic Papers
Abhay Buch / Computer Science & Adrian Trejo / Computer Science
Advisor(s): Carlos Guestrin / Robotics Institute
Rangos Hallway, 2nd Floor / 12-2:30

Carlos Guestrin, Khalid El-Arini and others have developed a way to use a set of query papers to find other related academic papers. We are working on a way to display the relationships between the query papers and the result papers using various kinds of graphs. This project involves using the Processing language, a mySQL database and force-directed graph drawing algorithms.

Distributed Systems as a Means to Increase the Performance of Low-Cost Low-Power Computing Clusters
Victor Marmol / Computer Science, Erin McCarty / Computer Sciences &
Tilak Sharma / Computer Sciences
Advisor(s): Gregory Kesden / Computer Science
Hoch Commons-2nd Floor, Rangos side / 3-5

We aim to design and build a low-cost low-power computing cluster which we will test against a higher-power higher-cost computer system commonly used in the market today. The distributed computing cluster we hope to build utilizes a series of computers running the Intel Atom microprocessor; a processor that consumes less power and costs less to manufacture than almost all other microprocessors in the market today. We are looking to understand what the performance per watt and performance per unit cost is for each of these types of system. We believe that the Atom powered systems will be able to match the performance of the higher-cost system while consuming less power due to its superior performance per watt ratio. This in turn would lead to lower costs since low-power systems require less electricity to run and to cool.

Estimating Robot Positions by Analysis of Ball Deflections and Other High Level Plays in the RoboCup SSL
Kevin Luo / Computer Science
Advisor(s): Maria Veloso / Computer Science
Hoch Commons-2nd Floor, Rangos side / 3-5

The RoboCup SSL is distinguished by its global perception from overhead cameras. In most, if not all, of the teams, the state of the world as perceived by the cameras is passed to a global controller that plans for the actions of the team of robots. At the last RoboCup, our team lost the quarter final game 0-1 due to an unexpected failure of the vision system, in particular in terms of detecting the opponent robots. Such loss led us to question the complete dependency of the team performance solely on the effectiveness of the vision system to perceive the position of the opponents. In this paper, we contribute a method that estimates the state of the robots on the field without the need to detect their tops through vision. We show that we can accurately estimate the position of a robot by tracking the deflections of the ball. We conducted experiments in the lab that show that our technique allows for a very good estimate of the robot position even when the vision system is not detecting the robots. Our work supports the general principle of augmented vision, in which vision can be redundantly supplemented by the processing of additional available state modeling and sensing.

Eterna: Democratizing Experimental Science via Computers
Jonathan Ciscon / Computer Science & Stephanie Federwisch / Computer Science
Advisor(s): Adrien Treuille / Computer Science
Wean Commons-1st Floor, Connan side / 12-2:30

We present EteRNA, an on-line computer game which seeks to democratize experimental science. This Flash-based game immerses non-expert players in the nanoscale world of designing ribonucleic acids (RNA). However, the world will not be purely simulated: high-throughput wet-lab experimentation is built into the gameplay. As players explore a simulated RNA design space, the community itself will prioritize a list of candidate designs. Closing the loop, high throughput synthesis and validation will feed experimental data about these top designs back into the game.

EyesOn Mobile Eye Tracking
Thomas Jacques / Computer Science
Advisor(s): Tai-Sing / Computer Science
McKenna / 12:20

Eye tracking is an extremely valuable resource for behavioral research and the next generation of human computer interaction, especially for handicapped individuals. However, obtaining robust, high quality eye-tracking data can be enormously expensive, and low cost alternatives can be inaccurate and unable to be used as computer input devices. High end mobile eye tracking systems, such as those manufactured by Tobii®, can cost as much as twenty thousand dollars or more. I hope to deliver a method for creating a very low cost, easy to assemble mobile eye tracking unit which uses a USB interface, and to create robust software to analyze the video data streams. The novel contribution is a method for screen detection on the mobile eye-tracker by the use of a hot swappable filter and Infrared LEDs, and rigorous analysis of the accuracy of the tracker in various lighting conditions. This will allow real time eye-tracking as a method of computer input on a head mounted mobile eye-tracker, and create the opportunity for quality research at a low, affordable cost.

Formation Control in a Low-Cost Robot Colony
Jaime Bourne / Mechanical Engineering,
Austin Buchan / Electrical & Computer Engineering,
Megan Dority / Mechanical Engineering,
Emily Hart / Electrical & Computer Engineering,
Christopher Mar / Electrical & Computer Engineering,
Evan Mullinix / Electrical & Computer Engineering,
Bradford Neuman / Computer Science,
Nicole Paris / Electrical & Computer Engineering,
David Schultz / Physics,
John Sexton / Electrical & Computer Engineering &
Bradley Yoo / Electrical & Computer Engineering
Advisor(s): George Kantor / Robotics Institute
Rangos 2 &3 / Sigma Xi Group 5, 10:00am

Formation control, as it applies to the field of mobile robotics, is having robots maintain a certain distance and orientation between each other as they move as a group throughout an environment. This can be a simple and effective method of coordinating the movements of multi-robot systems and has several applications. Through this proposed research, the Colony Project will investigate how the principles of formation control apply

to a colony of low-cost robots. In an attempt to develop a flexible research platform for formation behaviors, we will explore how formation control can enhance the movement and sensory capabilities of our robot colony. This work is a continuation of previous Colony Project research and will serve as a foundation for future research within the Robotics Club

Graphics in the Cloud
David Klionsky / Computer Science & Bo Xian See / Electrical and Computer Engineering
Advisor(s): Adrien Treuille / Computer Science
Rangos 1 / 12-2:30

Computer graphics can produce stunning examples of curling smoke, crashing waves, even dancing patterns of underwater light. However, real-time graphics architectures emphasize view-dependent computation which ignores important global phenomena such as diffuse interreflection and fluid dynamics. This proposal explores a radical new cloud-based architecture for real-time graphics which will efficiently simulate complex global dynamics enabling highly detailed and interactive virtual worlds. We propose to calculate all graphics in the cloud, amortize computational costs across users, and stream fully rendered images from the cluster to each client. Graphics architecture plays a dominant role in the synthesis and even content of multi-user virtual environments. By creating a framework for amortized algorithms and data-structures, we lay the groundwork for a new generation of virtual environments which will overcome the limitations of client-based graphics and enable us to simulate profoundly more realistic interactive worlds.

Human Performance Modeling for All: Importing UI Prototypes into CogTool
Brett Harris / Computer Science
Advisor(s): Bonnie John / Human Computer Interaction Inst.
Rangos Hallway, 2nd Floor / 12-2:30

UI designers use a variety of prototyping tools, from paper and pencil sketching, to drag-and-drop mock-up tools (e.g., Balsamiq Mockups), to sophisticated suites of modeling tools and toolkits (e.g., iRise or dijit, the dojo GUI toolkit). Many projects would benefit from quickly analyzing prototypes at an early stage without the effort of bringing in users for empirical tests. Most analysis tools, however (e.g.,AutoCWW, Bloodhound, and CogTool), require prototypes to be in their own format, which forces the designer to re-do the prototypes in order to analyze them. Our work is a step toward allowing the CogTool

analysis tools to import from many different prototyping tools, so designers will have a path to quick usability analysis without changing the way they currently express their preliminary designs.

Human-Powered Word Sense Disambiguation
Nitin Seemakurty / Computer Science
Advisor(s): Anthony Tomasic / Language Technologies Inst. &
Luis A Von Ahn / Computer Science
McKenna / 12:00

One formidable problem in language technology is disambiguating the true sense of a word as it occurs in a sentence (e.g., recognizing whether the word "bank" refers to a river bank or to a financial institution). This work explores a specific strategy for solving this problem. The strategy involves harnessing the linguistic abilities of human beings to develop datasets that can be used to train machine learning algorithms. Generation of quality datasets can greatly aid the development of algorithms that tackle challenges such as automated language translation and the development of a semantic web. To create such datasets, we introduce a new interactive system: a fun game designed to produce valuable output by engaging human players in what they perceive to be the casual task of guessing the same word as another player. Our system makes a valuable contribution by tackling a bottleneck in the WSD domain: knowledge acquisition. Rather than using conventional and costly techniques of paying workers to generate training data for machine learning algorithms, we delegate the work to people who are looking to be entertained.

Identifying Anomalous Users in Social Networks
Daniel Schafer / Computer Science
Advisor(s): Luis A Von Ahn / Computer Science
McKenna / 12:40

Social networking websites have become increasingly important tools for commu- nication and interaction. The data sets intrinsic to these sites are nearly unparalleled in their size and quality. Unfortunately, many of these networks suffer from large pop- ulation of accounts not representing real individuals, or "anomalous accounts". Some of these may be desirable inhabitants of this social space, such as accounts for major news organizations or aggregators of interesting content. Others exist to only to spam legitimate users of the service, and decrease both the quality of the service and the value of the data set as a representation of a real social phenomenon. Over a period of

several months we have collected a large corpus of data by crawling the Twitter network. Our analysis examines over 65 million accounts, over two billion messages, and more than two billion network connections. We analyze the Twitter network at a broad level and report our findings on temporal patterns of message cre- ation, network structure, and aggregate trends in message content, and characteristics of information cascades. Many of these analyses reveal significant shifts from the ex- pected behavior on such a system, with anomalous accounts potentially responsible. A website was created to allow the general public access to the aggregated information and analyses performed. We provide a characterization of these anomalous accounts based on these ob- servable characteristics, and demonstrate that these methods do detect anomalous accounts. Furthermore, we use spectral graph theoretical methods to determine char- acteristics of these anomalous accounts to determine if they significantly contribute to the social ecosystem, allowing spammers to be distinguished from legitimate accounts.

