MEETING OF THE MINDS

2008

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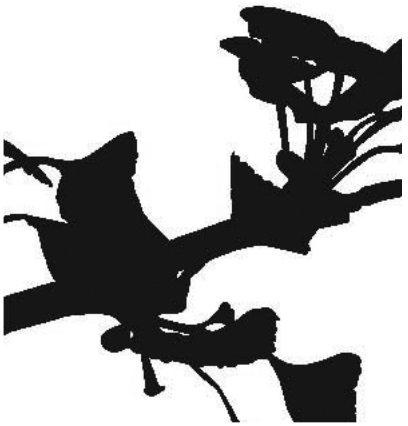
your mind

MEETING OF THE MINDS 2008

CARNEGIE MELLON UNDERGRADUATE RESEARCH SYMPOSIUM

Presented by the Undergraduate Research Office



WELCOME.

Thank you for joining us for the 13th annual Meeting of the Minds. This is a Carnegie Mellon tradition where undergraduate research takes center stage, and where the entire campus gathers at the University Center to celebrate the creativity, inventiveness, and originality of our students, their mentors, and the collaborations between them.

The abstracts in this booklet are a good place to begin as you plan your day and decide what you want to see and hear. The projects described in the booklet come alive in a variety of different ways: in the poster displays in the hallway as well as in Rangos Ballroom and the Connan Room; in the oral presentations along the second floor corridor; and in our first floor art gallery. Whatever you decide to see and hear -- whether it is truly a topic of burning intellectual interest to you, a friend's presentation, or, ideally, both at the same time – I have no doubt that you will be impressed with the high level of our students' research.

There are two important times to keep in mind. At 2:30, Peter Lee, Professor and Head of the Computer Science Department, will deliver a keynote address in the first floor Kirr Commons area. We will also hold a drawing of some items during this time — plus, there will be plenty of food.

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

Thank you again for coming, and please enjoy all parts of our 13th Annual Meeting of the Minds.

Best,

Stephanie Wallach
Director, 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 Initiative to ensure the accuracy or omission of information submitted for publication.

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SPECIAL THANKS

We extend our special thanks to:

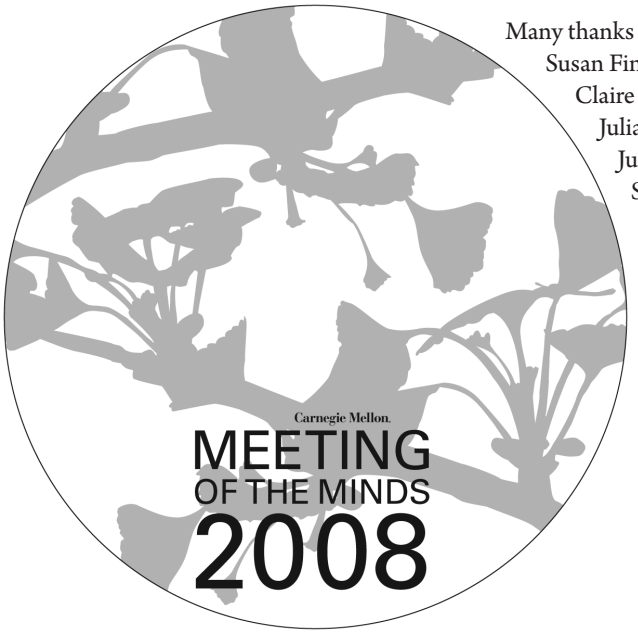
Carnegie Institute of Technology Dean's Office for the Mid-Afternoon Welcome

School of Computer Science Dean's Office for the Mid-Afternoon Welcome

Lockheed Martin for the Judge's Headquarters

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

Many thanks to Julia Brown, Vanessa Calvin, Rachael Clemmons, Susan Finger, Marcia Gerwig, Kourtney Kissel, Alex Lezberg, Claire Morgenstern, Indira Nair, Andrew Peters, Jessie Ramey, Julia Spencer, V. Emily Stark, Mark Stehlik, Jen Weidenhof, Judith Zang, 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.



PRESENTATIONS

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

Poster Presentations

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 Presentations

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 the UC Gallery, the McConomy Stage and in Wean Commons 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 for Meeting of the Minds 2008 begin on the next page.

BHA/BSA PROGRAMS

BHA

A Journey Through August Wilson's "The Piano Lesson"

Breanna Zwart (BHA)
Advisor: Michael Chemers (Drama)
Dowd
Oral 4, 1:00pm

The work of a dramaturg begins before the play is production and follows its process after the show has closed. It was my duty to ensure that the production did not loose its vision. This is achieved through research, discussions, making sure that the production is being true to the play, program notes and more research.
This process required me to step outside of the Carnegie Mellon campus and connect with the Pittsburgh community. It was a collaborative process that brought together multiple communities throughout Pittsburgh.

Bolivia: Consturcting a New Democracy

Breanna Zwart (BHA)
Advisor: Silvia Borzutzky (Social & Decision Sciences)
Dowd
Oral 7, 2:00pm

Bolivia is a country undergoing great change. Drawn to the political transitions taking place in a poor, often forgotten country, I spent the summer in Bolivia researching the Constitutional Assembly. On the 2nd of July, elections were held for representatives who would rewrite the constitution of Bolivia. This is a unique process which few countries have undergone, and Bolivia is a testing ground for this new type of democracy. The country is trying to reconcile its past, catch up with the present, and improve its future. Democracy is a concept which is often taken for granted. Many also associate the model for democracy with the United States, something Bolivia is not trying to duplicate. This process of developing new policies is centralized around the Constitutional Assembly, where there is hope that the ideas produced there will be codified and instituted for a positive change in the country.

Egg Ceremony: Interdisciplinary Performance Installation

Julia Stein (BHA)
John Eastridge (Architecture)
Advisor: Catherine Moore (Drama)
UC Gallery
3-5pm

Death and the emotions of guilt surrounding grief will be performed in a public performance installation. It is a cross-disciplinary live performance-installation exploring guilt and recurring memory in the context of grief and the ancient ritual of egg decoration. The relationship of guilt and grief will be looked at specifically through the lens of the narrative art book, "Swell" by Julia Stein. This book will act as a framework and serve as the inspiration for the project. The performance will be an interpretation of the 'egg ceremony' scene in the book. During this scene a fight occurs between two sisters, one of which is having a goodbye party where she and her friends are decorating eggs. The scene is filled with resentment, anger, physical and psychological violence. Soon after in the narrative one of the sisters dies. Therefore the egg ceremony becomes an event of significance. For the surviving sister, this memory reoccurs over and over as a reminder of her loss and her regret. The performance and installation will reflect this confluence of abstract memory, emotion and event.

Exploring Printmaking and Death in "Tome of Hallow County": A Receptacle and Narrative Art Experience.

Julia Stein (BHA)
Advisor: Kim Beck (Art)
UC Gallery
3-5pm

A graphic art story about the contentious relationship between sisters that becomes a story about grief in the present tense.

Infants' Understanding of Self-Propulsion

Shelly Kucherer (Psychology)
Caroline Eckert (BHA)
Lauren Krogh (Biological Sciences)
Advisor: David Rakison
Wean Commons-1st Floor,
Connan side
12-2:30

Research has shown that at the age of 20 months infants understand that objects that have moving parts - such as legs - are self-propelled, and that infants at the age of 18 months think that any object can be self-propelled. The aim of this study is to extend previous research to determine when infants generalize self-propulsion on the basis of movement alone. Infants will be shown an ambiguous clay object that moves without external contact from another object (it will be made to move by hidden magnets). After watching this demonstration, the infants will then be given two test objects and will be encouraged to move them in the same way as the ambiguous object. One of the test objects will be an animate object (a person or animal) and the other will be an inanimate object with wheels or an inanimate object without wheels. The results will provide a better understanding of how infants learn about self-propulsion in animate objects.

The Tale of Old Lady Merrell: New Performance in Los Angeles

Julia Stein (BHA)
Advisor: Patricia Bellan-Gillen (Art)
McConomy Auditorium
12-1pm

Was able to present The Tale of Old Lady Merrell and a new performance at the Gallery High Energy Constructs in Los Angeles in the fall of 2006.

SELF-DEFINED

Solar Decathlon Green-scape

Claire Hoch (Self-defined)
Advisor: Robert Bingham (Art)
UC Gallery
3-5pm

The Green-scape is the natural component of the 2007 Carnegie Mellon solar-powered house. The Solar Decathlon project incorporates innovative and ecologically friendly ideas about living, design, and construction. The Green-scape integrates the technological components of the solar house with the natural environment. Beyond its aesthetic value, it provides insulation, absorption and purification of rainwater, and a habitat for native life. The Green-scape is composed of organic growth in modular structures encompassing the orthogonal house. With the Green-scape, I plan to integrate the house and the land by extending the landscape: literally growing from the land, up the walls, and onto the roof.

Plug-In Hybrid Vehicle Simulation: How Batery Weight and Charging Patters Impact Cost, Fuel Consumption, and CO2 Emissions

Richard Hauffe
Advisor: Jeremy Michalek
Rangos 2 & 3
Sigma Xi Group 5, 10:15am

Plug-in hybrid electric vehicle (PHEV) technology is receiving attention as an approach to reducing U.S. dependency on foreign oil and emissions of greenhouse gases (GHG) from the transportation sector. Because plug-in vehicles require large batteries for energy storage, battery weight can have a significant impact on vehicle performance: Additional storage capacity increases the range that a PHEV can travel on electricity from the grid; however, the associated increased weight causes reduced efficiency in transforming electricity and gasoline into miles driven.
We examine vehicle simulation models for PHEVs and identify trends in fuel consumption, operating costs, and GHG emissions as battery capacity is increased. We find that PHEVs with large battery capacity consume less gasoline than small capacity PHEVs when charged every 200 miles or less. When charged frequently, small capacity PHEVs are less expensive to operate and release fewer GHGs, but medium and large capacity PHEVs are more efficient for drivers that charge every 25-100 miles. While statistics on average commute length suggest that frequent charges are possible, answering the question of which PHEV designs will best help to achieve national goals will require a realistic understanding of likely consumer driving and charging behavior as well as future trends in electricity generation.

BIOMEDICAL ENGINEERING

Anatomic Modeling of Pediatric Patients

Olusheun Ogunsunlade (Biomedical Engineering)
Advisor: Dr. James Antaki (Biomedical Engineering)
Rangos 2 & 3
Sigma Xi Group 6, 11:00am

An innovative pediatric ventricular assist device (PVAD) is being developed to treat young patients (2.5kg-15kg) with severe heart failure that currently lack treatment options due to their small size. To optimize the design of the PVAD for the target patient population, three-dimensional anatomical fit studies are currently being performed. The goal of this project is to develop a library of 3D models of pediatric patients in the target patient population. Serial CT scans of the chest cavity were acquired to complete this study. The results have yielded surface renderings of the rib cage, heart, lungs, skin and liver. The data was then amended with solid models of the implantable hardware, including the PVAD and cannulae allowing for optimal placement of the pump and cannulae. In the future, the 3D models will be used in the development of a surgical simulation program to assist surgeons in pre-planning the implantation of the PVAD device and cannulae for optimal performance.

Connecting the Aggregation Behavior of Formulated Recombinant Human Growth Hormone with Gibbs Energy of Unfolding Measurements

Amanda Dilenno (Biomedical Engineering)
Advisor: Dr. Todd Przybycien (Biomedical Engineering)
Wean Commons-1st Floor, Connan side
3-5pm

The tendency of pharmaceutical proteins to aggregate during storage and delivery is important in medical applications as this may result in some detrimental affects on the human body. Protein drugs are formulated by adjusting solution composition variables, such as pH, ionic strength, additive type and concentration, to minimize the tendency to aggregate. Rapidly determining whether or not a given protein solution is stable is key to the timely development and commercialization of protein drugs. It has been determined that the Gibbs energy of unfolding (DGunf) and the relative interactions of protein monomers in solution can be determinants of the tendency of proteins to aggregate. The research question we will address is whether the coupling of Gibbs energy of unfolding data together with available second virial coefficient data will enable more accurate predictions of the tendency of formulations of a model protein drug, recombinant human growth hormone (rhGH), to aggregate. The Przybycien group has previous information on the real-time tendency of rhGH and a homologous protein, recombinant bovine growth hormone (rbGH) to aggregate. We will test 19 solutions identical to the solutions test previously by the Przybycien group. We will measure DGunf by performing equilibrium thermal denaturation experiments on candidate rhGH and rbGH solutions via far-UV circular dichroism (CD) measurements as a function of temperature. If time permits, we will also examine unfolding behavior via tryptophan emission spectra; this serves as another tool to report on the structural stability of the molecule. The Gibbs energy of unfolding data gathered from these experiments will be combined with the second virial coefficient data to see if it enables a more accurate prediction of the tendency of rhGH formulations to aggregate than does the second virial coefficient data alone.

In vitro biocompatibility of resorbable composite implants for reconstruction of craniofacial defects -physicochemical characterization

Ruchi Desai (Biomedical Engineering)
Christine Ho (Biomedical Engineering)
Advisor: Abiraman Srinivasan (Biomedical Engineering)
Hoch Commons-2nd Floor, Rangos side
3-5pm

Massive craniofacial defects are currently reconstructed using nonresorbable plastics (e.g. poly(methyl methacrylate) PMMA) that transiently repair and restore fractured bone. However, currently available materials do not remodel or integrate with host tissue and can become infected. Consequently, revision surgeries are often necessary. Here we propose a physiological alternative that will overcome the constraining limitations of contemporary bone substitutes. The clinical goal is to develop PUR/MBP implants with growth factors that will induce new blood vessel and bone formation to facilitate the integration of the implant with the host tissue, and the implant resorbed over a time period leaving a healthy natural tissue behind. This study focuses on the in vitro biocompatibility and bioresorption of the polymers with osteoblast and osteoclast cells. Osteoblast (bone forming cells) and osteoclasts (bone resorbing cells) were seeded onto PUR/MBP disks and the cell cytotoxicity was evaluated using Live/dead staining, cell attachment by actin and scanning electron microscopy (SEM), cell differentiation for osteoblast (runx2, Type-I collagen and Osx) and osteoclast (CD14, TRAP staining) was analyzed using immunofluorescent and histochemical staining. Materials were characterized for their physicochemical property before and after cell seeding by Fourier

Transform Infrared Spectroscopy and SEM. Live/dead staining of cells seeded on PUR/MBP surface showed more than 80% viable cells, suggesting PUR/MBP material is biocompatible and non-toxic. PUR/MBP disk surface showed good cell attachment, proliferation , differentiation and mineralization with osteoblast cells. The polymer was stable and did not crack or degrade in response to osteoclast cells suggesting the polymer is stable and does not degrade actively.

CHEMICAL ENGINEERING

Alloy Decorated Gold Electrocatalysts

Diane Mattingly (Chemical Engineering)
Advisor: John Kitchin (Chemical Engineering)
Wean Commons-1st Floor, Connan side
3-5pm

Fuel cells will soon play a large role in our society because they have higher efficiencies than internal combustion engines, and produce less pollution than the combustion of fossil fuels. Most fuel cells work by converting hydrogen and oxygen into water and producing electricity. In order for this reaction to occur at a practical rate, a catalyst such as platinum must be present. Platinum is an extremely expensive metal, and as a result fuel cells can only be commercially feasible if the platinum is used very efficiently. We have investigated the electrodeposition of ultrathin Pt films on gold particles to better utilize platinum in fuel cell applications. By depositing a thin film of platinum nanoparticles on a gold nanoparticle surface, the reactions in a fuel cell can still occur, and the cost of the catalyst is reduced. The focus of this project is to accurately determine how much platinum has been deposited on a gold surface, in order to predict an optimal amount of platinum to deposit. Copper underpotential deposition (UPD) was utilized to measure the active surface area of the electrode. Different amounts of platinum were deposited, and the methanol oxidation activity was measured. Future work includes exploring multiple ways to deposit the platinum on the gold to determine an optimal method for deposition.

Assistive Technologies for the Blind

Miriam Cha (Chemical Engineering)
Advisor: Priya Narasimhan (Electrical & Computer Engineering)
Wean Commons-1st Floor, Connan side
12-2:30

Identification of currency is a critical task in a blind person's daily activity. Unfortunately, U.S. currency notes are of the same size, shape and texture, making currency identification difficult for blind and visually impaired people. The Trinetra currency identifier aims to develop a cost-effective cell phone-based application that can simplify the task of identifying U.S. currency notes. The application retrieves images of the currency note held by the blind user, and then matches these images against a database of known and previously identified currency notes. Once a match is detected, the blind user's cell phone is notified; onboard text-to-speech software audibly identifies the match to the user. We are interested in investigating the effectiveness of this application, in particular, the latency of currency identification and the usability of the interface for blind people. The goal is to ultimately build a user-friendly assistive technology interface for blind people.

Car Chassis Design

Rogaite Shafi (Chemical Engineering)
Sudarsan Venkatachalam (Chemical Engineering)
Advisor: Jim Schneider (Chemical Engineering)
Hoch Commons-2nd Floor, Window side
3-5pm

The objective of this research project is to design and build two car bodies which will support either a fuel cell or a battery. The car must be able to carry the powering mechanism, motor, gears, and load. Other concerns include frictional forces and load carrying capabilities. Over the course of this project, the team will research the effects of car designs and terrain on performance. The cars will run in the regional and national competitions conducted by the American Institute of Chemical Engineering (AIChE).

Characterization of Mikotarm Star Polymer and Silica Nanoparticle Emulsions

Jason Tchao (Chemical Engineering)
Advisor: Robert Tilton
Rangos 1
CIT Poster, 12-2:30pm

The existence of Pickering emulsions, emulsions stabilized by colloidal particles, has been known for over a century, but only recently have they sparked interest within the scientific community. Numerous potential applications exist. For example, diesel emulsions burn more cleanly than normal diesel. Emulsions of oil and water must be stabilized at the oil-water interface by an emulsifying agent, typically a surfactant. The emulsifying agents studied in this project can form stable emulsions typically lasting for several months using concentrations at least ten times less than conventional emulsifiers. The goal of this project is to characterize and assess the emulsifying efficiency of these emulsifiers. The polymers studied fall into two categories ? miktoarm star emulsifiers and silica core emulsifiers. Each emulsion was prepared using a sawtooth homogenizer. For each emulsion, the preferred emulsion type (oil-in-water or water-in-oil) was determined using a drop test at 50/50 oil-to-water ratio. Emulsion stability was monitored by measuring phase volumes regularly, and droplet size was measured using microscopy. Experiments were also performed to determine effects of varying the pH, temperature, homogenization time and speed, oil/water ratio, and weight percent of emulsifier.

Copper-Zinc Battery Design and Control

Melissa Bartel (Chemical Engineering)
Carlene Ulish (Chemical Engineering)
Advisor: Jim Schneider (Chemical Engineering)
Hoch Commons-2nd Floor, Window side
12-2:30

The objective of this research is to design and construct a battery to power a car. This car will run at the regional and national level competitions conducted by the American Institute of Chemical Engineering (AIChE). A key part of this research will be in investigating and developing a battery and a circuit system that can be controlled accurately and repeatedly so that we can predict the reaction and performance of the car theoretically. We will then proceed to test the car with the theoretical conditions to achieve the predicted reaction and power.

Dispersant and Seperation of Single Wall Carbon Nanotubes

Kelvin Hung (Chemical Engineering)
Advisor: Mohammad Islam
Hoch Commons-2nd Floor, Window side
3-5pm

Moore's law predicts that the transistor density on integrated circuits will double every two years.1 In other words, the law predicts that the size of electronics' hardware can be decreased to a half of its original size every two years. Moore's law was made with the notion that new materials will be consistently created, enabling the production of more compact electrical components than before. This project's goal will help uphold Moore's law by making a new nanotechnology material, called carbon nanotubes (CNTs), useable. Specifically, the objective is to find a process to isolate a single CNT and distinguish between their electrical conductivities - semiconducting and metallic. Essentially, the aim is to produce pure batches of different types of CNT, so eventually electrical circuit can be made out of them. Currently, this cannot be done because there is presently no effective way to separate and classify CNT when they are produced, since the CNT clump together in a mixture of both metallic and semiconducting of various sizes. In this research, DNAA, which means DNA amphiphile, will be used to disperse single wall carbon nanotubes and observed for its effectiveness in separating carbon nanotubes from each other and sorting them by length, diameter, and electrical conductivity. In the end, the hope is to use innovative biotechnological methods to make carbon nanotubes a more assessable material for advancements in nanotechnology.

Enhanced Catalyst Utilization in PEM Fuel Cells via Modification of the Membrane/Electrode Interface

Alicia Marrie (Chemical Engineering)
Advisor: Jay Whitacre (Materials Science Engineering)
Hoch Commons-2nd Floor, Window side
3-5pm

The objective of this project is to investigate the performance effects of increased catalytic surface area in Proton Exchange Membrane (PEM) Fuel Cells. These high catalytic surface areas will be achieved by printing multi-walled nanotubes onto carbon fiber paper and modifying Nafion PEM material using Pulsed Laser Modification. Thin films of platinum will be applied to these rough surfaces as the catalytic material. A relation can then be established between fuel cell efficiency and PEM surface area.

Examining the Effects of Carbon Nanotubes of Human Cells

Katie Dolan (Chemical Engineering)
Advisor: Kris Dahl (Biomedical Engineering)
Wean Commons-1st Floor, Connan side
3-5pm

This project studied the potential of carbon nanotubes to be used as synthetic, localized drug delivery vectors. In order to control the localization, the method of uptake of the tubes was examined. In addition, the toxicity of nanotubes to human cells was studied.

Fuel Cell Design

Alia Lubers (Chemical Engineering)
Lisa Augustyniak (Chemical Engineering)
Advisor: Jim Schneider (Chemical Engineering)
Hoch Commons-2nd Floor, Window side
3-5pm

The objective of this research was to design and construct a fuel cell to power a toy car. This car will run in the regional and national level competitions conducted by the American Institute of Chemical Engineering (AIChE). A key part of this research was to investigate and develop a fuel cell and a circuit system that can be controlled accurately and repeatedly in a manner consistent with theoretical performance. We will then proceed to test the car to determine if we can achieve the predicted reaction and power under competition conditions.
This project is one of three projects that are part of the Chemical Engineering Car Design Team. Although these projects are for three separate areas of our work and research, the team will be presenting one poster at the Meeting of the Minds.

Glycerin Use In Fuel Cells

Carlene Ulish (Chemical Engineering)
Rangos 1
CIT Poster, 12-2:30pm

Cleaner and more efficient than other means of energy production, fuel cells are gaining much attention in today's society. The primary fuels used in current fuel cells are hydrogen gas and methanol. There are drawbacks associated with each of these compounds which provide motivation to explore alternative fuels for use in fuel cells. Because hydrogen is highly flammable and therefore dangerous to transport, it would be a difficult fuel to consider for widespread consumer use as an energy source. Methanol, a liquid, is easier to transport, but is still flammable and poisonous. Glycerin ($C_3H_8O_3$), or glycerol, is one compound that was explored in this work as an alternative fuel for use in fuel cells. Glycerin packs a higher energy density than hydrogen or methanol, and is nonflammable and nontoxic. In addition, glycerin is a byproduct of biofuel production, and therefore, currently very inexpensive. This work explores the possibility of using glycerin in a fuel cell designed for methanol, including a platinum/platinum-ruthenium catalytic membrane. A glycerin and purified water solution are pumped across the anode and oxygen gas flows across the cathode. At a range of voltages, the current across the cell is measured, and CV curves obtained. The curves will be analyzed and power output calculated to determine the viability of this system. Should glycerin use in fuel cells prove feasible, it would provide a safer, cleaner, and inexpensive alternative to current energy production methods.

Nesprin 1-alpha continues

SiWei (Andy) Chang (Chemical Engineering)
Advisor: Kris Dahl (Biomedical Engineering)
Rangos 1
CIT Poster, 12-2:30pm
Rangos 2&3, Sigma Xi Group 3, 10:30am

The project focuses on the analysis of Nesprin 1 alpha, which is a nuclear envelope protein within the superfamily of spectrin-repeat (SR) protein. SR proteins are known for their ability to scaffold and provide mechanical resilience. Nesprin 1- alpha interacts with nuclear proteins lamin and emerin. Nesprin 1-alpha has seven spectrin repeats and a linker between repeat 5 and 6. Currently it is believed that the overall structure of Nesprin1-alpha is consistent with SR's role as important regulators of cytoskeleton mechanics and organization and as linker proteins of membrane sturcutuer in the cell. However, this has not yet been proven. To study Nesprin1-alpha will help us understand its interactions with various nuclear components; also it will aid us in determining the mechanism for nucleus related diseases.