Identifying Host Interactive Proteins using Conditional Random Fields
Wing-Hong Andrew Ko / Computer Science
Advisor(s): Ronald Rosendfeld / Language Technologies Inst.
Hoch Commons-2nd Floor, Rangos side / 12-2:30

Virus genomes contain three types of open reading frames (ORFs). Core ORFs encode for structural proteins, which help form the viral particle itself, and replicative proteins that are involved in its replication lifecycle. Most viruses also have ORFs that encode other proteins - dubbed Host-Interactive Proteins (HIPs) -- which increase viral fitness by interfering with important host cell pathways. The third type of ORFs do not encode for any proteins, and are often found on the reverse strand of a protein-encoding ORF. The goal of our project is to create a machine learning algorithm that learns to accurately label ORF types in a new, unstudied viral genome based on labeled examples of genomes of viruses from the same family. We use a conditional random field to express the relationship between the ORF type and a variety of genomic features, including homology to other ORFs, sequence length, and sense. We show biological and empirical evidence for the informativeness of these features. Given the learned model, we use the belief propagation algorithm to assign labels to each ORF in a new viral genome.

Improved Instrument Synthesis Models for Violin and String Instruments
Christopher Niessl / Computer Science
Advisor(s): Roger Dannenberg / Computer Science
McKenna / 1:00

In this research, we focus on using Spectral Interpolation Synthesis to reduce the amount of information needed in a control channel to successfully reproduce violin tones. SIS has found success in brass and woodwind instruments, but has encountered challenges in synthesizing string instruments. Through the introduction of additional parameters, we hope to reduce the amount of control information needed to express sounds on those instruments to make synthesis feasible.

Inductive Inference of Integer Sequences
Sam Tetruashvili / Computer Science
Advisor(s): Manuel Blum / Computer Science & Klaus Sutner / Computer Science
McKenna / 1:20

The goal of this senior thesis is to design algorithms that can inductively infer integer sequences with high confidence, under the assumption that all of the terms of the sequence are accessible. We aim to characterize how many terms of the sequence an inference algorithm needs to see before it can make an inference that it is confident in. We also aim to design a method that decides if a sequence cannot be inferred by some inference algorithm, i.e. if a sequence is hard for that inference algorithm.

Inference of Population Structure with Optimal Number of Ancestral Groups
Dae Gun Won / Computer Science
Advisor(s): Eric Xing / Human Computer Interaction Inst.
McKenna / 1:40

In this project I study the problem of population structure inference using multi-locus genotype data. Traditional methods for inferring population structure such as Structure program or mStruct does not present a good way to optimize the number of ancestral population groups by including the number in the model and inferring from the model itself. Therefore I aim to present a model that will have the ability to infer the optimal number intrinsically. So far studying the previous works, implementing parts of them, and coming up with new model have been done. For the rest of the semester I plan on finishing implementations including the new model and coming up with an inference method for the model.

Information Leakage in Zero Sum Games
Eric Seo / Computer Science
Advisor(s): Avrim Blum / Computer Science
Hoch Commons-2nd Floor, Rangos side / 3-5

The minimax strategy on two-person zero-sum games is based on the assumption that

any player won't discover the actual choice of the other player. However, in real world adversarial settings, there is always the risk of information leakage about the actual strategy instantiation. The paper "Adversarial Leakage in Games" by Noga Alon, Yuval Emek, Michal Feldman and Moshe Tennenholtz focused on the two models in both of which adversary is able to learn the value of b binary predicates about the strategy instantiation. I extend this idea of adversarial leakage, and introduce different models in which information leakage happens in various ways, such as by leakage probability vectors either on rows or on columns of game matrix. I also considered the possible model for two-way leakages where each player has chance to peek at the other player's choice. In addition to formally define the models, I compare the power of the leakage for each model and found interesting correlations between different models. Together, many possible models in which the possibility of information leakage plays an important role are introduced and fundamental properties of each are studied.

Inspiration
Yun Dong Yeo / Computer Science
Advisor(s): Anthony Tomasic / Language Technologies Inst.
Rangos Hallway, 2nd Floor / 12-2:30

The project is to create a new game testing how human collaborate to response to specific challenges. It is called Inspiration because when users are playing the game they need to think and express their minds or emotions when presented the challenges to their best. It is a game in the family of Game With A Purpose (GWAP) which based on the Human Computation idea. That is, when users are players game they not only have fun but also help us solving useful computational problem.

iSTEP 2010 Field Research
Anthony Velazquez / Computer Science
Advisor(s): Yonina Cooper / Computer Science
Hoch Commons-2nd Floor, Rangos side / 12-2:30

The innovative Student Technology ExPerience (iSTEP) conducts field research to address real-world problems in developing communities with multidisciplinary teams. Bringing together students from the Pittsburgh and Qatar campuses, this year's team is preparing for work with the Asian University for Women (AUW) and Young Power in Social Action (YPSA) in Chittagong, Bangladesh to address two problems. The team will be creating and evaluating culturally relevant educational technology and games for enhancing English literacy at the AUW Access Academy to prepare students for study at the university as well as enhancing and evaluating TechBridgeWorld's low-cost Braille Writing Tutor for

visually impaired students as part of YPSA's programs for increasing accessibility to technology in Bangladesh. Moreover, the team will be globally distributed with 5 members working overseas in Bangladesh, and one serving in a technical support position from Pittsburgh. Over the course of 10-weeks the team will be on the ground to conduct needs assessment, develop solutions, and test and evaluate the sustainability of these projects in Bangladesh.

L5: A small safe subset of the C programing language
Laura Abbott / Computer Science
Advisor(s): Frank Pfenning / Computer Science
Wean Commons-1st Floor, Connan side / 3-5

The C programming language remains a popular choice for language development. Certain aspects of C are poorly specified or undefined, making it a difficult language for beginning students to use. The goal of the L5 programing language is to create a well defined subset of C that can be used for teaching purposes. The language aims to be syntactically compatible with C and designed to make the transition to full C as easy as possible.

Layperson-Trained Speech Recognition for Resource Scarce Languages
Fang Qiao / Computer Science
Advisor(s): Ronald Rosenfeld / Language Technologies Inst.
McKenna / 2:00

We develop practical methods in speech recognition for low-resource languages overlooked by most effort in the field today. The resulting technique will potentially provide speech technology for languages of the developing world where many of the speakers are illiterate, by allowing one to build low-cost speech recognizers with high accuracy over small vocabularies involving minimal audio data and human expertise for training. Specifically, we will design pronunciation-generating algorithms for new languages based on existing speech recognition engines for other languages through cross-language phoneme mapping. We will also develop methods that will eliminate the need for language expert-based training.

Learning from Demonstration and Chip Kick Evaluation in Robot Soccer
Can Erdogan / Computer Science
Advisor(s): Maria Veloso / Computer Science
Rangos Hallway, 2nd Floor / 3-5

"To accomplish a task successfully, a robot relies on two levels of control: skills level and policy level. The skills level refers to the basic actions a robot can perform, whereas the

policy level refers to when and in which sequence these actions should be performed. In general, it is very challenging for a robot to possess both accurate skills and successful policies, and I address this challenge in my independent study. First, I focused on the problem of providing a policy to a robot where, with the help of a human demonstrator, the robot learns which actions it should take given a specific situation. This method of learning is called "Learning from Demonstration" and the domain I worked on is a single iRobot Create. Secondly, I focused on understanding specific robot skills as any kind of learning instruction must rely on the lower level skills of the robot. My target was the domain of small-sized robot soccer, with the chip kick skill as the focus of the study. In particular, I studied the parameterization, calibration and the evaluation of chip kicks. Thus, the core of my independent study shifted from a higher level policy learning problem to the study of a lower level skill, namely of chip kick skill, towards enabling its use in sophisticated behaviors."

Learning-based Change Detection for Mobile Robots
Bradford Neuman / Computer Science
Advisor(s): Anthony Stentz / Robotics Institute
McKenna / 3:00

Mobile Robotics has advanced to a stage where robotic vehicles are beginning to navigate autonomously and make decisions about the traversibility of obstacles based on rich sensor data and machine learning and planning techniques. Unfortunately, these systems can still fail, especially in circumstances on which they were not trained. My goal is to create a technique which should improve robot safety and reliability by allowing robots to detect important changes in their environment. If a robot sees a given scene more than once and there is a significant change, such as a human being present or a tree falling, the robot should be able to detect the change and avoid it or alert a human. I am investigating machine learning techniques to perform change detection on a set of rich sensor data collected by a mobile robot.

Local and Global Perspectives: An Investigation of How Cultural Factors Contribute to Gender Balanced Participation in Computer Science
Anthony Velazquez / Computer Science
Advisor(s): Carol Frieze / Computer Science
McKenna / 3:20

This thesis is based on the premise that cultural factors play an important role in the representation of women in computer science. I will argue that gender differences, usually noted as a primary source of women's low representation, do not provide a

satisfactory explanation for the low participation of women in computer science (CS) and that we need to look at factors other than gender differences. This thesis will begin by exploring research which shows that the underrepresentation of women in computer science (well documented in the United States) is not a universal phenomenon. Some countries such as Bulgaria are graduating women in engineering degrees in numbers equal to those of men. I plan to investigate the cultural factors that make this possible. Additionally, I plan to investigate the local culture at Carnegie Mellon where we enroll women in computer science at twice the average to other research 1 universities to investigate the local cultural factors at play. From this I hope to be able to make recommendations to engage a more diversified population in computer science in the United States.

Logic and Model Checking
Lesley Linne / Computer Science
Advisor(s): Andre Platzer / Computer Science
Rangos Hallway, 2nd Floor / 3-5

A brief overview of modern practices of model checking in computer science.

Lunar Rover Navigation
Wennie Tabib / Computer Science
Advisor(s): William Whittaker / Robotics Institute
Rangos Hallway, 2nd Floor / 12-2:30

How can we ensure that a robot will navigate correctly in space? The robot's state is dependent on sensors that record the acceleration, angle of elevation, and temperature. However, these sensors also have a certain amount of noise, or error, when reporting data, which means that the robot may not respond correctly to the climate. For example, if the robot is equipped with a GPS unit that provides an estimate of the position, but the estimate is noisy at high frequencies, then the robot might navigate to the wrong place. Because the data it is receiving might be different by a few meters than where it actually is, the robot will be in the correct place according to the data, but as the errors accumulate, the robot may be far away from the correct position. Therefore, it is imperative that we implement a Kalman filter that can minimize the error in the data delivered to the robot from the Inertial Measurement Unit (IMU). The Kalman filter uses a weighted average in order to predict the state of a system, which creates values with better estimated uncertainty that can be "trusted" more, thus leading to more reliable navigation. This research will minimize any accidental loss of accuracy in data

measurements, which will allow Red Whittaker's Lunar XPrize rover to navigate easily on the surface of the moon. The Kalman filter uses control inputs and sensor measurements from the rover in order to form an estimate of its state, which is a better estimate than by using any one measurement alone. Sensor data can be very noisy, or prone to contain error; approximations in the equations that describe how the rover's system changes; and external factors that are not accounted for can introduce uncertainty about the values of a system's state. Hence, in order to develop a lunar rover with reliable navigation techniques, we must implement a Kalman filter to guarantee accurate data.