Platinum-Silver Nanoparticles as Fuel Cell Catalysts

Carmeline Dsilva (Chemical Engineering)
Advisor: John Kitchin (Chemical Engineering)
Rangos 2 & 3
Sigma Xi Group 3, 10:45am

We have been investigating the preparation of high-activity platinum-silver catalysts for use in direct methanol fuel cells. Fuel cells are a promising energetic concept because they convert chemical energy directly into electrical energy with minimal energetic losses. However, fuel cells require metallic catalysts so that the reactions will be fast enough to produce currents that are practical for operating equipment. These catalysts are often expensive, as metals such as platinum are most common. Therefore, increasing the activity of the catalyst and decreasing the overall amount of metal needed would greatly decrease the cost of a fuel cell.
Our work looks at platinum-silver alloy nanoparticles as potential electrochemical catalysts. We synthesize silver core nanoparticles with platinum shells using wet chemical methods. These nanoparticles are deposited on carbon paper electrodes and heated to form a silver-platinum alloy at the surface. They are then etched in nitric acid to remove the excess silver and leave a pure platinum surface. The resulting microstructure can be varied by changing the etching time. We found that this change in microstructure has a direct effect on the activity of the platinum in methanol oxidation. We hope to determine the optimal etching time for these particles so that we can require less catalyst and produce an economically feasible fuel cell.

Synthesis and Self Assembly of Metallic Nanoparticles

Elyse Coletta (Chemical Engineering)
Advisor: Nisha Shukla (ICES)
Interdisciplinary Area of Weigand Gym
3-5pm

Dr. Shukla's research group is examining new materials that can be used as catalysts for energy conversion and fuel cell applications. Finding a better material for catalytic reactions proves important for the oil refining industry, among others. The new material being explored involves creating shape selective metallic nanoparticles that will allow for more surface area and better reaction selectivity, which can further optimize catalysis. Wet chemical synthesis will be used to synthesize the nanoparticles. This method is an improved and inexpensive alternative to current catalyst materials.
The long-term vision of the proposed work is to lay the foundation for the preparation of shape selective metallic nanoparticles and for a better understanding of how novel synthesis methods for nanoparticles can be used to tailor activity and selectivity.

Synthesis of Nanoparticles with Chiral Surfaces

Melissa Bartel (Chemical Engineering)
Advisor: Nisha Shukla (ICES)
Rangos 1
CIT Poster, 12-2:30pm
Rangos 2&3, Sigma Xi Group 3, 10:00am

A new method for the separation of chiral molecules was examined. The technique explored involves creating chiral nanoparticles that will attach to one enantiomer of the chiral molecule, allowing differentiation and separation of the enantiomers. Gold nanoparticles were synthesized using a wet chemical synthesis reduction of gold chloride with sodium borohydride. Transmission electron microscopy and x-ray diffraction characterization has provided information about the composition, size, and shape of these nanoparticles. The gold nanoparticles have been successfully coated with both enantiomers of the amino acid cysteine both during and following synthesis. Optical rotation measurements show that a mixture of propylene oxide enantiomers can be separated using the chirally modified gold nanoparticles.

Synthesis of Nanoparticles with Chiral Surfaces

Seif Yusuf (Chemical Engineering)
Advisor: Nisha Shukla (ICES)
Hoch Commons-2nd Floor, Rangos side
12-2:30

The main issue that this research group is trying to solve is the separation of chiral molecules, an issue that is very important to the pharmaceutical industry. Dr. Shukla's group is attempting to make nanoparticles with chiral surfaces to which one enantiomer of a molecule will attach. This attraction between the nanoparticle and one enantiomer will allow the two different enantiomers to be separated. Wet chemical synthesis will be used to create the nanoparticles because it is a fast and inexpensive synthesis method. The long term goals of the project are to make stable nanoparticles which are enantioselective and to gain a deeper understanding of how to make nanoparticles for specific purposes.

Testing Biodegradability of Polymers used in Groundwater Remediation

Lisa Plimpton (Chemical Engineering)
Advisors: Robert Tilton
Greg Lowry (Civil Engineering)
Kirr Commons-1st Floor, Window side
12-2:30

Chlorinated organic pollutants such as trichloroethylene (TCE) are a persistent source of groundwater contamination. Researchers in the Departments of Civil and Environmental Engineering and Chemical Engineering have developed nanoscale zero valent iron (NZVI) particles for in situ remediation of TCE-contaminated aquifers. These reactive nanoparticles are modified with a polymeric coating which allows the nanoparticles to transport through groundwater and access the sparingly soluble TCE source zone. The bioavailability of these polymeric coatings must be known in order to accurately determine the long term consequences, if any, of injecting these nanomaterials into aquifers. The bioavailability of the following four polymers was analyzed: poly(aspartate), poly(styrenesulfonate), carboxymethylcellulose, and poly(HEMA). An aerobic biodegradation test method was used to determine the bioavailability of the polymers. The extent of polymer biodegradation was determined by the evolution of carbon dioxide from bacterial degradation. Results showed that carboxymethylcellulose was the most biodegradable while, contrary to expectations, poly(aspartate) was the least. Therefore, carboxymethylcellulose is potentially an acceptable polymeric coating for NZVI particles. Future work will assess the bioavailability of polymeric coatings that are directly attached to NZVI particles since attached polymers may be inaccessible to bacteria.

Whole organ decellularization: investigating the ability of 3D extracellular matrix to be used as a scaffold for culturing hepatocytes in vitro

Denver Faulk (Chemical Engineering)
Rangos 1
CIT Poster, 12-2:30pm

The sandwich culture of hepatocytes, between double layers of extra-cellular matrix (ECM), is a well-established in vitro model for re-establishing hepatic polarity and maintaining differentiated functions. Applications of the ECM-based sandwich culture are limited by the mass transfer barriers induced by the top gelled ECM layer, complex molecular composition of ECM with batch-to-batch variation and uncontrollable coating of the ECM double layers. I have addressed these limitations of the ECM-based sandwich culture by developing a process in which hepatocytes are cultured within their native 3D ECM architecture. Whole intact native rat livers were decellularized by canulating the inferior vena cava and utilizing the vasculature system as a means of delivering decellularization solutions. The vasculature system also allows for optimal cell seeding throughout the entire liver. My hypothesis is that the native architecture of the liver is the optimal scaffold for hepatocyte culture.

I tested for improved hepatic polarity formation, better cell-cell interaction and improved differentiated functions over a 14-day culture compared to the hepatocytes in ECM-based sandwich culture. The native 3D ECM scaffold may readily replace the ECM-based sandwich culture for liver tissue engineering applications, such as drug metabolism/toxicity testing and hepatocyte-based bioreactors.

CHEMISTRY

Synthesis and Study of Multivalent Binding Peptides for the Detection of Spores

Jenny Kim (Chemistry)
Sabrina Lusvarghi (Chemistry)
Advisor: Bruce Armitage (Chemistry)
Rangos 2 & 3
Sigma Xi Group 2, 10:45am

Bacillus anthracis is a pathogenic bacterium which can cause the life-threatening disease called anthrax in animals and humans. Inhalation is the most serious form of the disease, therefore developing devices that can quickly detect the spores of such infectious bacteria is crucial for protecting human health. As a detection method, Biotinylated Tetrapeptide (BTP), which is able to bind Bacillus subtilis, a simulant of anthrax, was synthesized and characterized by reversed-phase HPLC and MALDI mass spectrometry. The significance of BTP lies on its four separate contacts which should significantly raise the affinity relative to the control peptide having only one contact point. In order to test the binding ability of BTP to spores, BTP was bound to fluorescently labeled streptavidin (F-STA) at first and then the spores were bound to the BTP-F-STA complex. Fluorescence intensity of the samples with the different concentration of the BTP-F-STA complex was measured by flow cytometer. Based on the results, 50% of the binding seems to occur at about 2 nM of the BTP-F-STA complex, which is a strong binding value. Also, fluorescence intensity of the BTP-FSTA complex is much higher than that of the complex with the control peptide with a random sequence. However, nonspecific binding of spores to the BTP-F-STA complex was evident at much higher concentrations of the BTP-F-STA complex. Further analysis of the data is expected after obtaining the additional data of the different control peptides.

CIVIL ENGINEERING

Dammed Energy

Rachel Cawley (Electrical & Computer Engineering)
Anna Lenhart (Civil Engineering)
Eric Couphos (Mechanical Engineering)
Advisor: Susan Finger (Civil Engineering)
Connan
12:30-4pm

The goal of our project is to engage children in a fun and educational activity: ?Dammed energy.? Through the activity, students will learn that water held behind a dam has potential energy. We will tie this into the purpose and basic construction of dams. We will discuss how dams are usually used for flood control by forming a reservoir behind the dam. A byproduct of this reservoir is the available potential energy gained from the height of the water behind the dam. This is usually harnessed with hydroelectric generators.
The activity will consist of a Rubbermaid model of a reservoir and a hydropower dam. The dam will consist of a foam barrier, holding the water back in the reservoir. The barrier will have multiple holes at different heights, each initially blocked. The girls will decide which hole they want to uncover so the water can flow through it. As this water flows through the hole, it will spin a

waterwheel. The waterwheel will be connected to a meter which measures the rotational velocity of the waterwheel. A higher velocity is correlated with more energy. The students will see that by increasing the elevation head, more power is generated in the waterwheel.

Drag Forces

Ioannis Goutakis (Civil Engineering)
Alexander Kalberer (Mechanical Engineering)
Nicholas Burkholder (Mechanical Engineering)
Advisor: Susan Finger (Civil Engineering)
Connan
12:30-4pm

The goal of our experiment is to teach children about how drag forces affect energy loss in vehicles such as airplanes. In order to illustrate this concept our group is going to build a wind tunnel a few feet long out of Plexiglas. We are then going to instruct the students to build two different models of airplanes with distinct differences in plane wing surface area. The one plane will have a large wingspan and total wing area. The second will be smaller and more stream line. Then the students will be instructed to calculate the wing surface area using basic geometry calculations. The concept of conservation of mass between the 2 planes will be reinforced throughout the entire process. The students will be shown that all though the wing surface area differs, the same amount of volume is displaces in the wind tunnel by both planes. Then when the students finish their calculations they will be able to their planes in the wind tunnel and test the flying. They will be able to compare the aerodynamics and will learn about how smaller wing area and more streamline designs, will cause the smallest loss in energy. We will then teach the students about how a small loss in energy translates into a large overall efficiency. The students will learn all of this by being able to measure the turbulent flow when smoke is added to the wind tunnel.

Friction Car

Andrew Zagoren (Civil Engineering)
Alex Au (Mechanical Engineering)
Michael Barako (Undecided)
Advisor: Susan Finger (Civil Engineering)
Connan
12:30-4pm

The goal of this activity is to illustrate the relationship between energy loss and friction. Children will roll a car down a track and vary parameters on both the car and the track. The car will have different sets of wheels varying in hardness. The flat portion of the track is interchangeable to allow for different surfaces, altering the coefficient of friction. When doing the iterations for the track, the children will monitor the maximum height of the car on the exit ramp. The children will observe patterns in energy loss by noticing how the height reached varies for different wheel and track combinations. Using the collected data, the children will attempt to construct setups with specific goals such as the setup that loses the most amount of energy (most friction), the setup that loses the least amount of energy (least friction) and some goals in between. From the patterns, the children can see that the frictional forces cause a loss in energy. They will also be able to gain a small understanding of automobile efficiency. Automobiles require a substantial amount of grip on the road surface but cannot lose more energy than necessary so as not to waste energy from the engine.

Homemade Electric Generators

Ryan Yates (Mechanical Engineering)
Christina Daup (Civil Engineering)
Heeyong Kang (Physics)
Advisor: Susan Finger (Civil Engineering)
Connan
12:30-4pm

This activity is designed to demonstrate a method of converting mechanical energy to electrical energy to middle school girls. Each team will assemble a basic electric generator with loops of copper wire, magnets, and a hand crank. Students will use the crank to manually spin the magnets in the center of several loops of wire. This changes the magnetic flux through the loops and current will flow through the wires. Students will learn that mechanical energy can be converted to electrical energy by using the induced current to operate electronics such as light bulbs.

Power Your Car

Kristie Bennett (Electrical & Computer Engineering)
Insoo Jung (Civil Engineering)
Meehyun Jang (Mechanical Engineering)
Advisor: Susan Finger (Civil Engineering)
Connan
12:30-4pm

The goal of this activity is for the girls to experiment and learn about the energy supplied from difference power sources. By comparing the amount of energy produced by various power supplies, the girls can draw conclusions about which are the most effective. We plan to demonstrate this concept by allowing the girls to use different power sources to race cars on a straight track. They will design “engines” for their cars using given materials. We will also teach them about cost efficiency by giving them game money they may use to buy the needed materials. We will have markers on the track to test how far each power supply moves the car. Each trial will be recorded on a white board so the girls can compare their results. Game money will be awarded if a team?s car reaches a certain marker. The power supplies will include balloons, springs, rubber bands, and a sling shot mechanism.