Machine Learning for Time Series Brain Imaging Data
Pengfei Li / Computer Science
Advisor(s): Geoffrey Gordon / Human Computer Interaction Inst.
Kirr Commons-1st Floor, Window side / 3-5

Magnetoencephalography (MEG) data are series of brain imaging data that measures the activities of neurons in the brain. Normal classifications are done on these data by treating each set of brain image data as separate entity. In this study, the MEG data are treated as time series observations which allow the models to capture the change of neuron activities. Therefore, by using various practical machine learning algorithms like Kalman Filter and Predictive State Representation on the Brain Imaging data to learn various time series model, the effectiveness of these algorithms are evaluated based several metrics like predicted errors on observation states and accuracy of classifications.

Modeling Common Student Errors Using SimStudent
Jinyu Liu / Computer Science
Advisor(s): Noboru Matsuda / Human Computer Interaction Inst.
Rangos Hallway, 2nd Floor / 3-5

Is it possible to model the common errors a student makes throughout a sequence of test problems? To answer this question, we will use data mining techniques to extract common errors that students make and try to model these errors in SimStudent by investigating how different levels of prior knowledge and operator knowledge affect learning. Testing is done by doing multiple trial runs on a specified sequence of test problems to see which set of operators and prior knowledge most closely match the errors made by a typical student on the same sequence of problems.

Neighborhood-Aware Networking: A Distributed Neighborhood Video-on-Demand System
Ram Raghunathan / Computer Science
Advisor(s): Konstantina Papagiannaki / Computer Science
Kirr Commons-1st Floor, Window side / 3-5

Video-on-Demand is becoming more popular and service providers have heavy loads on their infrastructure because of it. This project sought to find a viable method of reducing this load by leveraging local resources such as local storage and local networking on a neighborhood scale. This presentation describes the various methods and techniques we developed and describes the prototype system that we designed and implemented.

Pizza Consumption and Preference of CMU Undergraduate Students
Augmentation and Rehabilitation
Stafford Brunk / Self-defined,
Atishe Chordia / Mechanical Engineering,
SeungJin Park / Economics and Statistics,
Tony Poor / Computer Science &
Henry Wu / Mathematics
Advisor(s): Brian Junker / Statistics
Kirr Commons-1st Floor, Window side / 12-2:30

We are conducting a consumer survey of Carnegie Mellon students in order to learn about their pizza consumption behaviors. We have utilized a post-stratified random sample of 800 undergraduate students from the CMU directory, emailing them a Google Docs-powered survey (with the offer of an Amazon gift card raffle to increase the response rate). Our survey hopes to gain insight on the current consumption behaviors and motivations of CMU undergrads, including issues like when students generally want to order pizza, the impact of DineXtra or PlaidCa$h in their decisions, and what other characteristics (cost, quality, quantity, location, etc.) are most important to them. These results may be used by local businesses and Carnegie Mellon dining venues, improving both their business and marketing abilities as well as the satisfaction of CMU students.

Predicting Bus Arrival Times using Mobile Location Services and Machine Learning
Nikhil Thiruvengadam / Computer Science
Advisor(s): Charlie Garrod / Computer Science
Kirr Commons-1st Floor, Window side / 3-5

Current technologies to monitor transit infrastructure are expensive and require a large initial investment. Location-aware mobile devices, however, are increasingly ubiquitous and provide an opportunity to monitor existing transportation systems cheaply without

deploying new static infrastructure. A key challenge is predict bus arrival times based on "crowd-sourced" riders. In this project we develop an iPhone application to monitor the Pittsburgh Port Authority bus network. We combine data from the schedule, the history of users, and current users to build a machine learning model that predicts bus arrival times.

Predicting Risk from Financial Reports with Supervised Topic Models
Neel Shah / Computer Science
Advisor(s): Noah Smith / Language Technologies Inst.
McKenna / 3:40

Forecasting from analysis of text corpora is an exciting research area, one that has potential for application to a variety of fields such as finance, medicine and consumer research. We apply techniques from NLP to predicting real-world continuous quantities associated with a forward-looking text's meaning. In particular, we study Financial Reports because of the presence of a large text corpus that is highly standardized and widely studied by financial analysts in industry. In conducting our analysis we use a class of generative probabilistic models known as Topic Models. In such a model, documents are a mixture of topics, where a topic is defined as a probability distribution over words. These models are interesting because they provide a simple probabilistic procedure for generating documents. Such a procedure can be inverted using standard statistical techniques, allowing us to infer a set of topics from which a particular document was generated. The problem then is to associate the inferred topic distributions with real-world quantities such as company-level financial indicators for the prediction task.

PURRS: Profile-Based Email Organization using User Response Behaviors and Social Networks
Kornchawal Chaipah / Electrical and Computer Engineering,
Tanachat Nilanon / Computer Science &
Dolsarit Somseang / Electrical and Computer Engineering
Advisor(s): Hyong Kim / Electrical and Computer Engineering
Rangos hallway, 2nd Floor / 12-2:30

We propose PURRS, a profile-based email management system that provides personalized email prioritization and adapts to users' changing behaviors. The proposed system learns and leverages behavioral and social-networking information to build profiles of email senders. Users will be able to identify important email quickly based on senders' ranking. Therefore, they can handle email more efficiently as the system

mitigates their frustration and negative impacts from email cluttering. Although standard email systems allow users to define rules for email prioritization, they require the users to update the rules manually and regularly as user behaviors and contacts change over time. Previous work on automatic email prioritization mostly focused on text categorization using email bodies and subjects. Spammers and/or non-important contacts can craft email to bypass these filters. Our work takes a different approach by mimicking users' perceptions-how they examine senders and subjects to triage email. We hypothesize that users tend to handle email from senders within their social networks first because they already learned of the senders' importance. For this reason, our system transparently learns how users interact with contacts, and then it clusters contacts into Social Network Rings (SNR). Contacts whom the users have paid more attention to are in higher priority groups and placed closer to the center of the SNR. The system prioritizes incoming email by senders' positions in the SNR. Moreover, the system uses information from the users' social networks to prioritize email from unknown senders. The specific contributions of this work are as follows:
1) We use an extensive set of user actions, including reading (and reading delay), deleting (and deleting delay), replying, forwarding, composing, flagging, and archiving email.
2) We introduce the Social Network Rings (SNR) with five rings/layers to represent not only users' social network maps but also relationship strength. The five rings represent five priority groups, which include five relationship strength levels, adapted from a human relationship development model. 3) Since user behaviors and relationships change over time, we propose to apply the time-sliding database and the Slow Adjustment Tuner. Our time-sliding database assigns decaying weights to older user actions, giving more attention to recent ones. The Slow Adjustment Tuner, adapted from the TCP Slow Start with Fast Recovery scheme, regularly updates the system parameters in accordance with user feedback on email priority classifications. 4) Because a user does not have information about unknown contacts, we propose to apply a social network concept to help identify new contacts that could be important to the user. The user's profile is shared among selective contacts, and potentially important new contacts are suggested from the user's social networks. For privacy, the user has control over who receives which pieces of his/her profile information. We will implement PURRS as a Microsoft Outlook 2007 add-in and conduct a user study to evaluate the system. The evaluation goals are:
1) To verify the project concept, by confirming the actions that indicate the relationship strength with contacts and by studying the user's information sharing behaviors, 2) To measure system performance, including the priority prediction correctness, the system's

learning ability, and the correctness of the unknown contact's rank estimation, 3) To measure the typical system resource consumption, and 4) To assess user feedback of the system performance. We will conduct a 12-week user study in which participants use the system, while we automatically collect data weekly. At the end of the study, we will conduct an email-identification study, conduct a user feedback survey, and analyze the collected data. Upon the completion of the work, the system will allow the user to handle a large volume of email more efficiently

RobOrchestra V
Rohan Aletty / Electrical and Computer Engineering,
Douglas Bernstein / Mechanical Engineering,
Jonathan Boerner / Mechanical Engineering,
Andrew Burks / Mechanical Engineering,
Gerald Carlson / Mechanical Engineering,
Katherine Coste / Mechanical Engineering,
Daniel Curhan / Mechanical Engineering,
Jaywoo Kim / Mechanical Engineering,
Michael Ornstein / Mechanical Engineering,
Michael Sandbothe / Computer Science &
Daniel Shope / Mechanical Engineering
Advisor(s): Roger Dannenberg / Computer Science
Wean Commons-1st Floor, Connan side / 12-2:30

The RobOrchestra project is dedicated to the creation of music using technology coupled with art. Now in its fifth year, RobOrchestra has created a number of robots with specific musical functions and generated meaningful ways for them to play together cooperatively. In previous years, this organization was dedicated to establishing a basis upon which a few instruments could play, but this year we plan to expand the number of instruments at our disposal and to bring out the "Orchestra" in RobOrchestra. In addition to building more instruments, expanding our reach to both the string and brass sections, we will also investigate creating methods for humans to interact with the robots' performance. In this manner we will expose the connection between science and art by showing the mathematical complexity of music and the artistic possibilities of robotics.

Tashi
Michael Wang / Computer Science
Advisor(s): Michael Ryan / Intel Research Pittsburgh
Kirr Commons-1st Floor, Window side / 3-5

An Infrastructure for Cloud Computing on Big Data.