Preferences for Regulatory Change

Jessica Meese (Civil Engineering)
Advisor: Cliff Davidson (Civil Engineering)
Rangos 1
CIT Poster, 12-2:30pm

A web-based survey was used to determine how perceived effects of regulations influence people's acceptance of the regulations. This survey was conducted as part of a larger study focusing on factors that affect people's behavior related to energy consumption and global climate change. A previous study suggested that personal freedom has a strong influence on people's attitudes toward regulations. This survey further examines the effect of personal freedom and perceived benefits and inconvenience. This survey consisted of pairs of regulations addressing the same subject. Each pair consisted of one regulation that would affect the general population and another that would affect a specific group. Respondents were first asked whether they would accept the regulation, and then asked to rate the benefits, inconvenience, and effect on personal freedom the regulation would have for them and for Americans in general. Using open ended questions, participants were also asked to identify specific personal benefits or inconveniences. Demographic information was collected to determine whether there were any social bases for preferences seen in participant's response choices. Analysis will be conducted to determine when and why people will accept hard regulations.

Sailboats

Edward Yuen (Civil Engineering)
Samson Debela (Civil Engineering)
Chris Stubbs (Mechanical Engineering)
Advisor: Susan Finger (Civil Engineering)
Connan
12:30-4pm

The sailboat activity engages children in learning about wind power ¿ specifically how people can turn wind energy into kinetic energy. The activity also teaches children how force can be split into different components, which move the sail in a desired direction. In the beginning of the activity the children will listen to a short lesson about the effects of the size of the sail and the centerboard of the boat. After working with a scale model of a sailboat, the children will design and build their own boat using recycled materials. The children will be able to change the size of the sail and its angle to the wind so they can see how these parameters affect the speed and direction of the boat. The children will try to create a sailboat that is faster than the target time.

Van de Graaff Generator

Ian Norman (Mechanical Engineering)
Lucy Terrell (Civil Engineering)
Advisor: Susan Finger (Civil Engineering)
Connan
12:30-4pm

We would the students to learn that electrons can build up on materials and objects. By the end of the activity, they should understand that this happens by transferring elections from one type of material to another. Not only this, but already built-up electrions can disperse, effectively discharging the object, taking the object back to neutral.
In this activity, they will first experience well-known phenomena, like static-laden clothing and hair sticking to combs. This concept will be extended to other phenomena such as the electric shocks that people feel when walking in dry rooms on carpets and lightening. They will see the build up of electrons on a large Van de Graff generator. Finally, the students will assemble smaller do-it-yourself Van de Graff generator kit which they can take home.

ELECTRICAL & COMPUTER ENGINEERING

3D Body Position Measurement Using Accelerometers

Yush Gupta (Electrical & Computer Engineering)
Andrew Strat (Undecided)
Advisor: Tsuhan Chen (Electrical & Computer Engineering)
Hoch Commons-2nd Floor, Rangos side
12-2:30

The purpose of this project is to see if it is possible to use accelerometers to detect body movement and changes in body positioning. To test this hypothesis, this project will attempt to use the AXDL330 accelerometers (the same sensors that are used by the Nintendo Wii remotes) to create a wearable system that can detect changes in position. In the system, a user wears two sensors on a headpiece which capture the 3 dimensional acceleration at the front and back of the user's head. This information is digitized and then sent to a laptop. With it, the computer calculates any positional changes such as translations or rotations of the user's head. This research will eventually assist Dr. Tsuhan Chen's study of camera image stabilization using accelerometers.

A Study and Application of the Magnetic Field of Leaky Solenoids

Maxwell Hutchinson (Physics)
Benjamin Morse (Electrical & Computer Engineering)

Solenoids are widely used as basic inductors and electromagnets. This study serves to model solenoids of spatially varying wrapping density computationally and derive a simple analytic approximation that is valid for most points within the solenoid. An iterative model is used. It is found that the axial field is directly proportional to the wrapping density, and the radial component of the field is directly proportional to the radial position and the spacial derivative of the wrapping density. The scope of the approximation is

Advisor: Gregg Franklin (Physics)
Rangos 2 & 3
Sigma Xi Group 4, 10:45am

found to be similar to that of the long solenoid approximation.
One can conceive of using a solenoid of these properties to linearly accelerate a conducting core. The proposed system is computationally modeled. The model qualitatively confirms the acceleration, and provides a framework for optimizing the effect. A physical model is produced and tested. Results of the physical model are pending.

Analysis of Neural Data

Daniel Burrows (Electrical & Computer Engineering)
Advisor: Robert Kass
Kirr Commons-1st Floor, Window side
3-5pm

One of the most important techniques in learning about the functioning of the brain has involved examining neuronal activity through electrophysiological recording. I investigated changes in neuron firing rates between small successive time intervals and the relation these differences may have with hand speed. These successive differences in firing rate may hold additional information that could improve algorithms that predict hand motion. This research has focused on determining if these firing rate differences can account for speeding up and slowing down of the hand in order to make such algorithms more responsive.

ASME Student Design Project: Robotic Window Washer

Richard Pantaleo (Mechanical Engineering)
Victor Marmol (Computer Science)
Jaime Bourne (Mechanical Engineering)
James Forbes (Electrical & Computer Engineering)
Michael Menchaca (Mechanical Engineering)
Katherine Coste (Mechanical Engineering)
Benjamin Som-Pimpong (Mechanical Engineering)
Gaurav Verma (Undecided)
Bradley Yoo (Undecided)
Justin Yi (Mechanical Engineering)
Paul Kim (Mechanical Engineering)
Bradley Hall (Mechanical Engineering)
Michael Cushman (Mechanical Engineering)
Jacob Coffelt (Mechanical Engineering)
Daniel Shope (Mechanical

The ASME student design project is a group of undergraduate engineers and computer scientists who meet every year to compete in the ASME student design competition. This year the project was to build a robotic window washer while adhering to the ASME guidelines. Our group met that challenge and competed in the 2008 ASME regional conference which was held at Carnegie Mellon on April 5th.

Engineering)
Advisor: John Wesner (Mechanical Engineering)
Kirr Commons-1st Floor, Window side
12-2:30
Dowd
Oral 2, 12:20pm

Assistive Automotive Intelligence Technology

Ethan Minogue (Electrical & Computer Engineering)
Ilya Kelner (Electrical & Computer Engineering)
Jason Mirra (Computer Science)
Advisor: George Kantor (Robotics Institute)
Rangos 2 & 3
Sigma Xi Group 4, 11:15am
Dowd
Oral 8, 3:00pm

Our project will be 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.

Autonomous Quad-Rotor Helicopter Stability Control

Daniel Pehush (Electrical & Computer Engineering)
Ilya Brin (Undecided)
Frank Costello (Computer Science)
Gaurav Verma (Undecided)
Paul Desiderio (Mechanical Engineering)
Scott Ridel (Mechanical Engineering)
Rajit Kumar (Electrical & Computer Engineering)
Advisor: William Messner
Hoch Commons-2nd Floor, Window side
3-5pm

This project will develop a flight controller for an autonomous quad-rotor helicopter, in order to maintain stable flight. This proposal is being presented with two other grants in order to develop a functional autonomous helicopter. A quad-rotor helicopter is a modification of the conventional-single rotor helicopter configuration. The quad-rotor helicopter has four motors arrange in at the corners of a square, each of which turns its own rotor independently. The sum of the thrusts from the four rotors produces the thrust perpendicular to the plane of the rotors. The difference in the thrusts from the left and right rotors produce a pitch moment. The difference in the thrusts from the front and back rotors produce a roll moment. The pitch and roll dynamics of the quad-rotor helicopter are inherently unstable, and thus active control of the rotor speeds is needed to produce stable flight. This will be achieved through the use of a gyroscope for sensing angular velocity and accelerometer for sensing orientation and angular velocity in tandem with a stabilizing control scheme, which will be implemented upon a gumstix© miniature motherboard.

Cooperative Manipulation in a Robot Colony

Kevin Woo (Electrical & Computer Engineering)
Eugene Marinelli (Computer Science Department)
Gregory Tress (Electrical & Computer Engineering)
James Kong (Electrical & Computer Engineering)
Jaime Bourne (Mechanical Engineering)
Jason Knichel (Computer Science Department)
Austin Buchan (Electrical & Computer Engineering)
Brian Coltin (Computer Science)
Justin Scheiner (Electrical & Computer Engineering)
Siyuan Feng (Computer Science)
Christopher Mar (Electrical & Computer Engineering)
Bradford Neuman (Physics)
Advisor: George Kantor (Robotics Institute)
Rangos 2 & 3
Sigma Xi Group 4, 11:45am

Object manipulation and interaction with the environment is a critical application in the field of mobile robotics. In situations where multiple robots cooperate, sensor data can be shared allowing any robot within the colony to find objects located by other robots. Once an object is identified, robots can cooperatively manipulate the object by coordinating movement. While many current robots utilize vision to aid with object detection, this incurs a prohibitive cost for many researchers. By developing the necessary sensory capabilities and coordination algorithms based on inexpensive light sensors, the Colony Project has demonstrated that cooperative manipulation can be feasibly performed within a low-cost robot colony.

Correlation Filter Analysis and Extreme Value Distribution Modeling for Improved Axonal Bouton Detection

Katie Menzies (Electrical & Computer Engineering)
Advisor: Jelena Kovacevic (Biomedical Engineering)
Rangos 1
CIT Poster, 12-2:30pm

We propose a modification to an automated detection system for boutons in populations of labeled neurons, which aids in bouton distribution analysis for the study of neural circuit organization and plasticity. Since axonal boutons are the presynaptic specializations of neural synapses, their locations can be used to determine the organization of neural circuitry, and in time-lapse studies, neural circuit dynamics. The current method involves simple geometric models for axonal boutons that account for variations in size, position, rotation and curvature of the axon in the vicinity of the bouton. The normalized cross-correlation between the models and image data are used as test statistics for bouton detection and position estimation, casting the problem as a statistical detection problem. The limitations of the current method include its long run time and the normalized cross-correlation?s lack of resolution between close boutons and its sensitivity to image noise. To address these issues, we propose two modifications to the current method. First, advanced correlation filters to replace the normalized cross-correlation. These filters decrease run time, increase resolution, and decrease sensitivity to noise but are no

longer normalized. Normalization allows for comparisons across all images and models. The second modification attempts to re-normalize the cross-correlation values by using an extreme value distribution model. Using these two modifications we attempt to replicate the results of the current method for a proof of concept.

Dammed Energy

Rachel Cawley (Electrical & Computer Engineering)
Anna Lenhart (Civil Engineering)
Eric Couphos (Mechanical Engineering)
Advisor: Susan Finger (Civil Engineering)
Connan
12:30-4pm

The goal of our project is to engage children in a fun and educational activity: ?Dammed energy.? Through the activity, students will learn that water held behind a dam has potential energy. We will tie this into the purpose and basic construction of dams. We will discuss how dams are usually used for flood control by forming a reservoir behind the dam. A byproduct of this reservoir is the available potential energy gained from the height of the water behind the dam. This is usually harnessed with hydroelectric generators.
The activity will consist of a Rubbermaid model of a reservoir and a hydropower dam. The dam will consist of a foam barrier, holding the water back in the reservoir. The barrier will have multiple holes at different heights, each initially blocked. The girls will decide which hole they want to uncover so the water can flow through it. As this water flows through the hole, it will spin a waterwheel. The waterwheel will be connected to a meter which measures the rotational velocity of the waterwheel. A higher velocity is correlated with more energy. The students will see that by increasing the elevation head, more power is generated in the waterwheel.

Data privacy in the home

Christina Johns (Electrical & Computer Engineering)
Advisor: Gregory Ganger
Rangos 1
CIT Poster, 12-2:30pm
Rangos 2&3, Sigma Xi Group 4, 11:00 am

My research explores access controls for digital data storage in the home environment. The overall goal is to provide as simple a security scheme as possible, so that non-experts can use it effectively, while providing the flexibility wanted by users in a household. To explore options, I conducted hour long interviews with non-technical users about their current privacy practices and their preferences in a new distributed home storage system being developed in CMU's Parallel Data Lab. The study will be used in future design of the access controls of perspective and provide insight into home users needs for access control.

Design of a Controller to Synchronize Multiple High Powered Motors

William Wedler (Mechanical Engineering)
Hemant Sikaria (Electrical & Computer Engineering)
Winston Wan (Undecided)
Advisor: Susan Finger (Civil Engineering)
Hoch Commons-2nd Floor, Window side
12-2:30

To gain wide-spread use, systems powered by alternative fuels, such as wind or solar power, must use that energy as efficiently as possible. In particular, the precise control of electric motors in high-performance alternatively-fueled systems is critical to increase efficiency due to limitations in available power. This study included the development of a control algorithm to synchronize multiple electric motors. The algorithm was designed based on control theory using feedback from motor sensors. PID and Fuzzy Logic control algorithms were considered and compared in this study. The motor controller was designed to manage battery voltage and current to two coupled DC electric motors.

Dynamic Physical Rendering Shape Morphing

Eric Cheng (Electrical & Computer Engineering)
Advisor: Tim Hoffman (Computer Science)
Kirr Commons-1st Floor, Window side
3-5pm

This project investigates shape morphing for the Dynamic Physical Rendering Project. Specifically, the movement of catoms controlled by a outside "path planner" is simulated and analyzed for its feasibility.

Electro-Mechanical Design for a Quadrotor Helicopter

Zohar Bhagat (Mechanical Engineering)
Daniel Pehush (Electrical & Computer Engineering)
Mikhail Charkin (Computer Science)
Ilya Brin (Undecided)
Matthew LaTorre (Mechanical Engineering)
Gaurav Verma (Undecided)
Chaman Saron (Electrical & Computer Engineering)
Paul Desiderio (Mechanical Engineering)
Scott Ridel (Mechanical Engineering)
Rajit Kumar (Electrical & Computer Engineering)
Harkirat Singh (Electrical & Computer Engineering)
Adam Lederer (Electrical & Computer Engineering)
Advisor: James C. Hoe (Electrical & Computer Engineering)
Pake
Oral 8, 3:00pm
Hoch Commons-2nd Floor, Rangos side
3-5pm

Information of the ECE side of the helicopter

Exploring Applications of Embedded Systems in Football Engineering

Dan Dancescu (Electrical & Computer Engineering)
Xunnan Fu (Electrical & Computer Engineering)
Advisor: Priya Narasimhan (Electrical & Computer Engineering)
Rangos 1
CIT Poster, 12-2:30pm

Sensor networks have been used in many types of embedded systems, but rarely have they been applied to football. This research focuses on building systems which improve many aspects of the game for the players, fans, and referees. For example, many game-changing mistakes are made by referees because of the lack of technology to provide reliable data such as placement and possession of the ball. Accelerometers, pressure sensors, X-Bee transceivers and various other technologies are explored and analyzed for a suitable application in football engineering.

Exploring the Linear Regression Model Space

XiaYi (Sandy) Shen (Electrical & Computer Engineering)
Advisor: Rebecca Nugent (Statistics)
Kirr Commons-1st Floor, Window side
12-2:30

In this research project, we are interested in exploring the multivariate linear regression model space. By treating possible regression models as observations, we use visualization techniques and density estimations to identify/generate "similar" regression models, and these regression models are compared to models generated by standard model selection procedures (stepwise, forward, backward, etc).

Face Recognition for the Roboceptionist

Eileen Min (Electrical & Computer Engineering)
Advisor: Reid Simmons (Robotics Institute)
Kirr Commons-1st Floor, Window side
3-5pm

Although the Roboceptionist has the ability to interact with people, its level of human-like communication is quite limited. In order to enhance the ability to interact with individuals, face recognition for the Roboceptionist has been a project of interest, for the successful implenmentation of face recognition will make it possible for a more personal acquaintence. The difficulty in this is that the Roboceptionist cannot assess the accuracy of the identified faces as human beings do. Thus, to mimic the human behavior in recognizing others, the most suitable approach is to evaluate each face recognition so that when the Roboceptionist personally identifies someone, the chance of doing so incorrectly is reduced.

Faster, Further, for Less - Practical Aerodynamics in Action

Scott Moorby (Mechanical Engineering)
Vitaly Cherednichenko (Electrical & Computer Engineering)
Paul Kim (Mechanical Engineering)

This activity is designed to facilitate hands-on learning about the effects of drag on moving vehicles, through a series of wind tunnel experiments and a practical road test of miniature toy cars, which are designed by the participants. Children will have the opportunity to mix and match different car components and test them in a small wind tunnel. They can then modify their design to make improvements, re-testing and enhancing their designs until they are satisfied with their vehicles. At that point, their final design may be tested on a track, powered by its own tiny CO2 container, in order to evaluate its practical

Advisor: Susan Finger (Civil Engineering)
Connan
12:30-4pm

performance on the test course.
The children will be able to use hands-on experiments to develop an intuitive understanding for the practical ways in which a vehicle's geometry and cross sectional area is related to the amount of drag exerted upon it. Also, the iterative cycle of design, testing, and modification will encourage the students to develop a better understanding of the engineering discipline in general.

Firefly

Sidharth Singh (Electrical & Computer Engineering)
Advisor: Anthony Rowe
Rangos 1
CIT Poster, 12-2:30pm

The goal of this project is to create a network-wide cycle-accurate simulator to model the Nano-RK operating system running on multiple FireFly sensor nodes. This will be a cycle accurate simulator in that it will simulate the hardware aspects of a sensor node which should be able to run binary executables that would be loaded on a real sensor node. This simulator will extend on the Avrora simulator currently maintained by UCLA. The Avrora simulator currently does not support the latest FireFly radio hardware or the most recent FireFly processor. Simulating the current processor, the Atmega1281, will require changing various parameters in the current processor's model (the Atmega128). The new radio hardware (the CC2420) is similar to the currently supported radio (the CC1000), but differs substantially enough that it will likely require development from scratch.
Nodes deployed in the environment can be used to collect packet loss data, power performance data and the performance of the simulator itself to simulate very large networks.

Galaxy Classification Using SDSS Spectra

Shawn Yoon (Statistics)
Michael Wang (Business Administration)
Sergey Bystritskiy (Mathematics)
Gerry Llaque (Mathematics)
XiaYi (Sandy) Shen (Electrical & Computer Engineering)
Advisor: James Delaney (Statistics)
Hoch Commons-2nd Floor, Rangos side
12-2:30

The primary problem under investigation is to accurately and automatically classify galaxies into either the star-forming or active galactic nuclei categories. Shawn Yoon, Sergey Bystritskiy, Xiayi(Sandy) Shen, Michael Wang, and Gerry Llaque worked together to create a program in R to automate the processes of classifying galaxies based on wavelength data collected from the Sloan Digital Sky Survey(SDSS). Part of the data is in the form of a continuum which is the underlying distribution of background "noise" in galaxies. There are also various emission lines which come from emitted photons from galaxies. Our code is designed to fit a distribution of the continuum while overlaying a normal distribution to model the emission spike.
Taking the ratios of the area under the distribution, we can then begin to classify the type of galaxy we are viewing.

Gesture Recognition Platform for Deaf Users

Bhargav Bhat (Electrical & Computer Engineering)
Hemant Sikaria (Electrical &

What if you could use your hand to talk to an application, play a video game or even speak to a person? HandTalk is a portable glove that recognizes the gestures that you make using an embedded system. We have developed a cell phone application to receive and voice the hand gestures - the main focus being to assist the deaf communicate with those unfamiliar with Sign Language.

Computer Engineering)
Advisor: Priya Narasimhan (Electrical & Computer Engineering)
Rangos 2 & 3
Sigma Xi Group 4, 10:15am

Importance of Rigorous Implementation of Experimental Procedures in Developmental Research: A Case Study

Andrea Poon (Biological Sciences)
Samantha Creighan (Psychology)
Brian Goldfain (Electrical & Computer Engineering)
Advisor: Anna Fisher (Psychology)
Kirr Commons-1st Floor, Window side
12-2:30

It is crucial to any field of research to have standardized procedures when carrying out an experiment in order to eliminate confounding variables and ensure internal validity (we refer to this as experimental rigor). The proposed research will address the issue of experimental rigor using the paper by Shulz and Bonawitz (in press)as a case study. Shulz and Bonawitz examined exploratory play in 4-year-old children and found a reversal of the common novelty preference when participants lacked causal knowledge about how a toy operated. However, upon close examination of this study's experimental procedures, we identified two possible confounding variables stemming from a lack of standardization in each of the experimental conditions. The proposed research will replicate the experimental design used by Shulz and Bonawitz, using standardized procedures to control for the two variabes that we identified as potential confounds.

Improving Camera-Based Localization for an Indoor Mobile Robot

Rajit Kumar (Electrical & Computer Engineering)
Advisor: Mr. Mike Vande Weghe (ICES)
Hoch Commons-2nd Floor, Window side
3-5pm

Robot localization is a critical component of a robust indoor mobile robot since it allows the robot to know where it is. Traditional sensors like sonar or a laser rangefinder don't work in environments crowded with people, but an upwards-facing camera will never be obscured. This project investigates the various ways of improving camera-based localization. Black and white checkerboard markers were put on the ceiling and used for the localization. Various methods will be used to improve the localization such as calibrating the camera offsets, correcting for disparities in height readings and eventually fusing together readings from multiple markers at once.

Improvisation of people detection and tracking systems on the Snack Bot

Tarun Agarwal (Electrical & Computer Engineering)
Advisor: Dr. Paul Rybski (Robotics Institute)
Rangos 1
CIT Poster, 12-2:30pm
Rangos 2&3, Sigma Xi Group 4, 10:00 am

We have created a system which can be used to on the Snackbot to efficiently and quickly track people at run time. Using motion detection by frame differencing and background subtraction the vision system learns about the current environment and track people. This system combines with the laser and the preexisting system to decide where is a person is located. We have even considered various scenarios in which the robot can be in. This helps us to focus on more important issues rather than the entire computer vision issue in general.

Investigating Power Management in a Robot Colony

Kevin Woo (Electrical & Computer Engineering)
Eugene Marinelli (Computer Science Department)
James Kong (Electrical & Computer Engineering)
Aaron Johnson (Electrical & Computer Engineering)
Austin Buchan (Electrical & Computer Engineering)
Brian Coltin (Computer Science)
Justin Scheiner (Electrical & Computer Engineering)
Siyuan Feng (Computer Science)
Christopher Mar (Electrical & Computer Engineering)
Bradford Neuman (Physics)
Advisor: George Kantor (Robotics Institute)
Pake
Oral 7, 2:00pm

Power management is a critical issue in the field of mobile robotics. Managing the supply of power for a team of robots becomes an increasingly difficult problem as the number of active robots increases. As the capabilities and complexity of robots increase, so do power requirements. The Colony project has worked to build a scalable power management platform upon which an increasingly large colony of robots can operate while efficiently completing its tasks. We focused our study on power management algorithms, including charging bay design and location, robot priorities, and battery charging.

ISADS

Soojin Jeong (Computer Science)
Benjamin Poole (Undecided)
Kyri Baker (Electrical & Computer Engineering)
Advisor: Mei Chen
Kirr Commons-1st Floor, Window side
12-2:30

The Interactive Search Assisted Decision Support (ISADS) project aims to help doctors make more informed decisions about pigmented skin lesions by analyzing dermoscopic images automatically, and presenting relevant data from a large, annotated repository. This project uses machine learning to determine similarity between images, which requires a substantial amount of training data. There are certain protocols that need to be followed when collecting data to protect patient confidentiality. My task is to collect dermoscopic images of pigmented skin lesions and their diagnostics (from International Society of Dermoscopy) and create filters using Java for ImageJ to analyze the images.