Temporal Continuity Learning for Convolutional Deep Belief Networks
Carl Doersch / Computer Science
Advisor(s): Tai-Sing Lee / Electrical and Computer Engineering
McKenna / 4:00

The human visual system can robustly recognize objects, even though a single object can project many different images onto the retina. Furthermore, humans learn to perform this task from mostly unlabeled data. The goal of this work is to develop a computer algorithm which can replicate this sort of learning. One approach to this problem is called Temporal Continuity Learning. This theory assumes that images close together in time are likely to contain the same object, and therefore that the visual system should learn representations that vary slowly in time. A different approach uses Deep Belief Networks. With DBNs, the goal of the learning is to maximize the likelihood of the training data in the marginal distribution of the Deep Belief Network. Interestingly, these approaches use entirely different heuristics to measure how 'good' a representation is. In this work, I hope to create an algorithm which uses both of these heuristics to form a better representation of images than either heuristic could produce on its own.

The Fence
Maxwell Hawkins / Computer Science
Advisor(s): Mark Stehlik / Computer Science
Rangos Hallway, 2nd Floor / 12-2:30

The Fence is an online events guide for Carnegie Mellon being developed by The Tartan.

Towards Simultaneous Location and Mapping (SLAM) for Mobile Robots in Indoor Dynamic Environments
Jonas Cleveland / Electrical and Computer Engineering,
Brett harris / Computer Science & Francisco Santiago / Mechanical Engineering
Advisor(s): John Dolan / Computer Science
Hoch Commons-2nd Floor, Rangos side / 12-2:30

We will tackle several obstacles in the field of mobile robotics by developing an inexpensive, reprogrammable platform for the development of indoor robotic applications. This platform will employ the capabilities required of a mobile robot in an indoor environment - traversal over objects such as stairs, movement in tight spaces, carrying of medium-sized payloads- in an inexpensive platform. Foremost, this platform will be equipped with a novel SLAM(Simultaneous Location and Mapping) algorithmic approach, which will allow it learn new environments, localize itself in a self-created map, and therefore easily traverse to a desired place or object.

Training Set Selection Algorithms for Face Recognition Systems on Game-playing Robots
Brendan Kiu / Computer Science
Advisor(s): Reid Simmons / Robotics Institute
Rangos Hallway, 2nd Floor / 3-5

In modern face recognition systems, a training set is associated with each subject in the database, and faces in question are matched against these training sets to determine their identities. CMU Robotics is currently involved in a Gamebot project, in which a Scrabble-playing robot will be equipped with a face recognition system to save and retreive player profiles. Given N possible training images for a single person, this research focuses on how to select k images to place into the database to get optimal results.

Unfolding Buchi Automata
Jonathan Kilgallin / Computer Science
Advisor(s): Klaus Sutner / Computer Science
McKenna / 4:20

Existing algorithms for finding the complement of a language recognized by a -Büchi Automaton - that is, an automaton that recognizes words extending infinitely in both directions - suffer enormous blow-up in the number of states in the resulting complemented automaton. We aim to adapt an algorithm developed for complementing languages over one-way infinite words, and to present an optimization of this algorithm by slightly changing the definition of an automaton.

Using Association Metrics to Help Users Navigate API Documentation
Daniel Eisenberg / Computer Science
Advisor(s): Brad Myers / Human Computer Interaction Inst.
Rangos Hallway, 2nd Floor / 12-2:30

In the past decade there has been spectacular growth in the number and size of third-party libraries, frameworks, toolkits and other Application Program-ming Interfaces (APIs) available to modern software developers. However, the time-saving advantages of code re-use are commonly hampered by the difficulty in finding the correct methods for a given task among the thousands of irrelevant ones. We have developed a tool called Apatite that helps address this issue by letting programmers browse APIs by viewing associa-tions between their components. Apatite indicates which items of an API are popular in different contexts and allows browsing by initially selecting verbs (methods and actions) in addition to classes and packages. The associations are calculated by

leveraging existing search engine data and source code, and verbs are identified by parsing the documentation descriptions. Apatite is available on the web and is being used by users worldwide on a regular basis.

Using Machine Learning Techniques to Uncover What Makes Understanding Spoken Chinese Difficult for Non-native Speakers
John Kowalski / Computer Science
Advisor(s): Geoffrey Gordon / Human Computer Interaction inst.
McKenna / 4:40

The Chinese dictation tutor has been used for the past few years in over thirty classrooms at universities around the world. A large amount of data have been collected from this program on the types of errors students make when trying to spell the pinyin of the Chinese phrase spoken to them. I plan to use this data to help answer the question of what is hard about understanding Chinese. Is it a particular set of consonants, vowels, or tones? Or perhaps do certain difficulties arise in the context in which these sounds are spoken? Since each pinyin phrase can be broken down into features (consonants, vowel sounds, and tones), we can apply machine learning techniques to uncover the most confounding aspects for beginning students of Chinese. We can extend the methods we developed here to create an ML engine that learns on the fly for each student what they find difficult. The items to be presented to the learner can be chosen from a pool that has features with the lowest probability of being correctly classified by the student. This will allow the Chinese learner to focus on what he or she is having most difficulty and hopefully more quickly understand spoken Chinese than without such focused "intelligent" instruction.

Visual Recognition Program
Jeung Won Kim / Computer Science
Advisor(s): Alexander Hauptmann / Computer Science
Kirr Commons-1st Floor, Window side / 12-2:30

This project is to integrate many different modules that are developed in Informedia team led by Dr.Alex Hauptmann.

Visualization of Data Structures
Chuan He / Computer Science
Advisor(s): Victor Adamchik / Computer Science
Kirr Commons-1st Floor, Window side / 3-5

This research focuses on the visualization of data structures and algorithm animation on

tablet computers using C# and Microsoft Tablet PC API. Program reads users inputs and parses into shapes and diagrams as representations of data structures and enable users to perform inner manipulations graphically.

Walk Through Interfaces
Shilpa Ramamurthy / Computer Science
Advisor(s): Scott Hudson / Human Computer Interaction Inst.
Kirr Commons-1st Floor, Window side / 12-2:30

We are exploring the use of cameras and projectors in order to detect people in a room and display relevant information to them that they can interact with in a convenient way. To do so we must first figure out how to detect people, then determine good locations to project information based on their location, recognize large scale gestures, and finally go through design iterations.

HUMAN COMPUTER INTERACTION INST.

Slideshow Commander
Steven Chou / Human Computer Interaction Inst.
Advisor(s): Bryan Myers / Human Computer Interaction Inst.
Rangos Hallway, 2nd Floor / 3-5

SlideshowCommander is an application for mobile devices that acts as a remote control for Powerpoint presentations. It takes all of the useful functionality for Microsoft Powerpoint and transfers control to the mobile device. My device that I worked on was the iPhone. It has functionality to go to the next slide, previous slide, cache slides and even preview slides for the presentation.

SCIENCE & HUMANITIES SCHOLARS PROGRAM

Classifying Patients' Need for and Use of Pain Relief Medication
Chan Kim / Statistics, Elaine Lee / Mathematics &
Vishash Verma / Science and Humanities Scholars
Advisor(s): Brian Junker / Statistics & Cosma Shalizi / Statistics
Wean Commons-1st Floor, Connan side / 12-2:30

Data was collected on post-operation patients who used patient-controlled analgesics and statistical analyses were performed on this data to determine whether the patients fell into distinct clusters based on their pattern of pain across time; to determine whether there was a difference between the patients who used hydromorphone and those who used morphine; to devise a method for predicting the total amount of analgesic a new patient will use after being operated on. The methods and concepts used were hierarchical clustering, curve clustering, multidimensional scaling, and hidden Markov models. Based on the analyses, the patients seem to fall into between four and six clusters based on their pattern of pain across time and there does seem to be a difference between the hydromorphone and morphine patients.

CMU Dining: For better or for worse?
Sally Cheung / Statistics, Hee Won Chi / Statistics, Jisu Kim / Self-Defined &
Tianjiao Qi / Science and Humanities Scholars
Advisor(s): Brian Junker / Statistics
Hoch Commons-2nd Floor, Window side / 12-2:30

Dining has always been a hot topic at Carnegie Mellon University (CMU). Even though many changes have already taken place last year, improving the quality and the selection of foods, we would like to once again investigate to see how satisfied students who are on the meal block system now are with the current dining options. We have spoken to a representative from the student senate and they are still constantly looking for updates to see how satisfied students are with the dining system, therefore one potential client of our survey would be to conduct a study to see the student satisfaction of the dining system

and pass these results to the student senate for potential changes to take place. Carnegie Mellon requires first year students to be on a meal plan, so these changes would be highly relevant for years to come. Being able to constantly improve dining services on our campus can motivate students to eat at certain dining places more. Also, although new additions have been made, are people aware of such changes and how do they feel of these changes? We would like to focus mainly on Freshmen who are on the meal plan because they are the ones who are most familiar with the dining places at school. Through this survey, we hope to find answers to questions such as places that students like the most and least and why and possibly how the places could continue to improve.

College Students With Diabetes: An Exploratory Study of Friendship
Ashley Klein / Science and Humanities Scholars
Advisor(s): Vicki Helgeson / Psychology
Wean Commons-1st Floor, Connan side / 12-2:30

I want to study the nature of peer relationships among college students with diabetes. In particular, I want to learn if college students with diabetes find it more difficult to form relationships because they are uncomfortable sharing information about the condition with others. In order to answer the question, I will first conduct an exploratory pilot study on this topic to develop more focused questions for my honors thesis senior year. I will recruit a convenience sample of 20 college students with diabetes and ask them to complete an in-depth interview and a brief questionnaire.

Degradation of Sertraline using Fe-TAML and Hydrogen Peroxide
Natalya Khanina / Science and Humanities Scholars
Advisor(s): Terrence Collins / Chemistry
Rangos 2 & 3 / Sigma Xi Group 3, 11:00am

Fe-TAML activators are iron-based catalysts that combine with hydrogen peroxide to oxidize many compounds, including selective serotonin reuptake inhibitors. One drug in this class is sertraline hydrochloride, the active ingredient in the popular antidepressant Zoloft®. This drug is present in small but increasing concentrations in treated wastewater. Though the effects of this growing concentration on the aquatic environment are still unclear, it is likely that these effects will be harmful. An Fe-TAML catalyst used with hydrogen peroxide has been shown to degrade sertraline within minutes. A High Performance Liquid Chromatography (HPLC) method was developed for the separation and identification of the byproducts of sertraline upon degradation with Fe-TAML and H2O2. Upon reaction completion, 9.4% of sertraline remains as desmethylsertraline, while 74.8%

has been converted to sertraline ketone. Other minor side products are likely. Solid Phase Microextraction/Gas Chromatography/Mass Spectrometry (SPME/GC/MS) was utilized to confirm these products.

Diketopyrrolopyrrole- and sexithiophene-based copolymers as organic semiconductors for molecular electronics
Swati Varshney / Science and Humanities Scholars
Advisor(s): Richard McCullough / Chemistry
Rangos 2 & 3 / Sigma Xi Group 3, 11:30am

Diketopyrrolopyrrole (DPP) and sexithiophene (ST) copolymers were investigated as active semiconductors for application in organic electronic devices. Conducting polymers, such as polythiophene, have close to commercial properties as charge-transporting materials in transistors, organic photovoltaics (OPVs), and LED displays. DPP is a rigid, conjugated, organic dye in which electrons are readily excited by visible light, showing promise as energy-accepting materials in transistors and solar cells. Together, DPP and thiophene show desirable properties in organic electronics, giving polymers with charge mobility of 0.1 cm2/Vs and polymer conversion efficiency (PCE) of 4.0%. Increasing the length of the conducting polymer segment in these copolymers was hypothesized to increase the planarity of the polymer backbone for enhanced conjugation. Higher mobility and conductivity, as well as desirable HOMO and LUMO, were expected. The polymer was synthesized via Stille coupling. Using UV/Vis. Spectroscopy, the polymer was found to absorb light across the entire visible spectrum, showing promise for use in solar cells. Charge-transport mobility of the polymers were tested in field-effect transistors (FET) and found to be .003 cm2/Vs. Thin-film microstructure was examined by atomic force microscopy (AFM), showing the formation of wide nanofibrils with a short persistence length upon self-assembly into a thin film. The deep grain boundaries between nanofibrils suppress charge transport, explaining the lower-than-expected charge mobility. The next step of the experiment is to investigate a similar copolymer with an altered chemical structure to suppress nanofibrillar formation, thus leading to higher mobility

Expression of Activation-Induced Cytidine Deaminase in Yeast
Katherine Bonnington / Science and Humanities Scholars
Advisor(s): Gordon Rule / Biological Sciences
Hoch Commons-2nd Floor, Window side / 3-5

DNA of B-cells. The AID enzyme accomplishes this antibody diversification by acting on the variable region of an immunoglobulin through somatic hypermutation (SHM), a process

which improves an antibody's affinity for an antigen by introducing random mutations. Additionally, AID allows for B-cell class switch recombination, a change of the antibody's constant region which alters the body's response upon encounter with the antibody's specified antigen. However, the mechanisms, regulation, and extent of AID's activity in the cell are not well known. To gain more insight about AID's structure and mechanism, the ability to produce large quantities of the enzyme to perform biochemical and biophysical assays in vitro would be extremely valuable. In order to accomplish this, methods of inducing the production of AID in vitro must first be explored through its expression in K. lactis (yeast). I plan to insert the sequence for the mouse AID into a shuttle vector that can be replicated in E. coli for use in yeast. Since both mouse and yeast are eukaryotic organisms, the codons for the AID enzyme can be more successfully translated in yeast, a fellow eukaryote. Previously, others have attempted secretion of the protein in yeast, however the results of this expression were unsuccessful due to multiple protease cleaving sites present in the AID sequence which destroyed the protein. In order to solve this problem, I will create two different expression vectors containing the AID gene, with one tagged for protein retention through the ER and one targeted for synthesis in the cytoplasm. Since these two methods do not allow the yeast to cleave portions of the protein, functional enzyme should be created. This enzyme can then be purified and used for future biophysical and structural studies of the enzyme, shedding light on questions related to the protein's structure, specificity, and mechanism of deamination.

Investigation of the Eigenvalue Spectrum of Random Networks
Kunting Chua / Science and Humanities Scholars
Advisor(s): Markus Deserno / Physics
Rangos 2 & 3 / Sigma Xi Group 6, 11:30am

In this research project, we studied the properties of 3 models of networks - the Erdos-Renyi random network, the Watts-Strogatz small-world network and the Barabási–Albert scale-free network. This involved representing each network as a Laplacian matrix that characterized its nodes and links. The simulations verified that random networks exhibited a phase transition when the randomness is increased. We also found that the smallest non-zero eigenvalue of the Laplacian was insufficient to determine the full long-term dynamics of networks.

Reasoning about impossibility and possibility
Faye Han / Science and Humanities Scholars
Advisor(s): Charles Kemp / Physics
Hoch Commons-2nd Floor, Rangos side / 3-5

Categories such as 'family' and 'around' are in many ways very different, but both rely on relational information. Family members are related by blood and marriage, and an object is around something else only if a spatial relationship exists. People use inductive reasoning to place objects into categories or create new categories for objects that don't fit in an existing one. The goal of this project is to determine how people make judgments about the possibility or impossibility of certain situations based on previously given events; or, in other words, how certain situations are determined to fit in the categories of possible or impossible using inductive reasoning.

Representation of the Healthcare Consumer in Healthcare Legislation
Benjamin Lee / Science and Humanities Scholars
Advisor(s): Barbara Johnstone / English
Hoch Commons-2nd Floor, Window side / 12-2:30

I analyzed the "Affordable Healthcare for America Act" passed by the United States House of Representatives on October 29, 2009 in terms of how the healthcare consumer, a major stakeholder in the healthcare system, is constructed within the discourse. Drawing from the work of Ainsworth and Hardy in their 2007 paper, "The construction of the older worker: privilege, paradox and policy," I examine the representation of the consumer in the legislative discourse. By looking at the vocabulary used to describe the consumer of healthcare and the agency the healthcare consumer possess within the legislation, I examined the role given to the consumer by legislators. I found that the majority of the time, consumers was portrayed as "individuals" rather than "participants" leaving them in an implied inactivity with regards to the healthcare system. In addition, consumers were generally acted upon or expected to act in a certain way, limiting agency and self-determination. This representation of the healthcare consumer is troubling in that a major stakeholder in a proposed piece of legislation appears to be involved in unclear and passive ways. For public policy on the scope of national healthcare legislation to be fully democratic, the legislation must be accessible to members of the public (the healthcare consumers) and the representation and role of the consumer must be clear.

Seeing Past The Symptoms: Medical Narratives of Ghanaian Eye Patients
Ashley Kilp / Science and Humanities Scholars
Advisor(s): Marie Norman / Hisotry
Pake / 1:20

This research examines the interplay of factors that affect health care and health behaviors pertaining to sight in the African nation of Ghana. A series of direct interviews were conducted with patients and observations of patients of Unite For Sight's partner eye

clinics. These were used to create medical narratives, in order to elucidate how social, cultural, economic, and political elements contribute to illness incidence, course, and outcome. Determination of the forces that shape the situations these patients find themselves in can bring insight into the efficacy of various methods, and could greatly impact how the clinics, Unite for Sight, and other NGO's operate.

Motivation in Foreign Language Learning
Jaclyn Bernard / Social and Decision Sciences & Science and Humanities Scholars
Advisor(s): Julie Downs / Social and Decision Sciences
Pake / 3:40

In the study of academic motivation in a language-learning setting, motivation has traditionally been considered an independent variable. The present study treats it as both a dependent function of classroom activities and an independent predictor of study time, expected grade, and whether a student will continue to study the language. Six distinct motivational types are discussed: motivation about the language, motivation about the class, confidence, external motivation, whether the class feels required, and self-reported motivation. Motivation about the language is found to be of particular importance in predicting outcomes, along with fun activities and activities that promote language use about students' own lives and interests.

Assessment of the Environmental Risks of Nano-Silver
Tim Helbig / Biological Sciences & Science and Humanities Scholars
Advisor(s): Stephen Tonsor / University of Pittsburgh
Dowd / 1:40

Artificial nanomaterials, or designed chemical structures having dimensions on the scale of nanometers (10^-9 m), are being produced in larger and larger amounts due to the discovery of new applications for them and demand for those applications. This increased production has led to their accidental and purposeful release into the environment, but due to the novelty of these materials, little is known about the implications of this. Attempts have been made to assess the overall risk of these new nanomaterials, but this has proven difficult because very small changes in the size, shape or composition of these materials has been shown to greatly alter their environmental impacts. Thus, the purpose of this project was to interpret and synthesize all of the current knowledge known about one particular class of nanomaterials, nano-silver, to get a broader sense of the viability of the risk assessment process and to elucidate important informational gaps for this new class of materials. The examination of nano-silver has revealed many pathways by which

release of this chemical product could adversely impact microbial communities of economic and health-related importance including the bacteria of the intestinal flora, the anaerobic microbes of river sediments and the nitrogen fixing rhizobia of plant roots. It is hoped that this assessment will not only serve to assist policy-makers, students and researchers in learning the intricacies of nano-silver, but that it will also be a template for how an environmental risk assessment can be done for any present or future nanomaterial of interest.

Developmental Differences in Response of Arabidopsis thaliana to Thermal Stress
Tim Helbig / Biological Sciences & Science and Humanities Scholars
Advisor(s): Stephen Tonsor / University of PIttsburgh
Rangos 2 & 3 / Sigma Xi Group 2, 10:00am

Due to the likely increase in the frequency of days with extremely high maximum temperatures caused by anthropogenic climate change, there have been great efforts in trying to biochemically modify, through genetic alteration, crop plants to be thermally tolerant. However, this has proven to be far more difficult than initially intended with most attempts resulting in negligible outcomes; one likely reason for this is that, when modification is done, the developmental complexity of plants is frequently ignored. The physiological change that occurs within a plant that switches from vegetative to reproductive growth can be as profound as that experienced by a tadpole when it morphs into a frog, so this must be considered when trying (with costs in the range of millions of dollars) to alter the physiology of plants for our own benefit. Thus, the purpose of this project was to elucidate the physiological differences, if any, of the plant thermal stress response at the selected stages of pure vegetative growth, bolting, flowering and fruit ripening and how stress at any of these stages might impact the overall fitness of the plant. This was done by exposing different strains of Arabidopsis thaliana to a set temperature deemed a thermal stress in growth chamber conditions at the selected developmental stages specified above and quantifying final plant size, yield of seed produced, total protein content following the heat stress and total Hsp101 content, a particular protein associated with the thermal response. While most quantitative measures are currently still being collected, there is preliminary evidence of substantial differences in how the plants respond to thermal stress at different life-stages and how it impacts their overall fitness.