Lapped Tight Frame Transforms: Seeding, Window Design and Properties

Christina Milo (Electrical & Computer Engineering)
Advisors: Jelena Kovacevic (Biomedical Engineering)
Amina Chebira
Rangos 1
CIT Poster, 12-2:30pm

In the world of multiresolution signal representations, redundancy has proven to be an important factor. For example, it is extremely useful to have a safety net -provided by redundancy- for information losses. For this reason, redundant multiresolution transforms such as frames are desirable for effective signal processing. Prof. Kovacevic and her group have proposed a new class of equal-norm tight frames termed Lapped Tight Frame Transforms (LTFTs). These can be seen as a redundant counterpart to bases known as Lapped Orthogonal Transforms (LOTs), as well as the infinite-dimensional counterpart to Harmonic Tight Frames (HTFs). The lapped nature of the LOTs is crucial in compression applications as it eliminates detrimental blocking effects caused by block transforms. LTFTs are constructed by seeding LOTs. Seeding is the

process of obtaining tight frames from orthonormal bases in larger dimensions. It has been shown that in a specific case, namely the Princen-Johnson-Bradley LOT family, this process preserves equal norm and tightness, two very desirable properties. In this project, to complete the development of LTFTs, we design a time domain window that modulates the filters or frame vectors of the LTFT. A modulating window provides freedom in designing the filters obtained by seeding and will allow them to evenly cover the frequency spectrum. However, finding one window to successfully shape each distinct filter, while retaining the desired properties of the LTFT is a difficult task. We use various optimization techniques to design such windows using the HTF filters as our desired target. The best results were obtained through a polar decomposition procedure. Another important property of frames is that of maximal robustness. This property ensures that losses or corruption -up to a certain amount- of transform coefficients will not affect the ability to reconstruct the original signal. To prove this property for LTFTs, we run various empirical tests. The success of all of these tests encourages us to believe that the Princen-Johnson-Bradley LTFT is maximally robust, as well as helps us converge towards a theoretical proof in the future. To complete our work, we look into obtaining new LTFT families. In addition to the cosine-based Princen-Johnson-Bradley LOT family, we look at other LOT families with complex basis functions from which we seed new LTFTs and study each family and its properties. The development of these families completes the LTFT framework and provides us with important signal processing tools that can be utilized in many applications including biometrics and image classification.

OpenSPARC Checkpoint and Rollback

Teck Hua Lee (Electrical & Computer Engineering)
Wei Jie Lee (Electrical & Computer Engineering)
Tze Chang Ng (Electrical & Computer Engineering)
Advisor: James C. Hoe (Electrical & Computer Engineering)
Rangos 1
CIT Poster, 12-2:30pm

This project adds checkpoint processing and recovery to a single-threaded OpenSPARC T1 core. A checkpoint is defined as a particular state of the processor and memory. This state could be restored without evidence of any subsequent operation after the checkpoint. Modifications were made to the SPARC ISA and the OpenSPARC micro architecture's RTL description to implement a minimally disruptive checkpoint creation and commit mechanism. We expect rollback to be the most expensive and infrequent operation. In addition a Write History Queue will be added to maintain data consistency in the memory hierarchy. The main area of research is to identify constrains that limit the length of a checkpoint. We will present an FPGA implementation of a modified OpenSPARC core and a sample application that leverages the new capabilities.

Optimization Algorithms for Hull Design

Ryan Yates (Mechanical Engineering)
Chunkit Yu (Electrical &

Finding the optimum design of a boat hull is difficult because there are many parameters that affect the overall hull performance such as the hull's width. One design approach would be to build models by varying physical parameters. Instead, this research aims to generate an alternative using software models. Using Computational Fluid Dynamics (CFD) software allows us to compute performance values such as drag force and lateral stability. Combining all of

Computer Engineering)
Riddhi Roy (Chemistry)
Andrew Moore (Mechanical Engineering)
Michael Barako (Undecided)
Advisor: Susan Finger (Civil Engineering)
Hoch Commons-2nd Floor, Window side
12-2:30

these values can produce an overall rating of a hull's performance. Finding the design which yields the greatest performance requires the use of CFD analysis over and over again. The use of a brute force approach to iteratively alter each physical parameter would result in too many combinations to be evaluated. With a response surface approach, we can create an optimization process to maximize a hulls performance using less CFD analysis. Through this research, we will learn how to optimize a hull design where many parameters make brute force techniques impossible.

Personal Robotics

Matthew Wagner (Electrical & Computer Engineering)
Rajit Kumar (Electrical & Computer Engineering)
Advisor: Siddhartha Srinivasa (Undecided)
Hoch Commons-2nd Floor, Rangos side
3-5pm

I will be presenting a project using multiple systems to find a red ball in an image and relay its three dimensional position to OpenRave, which relays that to the Barrett WAM.

Physical Testing of Racecar Aerodynamics (Continued)

Jicai Chow (Electrical & Computer Engineering)
Richard Zuckerman (Mechanical Engineering)
Advisors: Kenji Shimada
John Wiss (Mechanical Engineering)
Wean Commons-1st Floor, Connan side
12-2:30

The purpose of this research project is to physically model the airflow over a racecar using fluid visualization techniques in an attempt to improve aerodynamics. The model for the racecar is based on the 2007-2008 Formula SAE car body and chassis design. Additional aerodynamic elements were added and tested to verify improvements to aerodynamics, if any.

Picture Game

Anish Mathur (Electrical & Computer Engineering)
Hoch Commons-2nd Floor, Window side
3-5pm

Computer games are widely played, and people would try free games. If the free game is fun and enjoyable, people will keep playing the game. What if there is a game that is fun to play and also helps to solve research problems? There has been some work done in this field, however, there is still much more to be researched about this concept. Our goal for this research is to create a game that people can play and as a result photos in the albums will be labeled.

Power Your Car

Kristie Bennett (Electrical & Computer Engineering)
Insoo Jung (Civil Engineering)
Meehyun Jang (Mechanical Engineering)
Advisor: Susan Finger (Civil Engineering)
Connan
12:30-4pm

The goal of this activity is for the girls to experiment and learn about the energy supplied from difference power sources. By comparing the amount of energy produced by various power supplies, the girls can draw conclusions about which are the most effective. We plan to demonstrate this concept by allowing the girls to use different power sources to race cars on a straight track. They will design ?engines? for their cars using given materials. We will also teach them about cost efficiency by giving them game money they may use to buy the needed materials. We will have markers on the track to test how far each power supply moves the car. Each trial will be recorded on a white board so the girls can compare their results. Game money will be awarded if a team?s car reaches a certain marker. The power supplies will include balloons, springs, rubber bands, and a sling shot mechanism.

Profiling Instruction Mixes on Multiple Architectures

Thomas Cherry (Electrical & Computer Engineering)
Advisor: Shimin Chen
Hoch Commons-2nd Floor, Window side
12-2:30

My project will demonstrate the different patterns of memory access and register usage on different architectures (windows 32bit, linux 32 and 64bit machines). These statistics will be useful in determining the cost of software correctness monitoring tools.

Profiling study for propagation-style software monitoring on 64-bit architectures

Jessica Liao (Electrical & Computer Engineering)
Hoch Commons-2nd Floor, Rangos side
3-5pm

Many important software monitoring tools, such as TaintCheck and MemCheck, perform propagation tracking. Previously, Chen et al. proposed hardware acceleration techniques that improve the performance of propagation tracking [1]. Their work reported performance results and profiling study on 32-bit x86 architectures. In this study, we would like to understand the impact of the previous proposal for applications running on 64-bit architectures. In particular, we port a PIN-based profiling tool to a 64-bit x86 system running Linux. Then we collect statistics using this tool for a set of benchmarks.

[1] Shimin Chen, Michael Kozuch, Theodoros Strigkos, Babak Falsafi, Phillip B. Gibbons, Todd C. Mowry, Vijaya Ramachandran, Olatunji Ruwase, Michael Ryan, Evangelos Vlachos. "Flexible Hardware Acceleration for Instruction-Grain Program Monitoring". In proceedings of the 35th International Symposium on Computer Architecture (ISCA'08). (to appear)

RobOrchestra III

Erica Sandbothe (Computer Science)
Richard Pantaleo (Mechanical Engineering)
Justin Scheiner (Electrical &

The RobOrchestra project is dedicated to the creation of robots that combine musical artistry and new technology to gain a greater understanding of both the human creative process and robotic interaction and development. In its third year of being, the RobOrchestra team has extended its existing robots to interact with human musicians. This gives the robots a greater understanding of harmony, rhythm, and real-time improvisation. The group has constructed a new stringed instrument to increase the scope and breadth of its ensemble and

Computer Engineering)
Laura Abbott (Computer Science)
Daniel Shope (Mechanical Engineering)
Advisor: Roger Dannenberg
Wean Commons-1st Floor, Connan side
3-5pm

introduced motion-capture technology to allow for humans to influence the creation of the robots' music. In this way, RobOrchestra illustrates the creative process of both humans and machines and the ways in which they may interact for both the instruction of the robot and the enjoyment of the human musician.

Segmentation of Biomedical Data

Sarah Hsieh (Electrical & Computer Engineering)
Manuel Gonzalez-Rivero (Electrical & Computer Engineering)
Advisor: Jelena Kovacevic (Biomedical Engineering)
Rangos 2 & 3
Sigma Xi Group 7, 10:30am

We present an algorithm for segmentation of the Golgi body as well as cell volume computation using multiple active masks. Given a z-stack of 2D fluorescence microscope images of cells, we initialize our algorithm randomly with a large number of masks on the middle slice. We then segment the image using the multiple active mask framework for fluorescence microscope images. Then, instead of treating the images in the z-stack as being independent of each other, we propagate the segmentation result to aid in the segmentation of the adjacent slices. Further, by applying the cell-segmentation masks to the Golgi channel, we successfully assign multiple pieces of the Golgi body in a 2D image to the cell to which they belong. Finally, we demonstrate that our algorithm is fast and easy to compute and more accurate than manual segmentation of these images.

Segmentation of Stem Cells for Tracking

Manuel Gonzalez-Rivero (Electrical & Computer Engineering)
Advisor: Jelena Kovacevic (Biomedical Engineering)
Rangos 1
CIT Poster, 12-2:30pm

The discovery of stem cells has led to countless biological and medical advances. Scientists now need a reliable method to accurately and quickly track these stem cells. Such tracking requires a method of segmentation to identify the changing locations of the target cells. My research will develop such a segmentation algorithm which will be based upon stem cell data sets provided by the Kanade team. The Active Mask Segmentation Algorithm (AMSA) developed by the Kovačević group proves quite promising for such an application. However, new forces and parameters were developed for the particular stem cell dataset.

Software Defined Radio for CMU's Wireless Emulator

Jennifer Petersen (Electrical & Computer Engineering)
Advisor: Peter Steenkiste
Rangos 1
CIT Poster, 12-2:30pm

CMU research teams have developed a wireless emulator that works as a testbed for evaluating wireless network behavior. An extension of this work is to adapt the emulator to evaluate software radio, which has both a software component (GNU radio in this case) and a hardware component. This project focuses on the advantages and disadvantages of using two different methods that allow the GNU radio software, running on a host laptop, to communicate with the emulator hardware. The first method uses the serial port on the laptop to send data to the universal asynchronous receiver/transmitter (UART) on an emulator signal conversion module (SCM). The second uses an Ethernet connection for communications between the host and the SCM.

Speech Recognition in Alternative Platforms

Douglas Robl (Electrical & Computer Engineering)
Advisor: Rob Rutenbar (Electrical & Computer Engineering)
Rangos 1
CIT Poster, 12-2:30pm

Speech recognition technology has a wide spectrum of applications including healthcare, robotics, and human-computer interaction. However, the complexity of speech recognition algorithms has slowed the adoption of the technology. Real-time speech recognition requires large amounts of power, usually restricting speech recognition to high-performance CPUs. Another option is custom designed hardware, which is characterized by high design costs and minimal flexibility. This project is an attempt to migrate a portion of a speech recognition algorithm into a digital signal processor (DSP) platform, which has power consumption benefits over a CPU, and flexibility benefits over custom hardware. The DSP implementation will shine light on the design tradeoffs between the different architectures of a DSP, a CPU, and custom hardware.

Stereoscopic 3D LCD Display

Yush Gupta (Electrical & Computer Engineering)
Advisor: Tsuhan Chen (Electrical & Computer Engineering)
Hoch Commons-2nd Floor, Window side
12-2:30

It is this project's aim to understand if and how a successful virtual reality display can be created by employing the principle of a stereoscope. To test this hypothesis, it will attempt to develop and build a prototype head-mounted stereoscopic LCD display that allows a user to see a full color three dimensional (3D) animation. The LCD screen would show the left eye and right eye images which would then be channeled to the left and right eyes respectively with the stereoscope, conveying a 3D image. A laptop would drive the LCD screen by transmitting a composite video signal. While this display would have uses in a multitude of industries, the primary application of this project would be to visualize the 3D reconstructions that are generated by the Carnegie Mellon Advanced Multimedia Processing Lab's (AMP) Mobile Camera Array. The success of the project will dually be measured by the extent to which it facilitates visualization of AMP's 3D reconstructions, and the ease with which a layman can use the display.

The Development of an Autonomous Directional Antenna to Improve Wireless Signal Strength Reception

Gemma Easterling (Electrical & Computer Engineering)
Hoch Commons-2nd Floor, Window side
12-2:30

A directional antenna is an antenna which receives the greatest signal strength in one particular direction. By changing the direction that these antennas face, one can significantly increase the signal strength. I worked with anIntel adviser to develop an automated directional antenna that will always point in the direction of the strongest signal. Measurements of the signal strength were detected using open source computer software and software that I have developed. These measurements were communicated to a microcontroller that directed the antenna accordingly. After the device was developed, a variety of measurements were taken to analyze the effectiveness of this device.