Characterization of Carbon Nanotubes for Transparent Electrodes
Jane Herriman / Chemistry & Science and Humanities Scholars
Advisor(s): Lisa Porter / Chemistry
Hoch Commons-2nd Floor, Rangos side / 3-5

Future solutions to global energy needs will require a variety of alternative energy conversion devices, such as organic photovoltaics (OPVs), which are being pursued as a versatile and inexpensive energy source. In current OPVs indium-tin-oxide (ITO), is the primary material used for the electrodes. Important characteristics of materials for OPV electrodes include transparency, low resistivity, resistance to mechanical failure, and low cost. While ITO is transparent and conductive, it is relatively brittle and expensive. Single-walled carbon nanotubes (SWNTs) are an alternative transparent electrode material. A carbon nanotube is essentially a single atomic layer of graphite (graphene) in the form of a cylinder. In this research we are characterizing electronic and optical properties of SWNTs that have been prepared in the form of thin film networks or aerogels. Our results on optical transparency measured using UV-vis spectroscopy and four-point probe resistivity measurements will be presented. In future studies we plan to investigate the contact resistance of SWNT networks when incorporated in OPV-related devices, to determine whether SWNTs can serve as more efficient, cost-effective, and durable electrodes.

Assessing "Fat-ism": Reinforcement and Reduction of the Overweight Stereotype
Lauren Giesey / Psychology, Cynthia Peng / Psychology & Science and Humanities Scholars,
Maureen Satyshur / Psychology & Alyssa Sellitti / Psychology
Advisor(s): John Creswell / Psychology
Rangos 2 & 3 / Sigman Xi Group 7, 10:30am

Stereotypes and prejudices towards overweight people have a prominent role in socially acceptable Western attitudes. We aimed to reduce these stereotypes and prejudices via counter-stereotypic strategies. Participants were assigned to one of three experimental conditions: stereotypical, counter-stereotypical, and neutral, and watched videos portraying overweight individuals as such in each condition. Participants then completed both implicit and explicit measures of attitudes towards overweight people. We found that we were successful in reducing negative attitudes towards overweight persons for those in the counter-stereotypical condition in our implicit measure. We found trends towards significance in reducing negative attitudes towards overweight individuals in our explicit measures. This study highlights the malleability of stereotypes as well as the influential

role of the media in portraying the overweight stereotype. Successful reduction methods could bring forth less negative attitudes overall towards overweight individuals in Western society.

Scene Categorization and Individuation in Human Extrastriate Cortex
Cynthia Peng / Psychology & Science and Humanities Scholars
Advisor(s): Sharon Carver / Psychology
Dowd / 3:40

The recognition of visual scenes, mediated by the Parahippocampal Place Area (PPA) of the brain, is an integral part of human experience. Here, we explore how PPA categorizes and individuates scenes and how scene representations evolve along the visual hierarchy from early visual cortex (EVC) to PPA. Participants viewed 96 color, full-screen scene images while performing a fixation task in an fMRI scan. The stimuli were selected according to three fully-crossed dichotomies of open vs. closed, natural vs. manmade, and near vs. far. Multi-voxel pattern analyses revealed that the PPA tends to categorize scenes as open vs. closed. Further, we found that the pattern of response in PPA could also be used to discriminate individual scenes. In contrast, while the pattern of response in EVC could also be used to individuate scenes, this region tended to group scenes according to near vs. far. Overall, these findings provide important insights into how our brain perceives and interprets the visual world and how the representations of scenes are transformed during visual cortical processing.

Exploring the Structure and Function of an RNA-Editing Enzyme
Sefa Kploanyi / Biological Sciences, Amy Wang / Biological Sciences
Advisor(s): Mark Macbeth / Biological Sciences
Hoch Commons-2nd Floor, Window side / 12-2:30

The Macbeth lab studies the RNA-editing enzyme, adenosine deaminase that acts on RNA (ADAR) and the mechanism by which it catalyzes the deamination of specific adenosines in double-stranded mRNA (messenger RNA) substrates. mRNA is transcribed from DNA and serves as an intermediary template that travels out of the nucleus into the cytoplasm of the cell for protein synthesis. The product of the deamination reaction is inosine, which is read by ribosomes during translation as the nucleotide guanosine. The deamination of inosine to guanosine by ADARs is therefore a form of RNA-editing. There are many different types of RNA-editing that occur after transcription that results in a mature mRNA such as an addition of a poly-adenosine tail, guanine cap, and RNA splicing. The mechanism by which ADARs target certain adenosines for deamination is unknown; however, the lack of common sequence motifs among the known ADAR substrates suggests that the mechanism is dependent on structural characteristics of the RNA.

TEPPER SCHOOL OF BUSINESS

BUSINESS ADMINISTRATION

CMU Undergraduate Satisfaction with UC Athletic Facilities
Siddhartha Gupta / Economics, Christopher Lee / Statistics, Jung Yub Lee / Business Administration, Sonam Rajpal / Economics & Swetha Reddy / Business Administration
Advisor(s): Brian Junker / Statistics
Kirr Commons-1st Floor, Window side / 3-5

Through this study, we hope to find out how CMU undergraduate students feel about the UC athletic facilities. Through their responses, we feel that they can be used to improve all aspects of the facilities. We selected our participants through a random selection of the CMU C-Book and sent out an online survey through a website called QuestionPro.com. We reached out to 1,320 undergraduate students, accounting for a 25% nonresponse rate. With these numbers, we hope to receive feedback from at least 341 students. We will then analyze our results in an attempt to improve our campus facilities.

Improving Writing Assessment with Statistical Techniques
Jason Hwa / Statistics, Belle Peng / Business Administration, Antonios Tavlarakis / Mathematics & Samuel Ventura / Mathematics
Advisor(s): Cosma Shalizi / Statistics
Wean Commons-1st Floor, Connan side / 3-5

Due to the excessive demand of learning English in China, English teachers and professors find themselves overwhelmed by classroom size. This makes it difficult for them to provide each individual student with quality feedback and in turn limits the student's ability to

learn. Dr. Kaufer, a professor of English at Carnegie Mellon University, has helped develop a text-analysis software called DocuScope to aid teachers in providing quick feedback to their students. Currently, DocuScope reads in a collection of writing assignments and categorizes the words into 40 different dimensions. Using these dimensions, our tasks are to automate the use of statistical techniques to highlight how the students write similarly, how they are unique, and how they compare to a benchmark of standard English writing. An additional goal of ours is to make our analysis interpretable for teachers and students untrained in statistics. Using a training set of 98 essays written by Dr. Kaufer's Chinese students, we explored various clustering, classification, outlier detection, and dimension reduction techniques.

Perceived stress, perceived social support, depression and food consumption frequency in college students.
Jaclyn Wainer / Business Administration
Advisor(s): Chante Cox/Boyd / Psychology
Wean Commons-1st Floor, Connan side / 3-5

The purpose of the proposed study is was to learn more about how perceived stress, perceived social support, and depression influence weight changes and food choices in college students who are normal and abnormal eaters. On average both male and female students gain weight in college and this is often explained using the fact that the transition into the college environment is a large one. The eating habits we have in college are often very similar to those we will have for the rest of our lives. Obesity rates in America are continuing to increase. We hypothesize that those who are stressed, depressed, and lacking in social support will eat differently than people who do not suffer from these symptoms. We also predict that those who have problematic eating symptoms will cope differently than normal eaters. Thus, this study is important because figuring out why people are gaining weight in college has many implications for reducing and reversing this weight gain.

Should I Open this Email? Using inbox-level data to predict attention to an email
Jaclyn Wainer / Business Administration
Advisor(s): Laura Dabbish / Human Computer Interaction Inst. &
Robert Kraut / Human Computer Interaction Inst.
Wean Commons-1st Floor, Connan side / 3-5

The quantity of email we receive each day is often a staggering and overwhelming amount. People use email for a variety of tasks and functions, many of which email was

not originally designed for. Currently, a question that remains largely unanswered is, "what draws ones attention to an email." Focusing on inbox-level message data (e.g., subject line, time/date, and sender), this study attempts to answer this question. In the first study, using Think-Aloud methods, we developed a categorization for different types of work-related emails. In the second study, using a curiosity approach, and experimentally manipulating email importance, information gap, and workload. We hypothesize that emails with a moderate amount of inbox level information will elicit the most curiosity and be attended to the fastest. The implications from this study include designing intelligent email systems, improving email client interfaces, and lessening the burdens of the stress associated with email.

The Private Sector & Foreign Assistance
Megan Larcom / Business Administration
Advisor(s): Evelyn Pierce / GSIA
Pake / 4:40

Foreign assistance is an important and relevant tool for shaping international relationships. Business is too. This paper seeks to understand the relationship between the U.S. government and the private sector in the context of U.S. foreign assistance policy and practice and the debate that currently surrounds its reform. Amidst the evolving scope of values and international reach of private entities and amidst the changing landscape of global challenges and American interests, President Obama must address foreign assistance reform during his first term. Within this, it is necessary to consider the reinforcing interests and resources that exist between public agencies and private enterprises. This paper will answer an overarching policy question: how can the U.S. government, specifically the President, leverage the private sector for international development? It will answer the question by analyzing the internal structures for public-private coordination of three government organizations: the Millennium Challenge Corporation (MCC), the United States Agency for International Development (USAID), and the Overseas Private Investment Corporation (OPIC). This paper individually then collectively assesses each organization's strategy concerning the private sector for strengths and weaknesses of what exists as well as opportunities and threats for what could exist. The assessment first reveals the state of existing public-private coordination efforts then informs decisions about foreign assistance reform. President Obama must exert leadership to coordinate the various efforts working to reform foreign assistance; in doing so he will ensure U.S. goals are defined in a policy framework and soon after operationalize the articulated policy direction through awareness of and support to the private sector tool for development.