The Effects of Chemical Mechanical Polishing on Integrated Circuit Performance

Ryan Comes (Electrical & Computer Engineering)

As the size of features in CMOS integrated circuit (IC) devices shrink below the 45 nm level, the ability to predict the effects of chemical mechanical polishing (CMP) in planarization has become increasingly important. Current commercial software packages used for IC design, such as Cadence, do not consider the physical surface irregularities and machine process variables that are introduced during each CMP step in the manufacturing process. These

Advisor: Cecil Higgs (Mechanical Engineering)
Rangos 1
CIT Poster, 12-2:30pm
Rangos 2&3, Sigma Xi Group 4, 10:30am

irregularities can have significant impact on the performance of the circuit, including both power consumption and clock speed. Using a physics-based model of CMP, a method for modeling the effects of CMP planarization in circuit simulations is presented. This method may be used to better predict circuit performance based on initial CAD designs of the IC layout, leading to better device yield after fabrication. Results are presented showing a comparison of the original Cadence simulations of a simple integrated circuit and that of a post-CMP circuit, where the simulated polish was done by employing a physics based computational modeling simulation.

The electrical properties associated with DNA molecules

Cheeyew Peh (Electrical & Computer Engineering)
Rangos
CIT Poster, 12-2:30pm

The current research work that has surrounded DNA molecules has involved uncovering their electrical properties with regards to how conductive they are. Since this naturally involves conducting experiments at the nanoscale level, there is a challenge to ensure that findings are valid and precise. Current research and recent findings will be analyzed and possible improvements to experimental techniques will be proposed.

Transit Applications for Trinetra (Assistive Technologies for the Blind)

Colin Taylor (Electrical & Computer Engineering)
Advisor: Priya Narasimhan (Electrical & Computer Engineering)
Rangos 1
CIT Poster, 12-2:30pm

The overall goals of the Trinetra project involve improving independence and quality of life for the blind community through the use of networked embedded systems. There are many ways to leverage this technology specifically when dealing with commute planning and transit systems. By using the Global Positioning System (GPS), coupled with mapping and path planning technology, we can offer an end-to-end solution for both sighted and blind users to determine the best way to make use of public transportation. My part of this project involves the middle-tier server software between the end users (cellular phones) and the mapping/transit databases, and includes both network communications and activity logging for later analysis.

Trinetran: An Assistive Technology for the Blind

Geeta Shroff (Computer Science)
Hemant Sikaria (Electrical & Computer Engineering)
Advisor: Priya Narasimhan (Electrical & Computer Engineering)
Rangos 1
CIT Poster, 12-2:30pm
Rangos 2&3, Sigma Xi Group 4, 11:30 am

Trinetra is an ongoing initiative within the Electrical and Computer Engineering Department at Carnegie Mellon University which aims to develop low cost smart systems using mobile devices integrated with assistive technologies to provide the blind and the visually impaired community with more independence in their daily lives. As a part of this initiative, we have developed the Trinetran system to assist visually impaired commuters with respect to their transportation and route planning needs, by creating a location and context-aware application on a mobile embedded cell phone platform. We aim to bring information regarding bus schedules, bus stops, and accessibility paths to the user's hand held device in real-time by harnessing available technology resources built into buses, bus stops, and transit authority monitoring systems. We have incorporated client contextual models into the user side requests to achieve our mentioned goals of ease of use and user independence. We will also be conducting deployments and user studies shortly to better understand the route planning needs of the blind.

User Interface for Manual Verification of Automated Stem Cell Tracking

Kyri Baker (Electrical & Computer Engineering)
Wean Commons-1st Floor, Connan side
3-5pm
Wright

Automated computer vision based cell tracking is important for stem cell research and tissue engineering. It is important to evaluate the accuracy of the automated tracking results. The ground-truth for verification is manual tracking by a trained human operator. This project aims to develop a program that allows the user to manually track the stem cells. This is done by letting the user "track" each cell by drawing ellipses around each cell throughout a series of time-lapsed frames. Some features implemented include: saving/loading data from XML, zoom in/out, click and drag objects, custom color settings.

Using Clinical Data to Evaluate Gait and Balance in Patients

Shijong Ng (Electrical & Computer Engineering)
Kelly Koser (Mathematics)
Iulia Degeratu (Statistics)
Margaret Hebner (Mathematics)
Advisors: Rebecca Nugent (Statistics)
Marnie Bertolet (Statistics)
Wean Commons-1st Floor, Connan side
12-2:30

As today's population grows older and less independent, there is an increased risk of both hospitalizations and falls associated with a wide range of health factors. When doing this project, we want to determine which factors will accurately predict a patient's risk for future falls and hospitalizations. Information regarding demographics, lifestyle, and past and present health problems was recorded for 184 clinical outpatients. Each patient took a Tinetti test, a short, low impact physical test to determine one's overall health and independence based on a scale from zero to twenty-eight, and their gait speed was measured. Using correlations between variables and linear and logistic regression models, we are better able to predict a patient's Tinetti test score or gait speed, thus helping to predict whether or not a patient will have a fall or hospitalization in the near future.

Vision-Based Relative SLAM

Aaron Johnson (Electrical & Computer Engineering)
Advisor: Tsuhan Chen (Electrical & Computer Engineering)
Rangos 1
CIT Poster, 12-2:30pm

I am taking a group of robots with very simple hardware and trying to get them to visually locate and identify each other. The beauty of localizing each other is that even if a robot has no clue about its environment, the other robots in the team should be easy to pick out. Knowing this is useful in itself, but it also lets the robot ignore parts of the image that should not be considered in other vision algorithms. This is the first step of a larger project, with the end goal being a low cost robot colony capable of vision based SLAM (Simultaneous Localization and Mapping).

Wearable Medical Sensor Nodes

Mark Hamilton (Electrical & Computer Engineering)
Advisor: Ragunathan Rajkumar
Rangos 1
CIT Poster, 12-2:30pm

Our project aims to create a wearable device with medical sensors which communicates wirelessly and can be monitored and reconfigured remotely by a physician. In the first phase of the project, we investigated the analog hardware necessary to acquire an ECG signal. An expansion board for the FireFly sensor nodes was developed that allowed the node to capture and process the ECG data. Following this, we began work with IMEC-NL to integrate with their medical ASIC and MSP430 based sensor platform. We ported the nano-RK operating system to their hardware and added drivers for its sensors. We are currently continuing to work with them to refine the platform and expand its capabilities.

Wireless AP Localization

Aditya Agarwala (Electrical & Computer Engineering)
Advisor: Dr. Srinivasan Seshan (Computer Science)
Rangos 1
CIT Poster, 12-2:30pm

Wireless networks have become common ground in both businesses and homes. With the costs of portable computers continuing to drop, we can only expect that the number of wireless networks will keep rising. Being able to determine the physical location of access points has several purposes from finding rogue AP's to developing a map for a community mesh network. Current methods of AP localization with omni-directional antennas provide only a very coarse grained position. This work will show that through various improvements, such as vectorization and plane fitting, localization error can be reduced to a usable range.

Wireless Power Transfer via. Magnetic Resonant Coupling

Benjamin Cannon (Electrical & Computer Engineering)
Advisors: Daniel Stancil
Jim Hoburg
Rangos 1
CIT Poster, 12-2:30pm

As the popularity of wireless electronic devices and household robotics grows, questions arise regarding the possibility of powering these wireless systems without plugging them into a power source. This research investigates the transfer of wireless energy between resonant coils, coupled through their magnetic fields. A demonstration of this concept was built in the lab where a large, 30cm diameter coil was tuned to transfer energy to a small, 1.27cm diameter coil. Once a working system was developed, the transfer of power from a single, large coil to several small coils was then investigated. This system serves as a prototype for potentially powering small electronic devices (cell phones, laptops, robots, etc.) in the presence of a large, driven coil?s magnetic fringing fields. In addition to this in-lab work, a circuits-based description was developed to predict and optimize the behavior of such a system based on the coils? coupling strength.

ENGINEERING AND PUBLIC POLICY

Leg mechanism design for a wall-climbing robot using dry adhesives

Brad Brown (Engineering and Public Policy)
Advisor: Metin Sitti (Mechanical Engineering)
Rangos 1
CIT Poster, 12-2:30pm

The Waalbot is a robot designed to climb walls using dry-adhesives on leg mechanisms. In order to operate under a variety of conditions and adhesion levels, the design of the legs of the robot must be robust. In addition, in order for the robot to be considered for production in the future, the legs must be designed with manufacture and assembly in mind. To facilitate the improvement of leg design for the robot, we have considered the use of laser-printed parts, various materials, and improved designs.

MATERIALS SCIENCE ENGINEERING

Analysis of Fracture Toughness of Metal Nitride Superlattices in Milling Applications

Matthew Maurice (Materials

In order to facilitate the milling of metals, hard coatings are used to prevent interaction between the milling apparatus and the metal being milled. These hard coatings are essential to the milling procedure and, to function properly, must be able to prevent both chemical and physical interactions between the

Science Engineering)
Advisor: Paul Salvador (Materials Science Engineering)
Hoch Commons-2nd Floor, Rangos side
12-2:30

materials involved. Furthermore, they must have a high fracture toughness to function under high-stress milling conditions. Professor Paul Salvador's group has synthesized several new materials that could be used for hard coatings? these so-called superlattices are composed of many alternating nanoscale layers of two crystallographically dissimilar nitrides (such as TiN and TaN or TiN and AlN). Although these materials show enhanced hardness values, a primary materials feature of hard coatings, they have not been tested for their fracture toughness. To test for fracture toughness, a nanoindenter will be used to indent the coating, causing fracture, and the resultant cracks will be imaged using atomic force microscopy. Once the fractured samples have been imaged, the fracture toughness can be found by relating the force applied by the nanoindenter to the size of the crack formed. Besides testing individual hard coatings of each material independently (i.e., TiN, TaN, AlN, and ZrN), superlattices of several combinations (i.e., TiN/AlN and TiN/TaN) will be tested to optimize further the fracture toughness of the hard coating.

Analysis of the Morphology of Silver Nanoparticles used in Art Conservation

Jane O'Sullivan (Materials Science Engineering)
Advisor: Michael McHenry (Materials Science Engineering)
Hoch Commons-2nd Floor, Window side
12-2:30

In this research project I will be examining the morphology of triangular silver nanoparticles, for use in art conservation, by Transmission Electron Microscopy (TEM). These particles are of current interest in art conservation. Silver has plasmon resonances in the visible spectrum. For instance, since the triangular silver nanoparticles absorb in the red so they have a color that is close to blue. This color changes when the particles react with hydrogen sulfide which is a gas that typically causes silver to tarnish. This color changing ability leads to the use silver nanoparticles as gas-sensors. Previously sensing for the affects of gas on artifacts in art conservation was done by the Oddy test. This test has its disadvantages in that it can only give qualitative information. Therefore there is an attempt to make better gas-sensors using the silver nanoparticles. In order to completely understand the sensors the nanoparticles themselves must be examined. In my analysis I will be working with triangular nanoparticles to observe a TEM tilt series to reconstruct the 3-d shape of the nanoparticles. This will allow me to determine the orientation of the particles and the particular crystallographic faces that are exposed. Knowing this is important because different facet will have different chemical potentials and therefore react differently with hydrogen sulfide. I will model the surface crystallography using CrystalMaker@TM software which I have been trained in my course 27-201, The Structure of Materials. Specifically, I will examine specific surface site geometries which might promote the attachment of hydrogen sulfide allowing the identification of the role of surface crystallography on catalyzing the tarnish formation reactions. By determining the exact morphology of the particles I can learn more about the reaction and how it effects the particle's gas-sensing capabilities. If a model of the nucleation and growth of the particles can be developed, I may further learn how to control the morphology to optimize the gas sensing properties.

Application of Inductively Coupled Plasma Equipment for Etching GaNand AlxGatx Thin Films and Heterostructures

Michael Schmitt (Materials Science Engineering)
Advisor: Robert Davis (Materials Science Engineering)
Hoch Commons-2nd Floor, Rangos side
3-5pm

Inductively Coupled Plasma (ICP) etching provides a high-density plasma alternative to standard Reactive Ion Etching (RIE) methods. Galium Nitride (GaN) surfaces require the high plasma density etch offered by ICP systems. Standard operating pressure for ICP systems is around 150 mTorr. The base pressure of any ICP system must be three to four orders of magnitude lower than operating pressure, because the introduction of gases into the main etching chamber to form plasma will significantly raise the pressure of the system. Areas where parts to the system attach present possible leak points that could lead to an inadequate base pressure. In order for the system to become operational, the leak rate of our ICP system had to be minimized via several distinctive system changes.