Understanding The Appropriate Conditions For the Poisson Process
Kevin Kwan / Business Administration
Advisor(s): Robert Kass / Statistics
Hoch Commons-2nd Floor, Window side / 12-2:30

A common assumption for many of the existing Spike Train Probability Models is that spike trains aggregated over many trials can be described by an inhomogenous Poisson process. We aim to investigate how quickly the Poisson process becomes appropriate for different Spike Train Probability Models

Usefulness of Amazon discussion threads in consumer decision making
Benjamin Klixbull / Business Administration
Advisor(s): Carolyn Rose / Language Technologies Inst.
Wean Commons-1st Floor, Connan side / 12-2:30

This paper was created in an attempt to understand the correlations between the main attributes of an Amazon product and its affect on how peer product reviews are written. The primary objective is to provide Amazon with the foresight to optimally position advertisements on product pages. Holistically, one would assume that an increase in the level of a product's complexity, price, and longevity will correspond to a difference in the literature used in such peer product reviews. Keeping this assumption in mind, I segregated products by category, finding the most commonly used keywords associated with each of the five main product traits. The extent to which these keywords were used was viewed as a proxy for confirming if the above assumption for product features is correct.

Weather and Stocks: The Effect of Weather on the Stock Market and Investment Behavior
Seok Won Han / Business Administration
Advisor(s): Evelyn Pierce / GSIA
Peter / 12:40

Humans are irrational. Despite years of education and training, our decisions are influenced by our emotions and instincts. Such irrational behavior can be observed in various behaviors, including investment decisions in the common stock market. Since the development of the Efficient Market Hypothesis (EMH) in the 1960s, researchers and bankers have been utilizing the hypothesis to define and forecast the movement of the market. Their work was based on the hypothesis's assumption that markets reflect "all available information" and that investors are rational. Researchers and bankers could not, however, explain the market in its entirety—markets had anomalies that the Efficient Market Hypothesis could not explain. In response to the inability of the EMH to explain

certain aspects of the market, behavioral finance was established. Combining theories from finance and psychology, behavioral finance seeks to explain how people are influenced in their investment decisions. This paper is a response to the developing field of behavioral finance. After defining what behavioral finance seeks to explain, I will look at a universal factor that influences all investors in their investment behavior—weather. I seek to observe market behavior and provide a psychological explanation to the movement in the market in various weather conditions. After understanding how weather influences investors, I will formulate investment strategies people can follow in various weather conditions and countries.

ECONOMICS

Examining causes of delay in state court level civil trials
Hon Ming Quek / Economics
Advisor(s): Yaroslav Kryukoc / Economics
Class of '87 / 1:00

The project seeks to examine the causes of delay in civil justice cases prosecuted in state courts. Prior research in this area have attributed delay to the locale in which the trials are held. In this study, information about the characteristics of counties are included in our analysis to test the hypothesis.

Exploration of Government Policy through a DSGE model
Brian Moon / Economics
Advisor(s): Christopher Sleet / Economics
Class of '87 / 12:20

Government has greatly increased spending, in forms of stimulus packages and bailouts, during the past year and half to alleviate the ill effects of the current financial crisis. This paper attempts to explore the effects of government policy in a financial distress setting. However, the paper, does not include the banking sector and other features, and thus is not in direct relation to the current economic situation. Due to the current financial crisis, arguments for formally including credit markets and banks in analyzing the economy are becoming stronger. In light of this trend, the paper uses a dynamic general equilibrium model that embeds a "financial accelerator", described in Bernanke, Gertler, and Gilchrist, to let credit markets affect real variables.

CLASSES & SPECIAL GROUPS

Project Demonstrations for Rapid Design Through Virtual & Physical Prototyping
Instructor: Susan Finger
Connan, 12:30-3:30

The teams of students in Rapid Prototype Design (39-245) have designed, prototyped and tested toys and activities that engage children in informal learning about engineering and science.

Battle Curling
Tammy Dvir/Mechanical Engineering
Kin Hang Leung/Mechanical Engineering
Brian Mizrahi/Design

Circuit City
Asa Berg/Mechanical Engineering
Charles Doomany/Design
John Ni/Mechanical Engineering

Mentos and Diet Coke Car
Jocelyn Avila/Mechanical Engineering
Kellen Chow/Mechanical Engineering
Michael Serebrennikov/Mechanical Engineering

Pulley Drag Race: Building Intuition about Simple Machines
Ibuki Kamei/Mechanical Engineering
Daniel Miller/Mechanical Engineering
Nicholas Paris/Mechanical Engineering

Sling Shot Safety Car
Joshua Johnson/Architecture
Sarah Stroup/Mechanical Engineering
Cecily Sunday/Mechanical Engineering

Tesla's Tiles
Charles Ammerman/Drama
James Mesmer/Mechanical Engineering
Devin Murray/Mechanical Engineering

Tetris Building Blocks
Reyes Flete/Mechanical Engineering
Elizabeth Hohenstein/Civil and Environmental Engineering
Richard Musgrave/Mechanical Engineering

The Magnetic Ink Sketch Pad
Kevin Chung/Mechanical Engineering
Elisha Clayton/Mechanical Engineering
Michael Lynes/Architecture

The Super Spinner
Mukul Bhatt/Mechanical Engineering
Zari Salimnejad/Design
Won Shim/Mechanical Engineering

Tiny Tractable Trebuchet
Tyrone Celoza/Mechanical Engineering
James Hresko/Mechanical Engineering
Madeline Stearns/Civil and Environmental Engineering

Toy Plane Launcher
Jer-Chir Chuang/Design
Fedor Kleschchev/Undecided
Daniel Rapoport/Architecture

Velcro Building Blocks
Sarah Habib/BHA
Tristram Hogben/Mechanical Engineering
James Hulley/Mechanical Engineering

Waterworld
Paul Kimball Jr./Mechanical Engineering
Eric Totong/Mechanical Engineering
Ethan Weil/Drama

XyloHero
Jacob Devine/Mechanical Engineering
Mohiuddin Mohamad Ali/Civil and Environmental Engineering

'Thought' Undergraduate Research Journal
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James Berndt / Creative Writing and Ethics, History and Public Policy &
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Jennifer Baumgardner / Communication Design
Nick Abele / Communication Design
Lauren Cicozi / Communication Design
Joy Nelson / Communication Design
IT: Warren Pryde / Electrical and Computer Engineering

Common Area, 12-2:30 p.m.
Thought', the Carnegie Mellon Undergraduate Research Journal, presents its fifth issue along with a monetary prize for the best research submission. Authors must both submit their articles to Thought and participate in the Meeting of the Minds to be eligible to receive the prize. We continue our mission of seeking out and publishing compelling undergraduate research.

Thought

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SPECIAL COMPETITIONS JUDGES & SPONSORS

The Allen Newell Award for Excellence in Undergraduate Research

This endowed award, established in 1993, is presented annually by the School of Computer Science. Allen Newell had a long, rich and distinguished scientific career that contributed to multiple subdisciplines in computer science. Still, each individual endeavor was pursued with a characteristic style that his colleagues, students, and friends recognized as essential to Allen. Owing to the breadth and scope of Allen's contributions, this award recognizes extraordinary undergraduate research in his scientific style rather than computer science research in a particular area. The criteria by which a research project is judged is predicated, foremost, on the belief that a good idea is not enough. The qualities that transform a good idea into good science can be captured in three maxims attributable to Allen:

1) Good science responds to real phenomena or real problems.
2) Good science is in the details.
3) Good science makes a difference.

Alumni Award for Undergraduate Excellence in Computer Science

The Alumni Award for Undergraduate Excellence in Computer Science, established in 2003, is granted on behalf of Carnegie Mellon School of Computer Science alumni. The Award recognizes technical excellence in research and development. The Award is also intended to promote awareness within the undergraduate community that graduation represents both the end of an important phase of life and the beginning of a new phase within the vibrant Carnegie Mellon University School of Computer Science community as an alumnus. The Alumni Award recognizes such factors as contribution to the state of the art; technical excellence; potential societal impact; accessibility; quality of the written, oral, and poster presentations; and generated excitement among the alumni community participating in the process.

Award for Artistic Excellence

The Award for Artistic Excellence is sponsored by engineers in support of the arts and the Center for the Arts and Society at Carnegie Mellon. . Awards will be given to outstanding visual and performing arts presentations.
Paul Eiss, Associate Professor, History
Tim Haggerty, Director, Humanities Scholars Program
John Mackey, Assistant Department Head, Mathematical Sciences
Joe Mannino, Professor of Art
Rebecca Oreto, Language Development Specialist, Intercultural Communication Center
Terese Tardio, Associate Teaching Professor, Spanish

CIT Honors Poster Competition

All students conducting research through the Carnegie Institute of Technology Honors Program participate in the CIT Poster Competition. The judges for the CIT Poster Session will be:
Faculty:
Michael Bockstaller, Material Science Engineering
Kris Dahl, Material Science and Engineering
Kaushik Dayal, Civil and Environmental Engineering
Chris Hendrickson, Civil and Environmental Engineering
Gabriela Hug, Electrical and Computer Engineering
Michael Lancet, Electrical and Computer Engineering
Shawn Litster, Mechanical Engineering
Irving Oppenheim, Civil and Environmental Engineering
Tom Sullivan, Electrical and Computer Engineering
John Wesner, Institute for Complex Engineered Systems/ME
Alumni Judges:
Kate Jackson, Senior VP and CTO, Westinghouse
Jayshree Ranka, Defense and Space Industry Contractor

IBM Undergraduate "Smarter Planet" Award

IBM, in association with the CMU ACM Student Chapter, is proud to sponsor the Undergraduate "Smarter Planet" Award. As CMU Students, you have the opportunity to change the way the world works. Worldwide systems and processes enable physical goods to be developed, manufactured, bought and sold; services to be delivered; everything from people and money to oil, water and electrons to move; and billions of people to work, govern themselves, and live. For the first time in history, almost anything can become digitally aware and interconnected. Smart airports, smart banks, smart roadways, smart cities with so much technology available at such a low cost, the list of possibilities is endless. New levels of global integration mean that we are all now connected economically, technically and socially. But being connected is not sufficient. We must also infuse intelligence into our systems and ways of working. The world has become flatter and smaller. Now it must become smarter--a "Smarter Planet." This award is designed to challenge some of the brightest minds on the planet - - CMU Undergraduates - - no matter what their field of study - to collaboratively advance the state of the planet and society through interdisciplinary research.
Herm Anand
Kumar Bhaskaran
Billie Godlewski
Tom McManus
Janet Mostow
Mark Sherman
Frank Stein
Jiwu Tao
JoAnn Washam Winson

Intel IFYRE and SRC-URO Poster Competition

This competition, sponsored by Intel, seeks to recognize significant and creative work supported by the IFYRE (Intel First Year Research Experience) program and SRC-URO (Semi-Conductor Research Corporation – Undergraduate Research Opportunities) program, and to encourage students to develop and practice visual and oral presentation skills suitable for academic conferences and industrial research venues. Three prizes will be awarded.

Johnson & Johnson Undergraduate Research Award

Johnson & Johnson is proud to support innovative projects in the field of Information

Technology. Two prizes will be awarded.
Anuj Desai, Innovation I/T Manager
Eduardo Frias, Global Services I/T Director
Rob Wilson, Consumer I/T Director

The Tenth Annual Lockheed Martin ECE Undergraduate Project Awards Sponsored by Lockheed Martin, Organized by Eta Kappa Nu, Sigma, PA

The Sigma Chapter of Eta Kappa Nu at Carnegie Mellon is proud to present the Ninth Annual Electrical and Computer Engineering (ECE) Project Awards sponsored by Lockheed Martin. This competition is designed to encourage undergraduate ECE students to present their projects, and motivate them to learn from others' work. Eta Kappa Nu (HKN) Sigma Chapter is the Carnegie Mellon chapter of the National Honor Society of Electrical and Computer Engineering. Our goals are to enhance interactions between ECE students, improve student-faculty communication, and develop contacts with industry leaders.
Dave Casasent, ECE
Fred Dentel, Lockheed Martin
Jessica Liao, Senior ECE, Eta Kappa Nu (HKN) Officer

Psychology Department Competition

The department of Psychology is proud to sponsor a poster/presentation competition for all undergraduate students who are presenting research that involves psychological science. A panel of judges will evaluate each project.
Anna Fisher, Assistant Professor, Psychology
Laurie Heller, Associate Teaching Faculty, Psychology
Vicki Helgeson, Professor, Psychology
Charles Kemp, Assistant Professor, Psychology
Ken Kotovsky, Professor, Psychology
Erik Thiessen, Assistant Professor, Psychology

Richard Schoenwald Phi Beta Kappa Undergraduate Research Prize

Open only to members of Phi Beta Kappa, this award is sponsored by CMU's Phi Beta Kappa chapter and named after Dr. Richard Schoenwald, late professor of History. Dr. Schoenwald was a member of Phi Beta Kappa, a proponent of undergraduate involvement in research, and the leader of CMU's first application effort (in the early 1970's) to shelter a Phi Beta Kappa chapter at Carnegie Mellon.

William Alba (SHS)
Antonio-Javier Lopez (Biology)
Anne Marie Mesco (University Libraries)
Joseph Devine (H&SS)

Sigma Xi Poster Competition

The Sigma Xi poster competition is an independently sponsored event within the Undergraduate Research Symposium. Coordinated by the Carnegie Mellon Chapter of Sigma Xi, a national honor society for those engaging in scientific research, the competition is open to students presenting posters in quantitative sciences.
V. Emily Stark, Director of Department Operations, Biological Sciences
Catalina Achim, Associate Professor, Chemistry
Joseph Ayoob, Special Faculty, Biological Sciences
Jill Blankenship, Postdoc, Biological Sciences
Michael Bockstaller, Assistant Professor, Material Science Engineering
Maggie Braun, Assistant Department Head, Biological Sciences
Roy Briere, Associate Professor, Physics
Daniel Brown, Postdoc, Biological Sciences
Subha Ranjan Das, Assistant Professor, Chemistry
Jon Dolan, Senior Systems Scientist, Robotics
Robert Heard, Associate Teaching Professor, MSE
Colin Horwitz, Research Professor, Chemistry
Dan Hufnagle, Postdoc, Psychology
Sarah Laszlo, Postdoc, Psychology
Greg Lowry, Assistant Professor, Chemical Engineering
Michael McHenry, Professor, Materials Science Engineering
Nicholas Minnici, CMU Alumni
Linda Peteanu, Associate Professor, Chemistry
Frank Pfenning, Professor, Computer Science
Lisa Porter, Professor, MSE
Russell Schwartz, Associate Professor, Biological Sciences
Nan Song, CMU Alumni, Computational Biologist, Precision Theraputics
David Squarer, CMU Alumni, Consultant
Susana Steppan, Senior Lab Assistant, Chemical Engineering
Golnaz Tabibnia, Assistant Professor, Social & Decision Sciences

Statistics Competition

The purpose of this competition is to encourage undergraduate projects and research in statistics and its applications, and to inform faculty and students about these projects. The competition is open to any student or team of students who have completed a project under supervision of faculty in the Statistics Department.
Alessandro Rinaldo, Assistant Professor
Andrew Thomas, Visiting Assistant Professor

STUDIO for Creative Inquiry Award

This competition rewards a creative project that exemplifies or explores the zone between art, technology, science and society; and impacts the local or global communities. The recipient(s) will be selected by research fellows and staff of the STUDIO for Creative Inquiry.
Marge Myers, Associate Director of STUDIO
Amisha Gadami, Alumni

Thought Prize for Excellence in Research Presentation

Thought, Carnegie Mellon's Undergraduate Research Journal, is proud to sponsor its third annual competition for the best article in its current issue. A panel of editors will choose the winning article based on its originality, contribution to the field, quality of research, and quality of writing.
Brittney Warnick, Professional Writing
Faith Sumtsit Lam, Philosophy
Alejandra Rodriguez-Gitler, Design

Undergraduate Economics Program (UEP) Competition

A goal of the Undergraduate Economics Program is to encourage students to think creatively and bring together their formal training with their passions. Open to any undergraduate student pursuing a degree in Economics or team of undergraduate students enrolled in an UEP course. Eligible projects include students writing a senior honors thesis in Economics and projects developed in UEP courses (including independent study).
Elif Incekara Hafalir, Visiting Assistant Professor, Economics
Onur Kesten, Assistant Professor, Economics
Nicolas Petrosky-Nadeau, Assistant Professor, Economics

Undergraduate Environmental Research Award

The Green Design Institute and the Steinbrenner Institute for Environmental Education and Research will award the Undergraduate Environmental Research Award to an undergraduate whose research includes a strong environmental component.
Inês Lima Azevedo, Engineering & Public Policy
Michael Griffin, Executive Director, Green Design Institute
Sean McCoy, Engineering & Public Policy

Yahoo! Undergraduate Research Awards

Yahoo! will be looking for interesting and creative projects in the general areas of Web information management and software services, with particular emphasis on information discovery over Web content that is intelligently interpreted, including application projects in the social sciences, business or other areas.
Don McGillen, Ph.D., Senior Manager, Campus Relations

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Afzaal M. Akhtar (CIT '84, '86) and Sarah J. Bhutta (MCS '89), Bell Family Foundation, Rahul Bhargava (CIT '00), Susan L. Burkett, Cliff I. Davidson (CIT '72), Christa Bower Downey (IM '97), Sujata R. Emani (MCS '05), Michael K. Fenwick (CIT '99), Timothy K. (H&SS '00) and Sarah J. (H&SS '00) Fife, Elenore M. Francis, Vianey Garcia-Osorio (CIT '03) & Garth R. Goodson (CIT '98, '00, '04), James H. (CIT '82, '83, '86) & Ruth Ann (CIT '82) Garrett, Jr., Michael Andrew Gingras (CIT '99), Bishwamohan K. Gupta (CIT '77), Lars S. Hanson (CIT '05), Annette M. (CIT '79, '88) and Donald B. Jacobson, James W. Levis (CIT '04) & Francesca Denise Reale-Levis, Barry B. Luokkala (MCS '01), Richard D. McCullough & Jai Vartikar, Robb F. Moskowitz (H&SS '99), Glenn L. Radice (MCS '83), James A. Rose, Jr. (MCS '70), Naomi R. Schwartz (H&SS '95, MCS '01), Robert F. Sekerka, Derek J. Wahila (SCS '95, CFA '96), the Wallach Family, Stephanie L. Wu (MCS '05)

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Wesley Cowan Undergraduate Research Fund, Loyd (E'59) and Linda Crawley Undergraduate Research Fund, Arthur Vining Davis Foundations SURG Grants for Humanities Research, eSite Entrepreneurship Fund, Dr. J. Paul Fugassi & Linda E. Monteverde Award, Stacy Rae Gross (A'00) Memorial Undergraduate Research Fund, James J. Huttner, M.D., Ph.D. (S'74) Undergraduate Research Fund, Jennings Family Brave Companions Fund, Richard Kelson Undergraduate Research Fund, Walter P. Ketterer Undergraduate Research Fund, Jennifer Kye Hyun Kim Undergraduate Research Fund, Linda Daley Kosturko Undergraduate Research Fund, Frederick Kuo Jr. (E'69) Undergraduate Research Fund, Lathers Local #33 of Western Pennsylvania Undergraduate Research Fund, Barbara B. Lazarus Undergraduate Research Fund, Barbara Lazarus Undergraduate Research Fund for the Humanities, Deidre Maloney-Cutler Memorial Undergraduate Research Fund, John V. Nelson (S'76) Undergraduate Research Fund, Marie Colontoni Pechet (S'84, IA'91) Undergraduate Research Fund, Proctor & Gamble Technical Undergraduate Research Endowment, Sam Soo Pyo Undergraduate Research Fund, Jessie B. Ramey Alumni Undergraduate Research Fund, William H. and Frances S. Ryan Undergraduate Research Fund, Harry M. (E'39, '50) and Lila O. (MM '45) Schadel Jr. Undergraduate Research Fund, Frederick Osborne Stebbins Undergraduate Research Fund, H. Guyford and Louise Stever Undergraduate Research Fund, Donald E. (S '63) and Peggy Stitzenberg Undergraduate Research Fund, Hideto Tombabechi Undergraduate Research Fund, William Wallach Undergraduate Research Fund, Jill Van Wart Hood Undergraduate Research Fund, Everard M. Williams Memorial Undergraduate Research Fund, Robert K. Zurawin Undergraduate Research Fund.

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