Cranberry juice cocktail and proanthocyanidins effects on Escherichia coli biofilm formation: Inhibition of urinary tract infections

Kerrie Holguin (Materials Science Engineering)
Hoch Commons-2nd Floor, Rangos side
3-5pm

Urinary tract infections are caused by bacterial adhesion to uroepithelial cells in the form of biofilms. To determine the effects of cranberry juice cocktail and its subcomponent, proanthocyanidins, on bacterial adhesion for the prevention of UTIs, we used a wild-type E. coli HB101 strain and a mutant E. coli HB101pDC1 strain. A 10 wt.% CJC solution and 10 wt.% proanthocyanidins solution were created and biofilm formation was implemented on a PVC plate. Crystal violet staining determined the amount of biofilm formation, and measurements were taken at various time increments and multiple exposures. The 10 wt.% CJC solution produced no biofilm formation for either strain. The 10 wt.% proanthocyanidins solution produced no biofilm formation for the HB101 strain; however HB101pDC1 did. There was generally a decreasing trend in biofilm formation with increasing number of exposures. Proanthocyanidins might not be the only compound in CJC that limits bacterial adhesion.

Investigation of printable conductive inks on semiconductors (2)

Aswin Tejasukmana (Materials Science Engineering)
Advisor: Lisa Porter
Hoch Commons-2nd Floor, Window side
12-2:30

The conversion of sunlight into electricity via a (photovoltaic) solar cell is a clean and renewable energy source. With the increasing environmental, political, and economical problems associated with fossil fuel energies, photovoltaics are becoming more viable for widespread energy production. The development of nanotechnology has spawned intensive research efforts to produce solar cells with high energy-to-cost ratios. However, there are still many issues regarding lower production costs and increased cell efficiencies that must be resolved. One of these issues pertains to the formation of low-resistance metal contacts to the cells. Depositing metal contact materials on silicon techniques using a drop-on-demand printer and/or an off-the-shelf inkjet printer have the potential for economically printing electrical contacts onto solar cells. Investigations on methods to improve the adhesion of metal nanoparticles for printing on the semiconductor and controlling the shape of the printed lines will be discussed.

Iron Cobalt Nanoparticles in Hyperthermic Cancer Application

Courtney Ondeck (Materials Science Engineering)
Advisor: Michael McHenry (Materials Science Engineering)
Rangos 1
CIT Poster, 12-2:30pm
Rangos 2&3, Sigma Xi Group 5, 11:15 am

Because current cancer therapies have negative side effects, a new treatment is needed. One possible treatment is hyperthermia, using magnetic nanoparticles. When an RF magnetic field is applied, magnetic nanoparticles will dissipate heat and if functionalized with the proper biological agent, the nanoparticles will attach selectively to the tumor. When the nanoparticles heat, the tumor will heat and the healthy surround tissue will not be harmed. Since cancers are destroyed at lower temperatures than healthy tissue, we are using functionalized magnetic particles to eradicate cancer cells. Iron Cobalt (FeCo) is being investigated for this use because of its high magnetic moment (and consequent, high heating rate), and the biocompatibility from the inherent oxide layer. Different surfactants have been tested to determine the effect of surfactant on heating rate. Variations in the oxide layer and this effect on heating have been examined through scanning electron microscopy, X-Ray diffraction, and magnetization experiments. In addition, cell work has been done to assay the biocompatibility of the nanoparticles and a synergistic effect has seen when heat shock and anti-cancer drugs are combined.

Quantification of diffusion coefficient of magnetic nanoparticles through a porcine SIS ECM-based tissue scaffold

Rebecca Snyder (Materials Science Engineering)
Advisor: Michael McHenry (Materials Science Engineering)
Rangos 1
CIT Poster, 12-2:30pm
Rangos 2&3, Sigma Xi Group 5, 11:30 am

Naturally occurring extracellular matrix (ECM) scaffolds has been shown to promote "constructive" tissue remodeling in musculoskeletal, cardiovascular, urinary tract, dermatological, gastrointestinal, and neurological applications, among others. The remodeling process includes rapid degradation of the ECM scaffold with concomitant replacement by host tissue. Quantitative tracking of ECM scaffold degradation has been accomplished in the past using radioactively labeling. Although this approach has been a powerful tool for increasing our understanding of ECM remodeling, the process is laborious and costly. Furthermore, the utility of the process is limited to animal derived tissues. Finally, testing for radioactive species is destructive and can only provide a global measure at a point in time, so there is no possibility to determine temporal or spatial differences longitudinally. The objective of this study was to investigate the utilization of FeCo magnetic nanoparticles as a means to track the degradation and in vivo straining of scaffold and scaffold-derived materials. Assuming controllable migrational characteristics of engineered products, FeCo-infused systems could be used to yield an efficient and affordable means of studying in vivo properties and responses of scaffold material through the dissipation of the net magnetic signal at the site of implantation and surrounding tissue as well as the imaging capacities of the magnetic particles. Such a technique would provide great promise for the development and expansion of current regenerative medicine research and practices.

Styrene Biosnythesis in E. coli

Darin Clark (Materials Science Engineering)
Advisor: Newell Washburn

Based on previous work conducted by Prof. Domach of the Department of Chemical Engineering involving the optimization of folate biosynthesis in B. subtilis, I have generated a computational model of phenylalanine biosynthesis in E. coli based on a master equation detailing the conversion of glucose to phenylalanine within E. coli. From this computational model,

(Chemistry)
Rangos 1
CIT Poster, 12-2:30pm

the effects of knocking out various genes associated with enzymes key to the phenylalanine biosynthesis pathway were analyzed as well as several other thought experiments designed to guide real-world experimentation. We are attempting to optimize the production of phenylalanine in the hopes of coupling these optimizations with a plasmid which codes for enzymes that convert phenylalanine into the aromatic monomer styrene. Ultimately, we hope to engineer a strain of E. coli that produces styrene monomers in a bioreactor of a size viable for commercial implementation. We expect that the biosynthesis of styrene monomers will be a gateway leading to the biosynthesis of other aromatic compounds not commonly synthesized by such means and often synthesized synthetically at a very large cost. Overall, we are attempting to replace more traditional means of aromatic compound biosynthesis, typically involving the use of fossil fuels from the ground or ethanol produced from corn, with more environmentally friendly biosynthetic methods while still maintaining viability on a commercial scale.

MECHANICAL ENGINEERING

A comparison of models for ethanol distribution optimization

Anne Lewis (Mechanical Engineering)
Advisor: Jeremy Joseph Michaels
Rangos 2 & 3
Sigma Xi Group 5, 10:45am

As policies in the United States government support increased research and development of alternative fuels, an infrastructure is necessary to support national self-reliance on energy. I am focused on a national level optimization of ethanol plant placement based on associated costs and distribution needs. The most accurate optimization is found with a coordinate based nonlinear model, and since it is a large-scale problem the computational time is much greater than with a binary model. Thus, I am comparing varied problem types for coordinate and binary models. These use Mixed Integer Linear Programming (MILP) and Mixed Integer Non-Linear Programming (MINLP) algorithms. I will show that when parameters are tightened for both types of problems and the computation time increases, there is a point in computation time at which the coordinate approach delivers a better solution. These findings will provide a reference for when it is optimal to sacrifice computation time to find a better solution for the facility location problem.

A Granular Lubricated Journal Bearing: Modeling and Experiments

Martin Marinack (Mechanical Engineering)
Advisor: Cecil Higgs (Mechanical Engineering)
Rangos 1
CIT Poster, 12-2:30pm

Solids and fluids are well understood in the field of mechanical engineering. Granular flows, however, have been much harder to understand and predict as they exhibit multi-phase behavior, as both a solid and a liquid. Interaction between rough surfaces and granular flows involves the flow of granular materials in sliding contacts such as annular or bearing-type. In particular, the studies performed deal with the friction, lubrication, and wear of dry particulates between relative sliding surfaces. The study of the behavior of granular materials in rough, loaded sliding contacts, such as the granular lubricated journal bearing (GLJB), is important for two key reasons: the possibility of these particles being candidates as solid/particulate lubricants in extreme environments where oils can not lubricate; and, understanding

planetary rover exploration where the wheel/sand traction behavior is important for negotiating Martian terrain. The study of granular flow behaviors was done by both computer modeling with lattice-based cellular automata (CA), and "bearing" experiments using the GLJB. The CIT research honors had two main duties during the course of this research. First, he was to provide support to the work being done with the GLJB. The honors researcher prepared technical drawings for production of an enlarged journal. Other solutions dealt with determining an optimal configuration for the novel shaft. Ultimately, an optimal combination of mechanical and granular values was found to give an initial "lubrication lift". In other words, the granular flow was able to provide a load carrying capacity and support the load of the journal in the same manner as a liquid lubricant would. Second, he developed CA code that accounts for friction, which causes spin and changes in tangential velocity of particles that collide with the boundary, as well as with other particles. Ultimately, this work will serve as a precursor to research that will be conducted by the student during his PhD studies here at Carnegie Mellon.

Advanced Maneuverability in a Human Operated and Autonomous Robot

Victor Marmol (Computer Science)
Jaime Bourne (Mechanical Engineering)
Advisor: William Messner
Rangos 2 & 3
Sigma Xi Group 6, 10:45am
Wright
Oral 6, 1:40pm

To build a robotic platform through which a variety of advanced drive systems can be tested. We have split our research into human controlled and autonomous operation. In human control we will experiment with drive and control systems to improve the efficiency of several current drive concepts. In the autonomous field we will implement a variety of sensors and sensor checking in order to successfully complete a line following course.

Alternative Approach to Design and Fabrication of Larger Scale Water Strider Robots

Akshay Jayaram (Mechanical Engineering)
Advisor: Metin Sitti (Mechanical Engineering)
Hoch Commons-2nd Floor, Window side
3-5pm

Water strider insects are small, quick, and agile creatures. This project aimed to mimic these insects by designing and fabricating larger scale water strider robots. These robots use surface tension, and material properties to attempt to "walk on water". A new design was built, and successfully tested, with promising results.

An In-Vitro Study of Mechanical Attachment Components into Human Tissue

Vincent Chiodo (Mechanical Engineering)
Advisor: Burak Ozdoganlar (Mechanical Engineering)
Rangos 1
CIT Poster, 12-2:30pm
Rangos 2&3, Sigma Xi Group 5, 10:00 am

The study and research consists of developing a pattern of "microbarbs" that are on the order of uM that will safely and effectively attach to a human surface. The idea is that the microbarbs will be shaped so that they will adhere to a living human tissue and there interface can be used to transport or deliver medical enhancements, supplements or drugs. The way the microbarbs are developed is vital to how they perform inside a human's body or on the outside surface of a living organism. The patterns of microbarbs are inscribed on pieces of PMMA which is a type of material that is biodegradable by the body and can be ingested without excessive human resistance. The microbarbs are machined using micromachining techniques from the Mechanical Engineering department however collaboration between the biomedical field is also necessary to understand how the microbarbs will interact with living tissue when used in experimental protocols.

ASME Student Design Project: Human-Powered Potable Water Still Proposal

Erika Bannon (Mechanical Engineering)
Alexander Williams (Mechanical Engineering)
Bradley Hall (Mechanical Engineering)
Michael Cushman (Mechanical Engineering)
Advisor: John Wesner (Mechanical Engineering)
Wean Commons-1st Floor, Connan side
3-5pm

ASME Student Design Project is a group of undergraduate engineers and computer scientists who meet every year to compete in the regional ASME design competition. This year's challenge was to build a robotic window washer following ASME guidelines. Our group met that challenge and competed at the 2008 ASME Conference which was held at Carnegie Mellon University.

ASME Student Design Project: Robotic Window Washer

Richard Pantaleo (Mechanical Engineering)
Victor Marmol (Computer Science)
Jaime Bourne (Mechanical Engineering)
James Forbes (Electrical & Computer Engineering)
Michael Menchaca (Mechanical Engineering)
Katherine Coste (Mechanical

The ASME student design project is a group of undergraduate engineers and computer scientists who meet every year to compete in the ASME student design competition. This year the project was to build a robotic window washer while adhering to the ASME guidelines. Our group met that challenge and competed in the 2008 ASME regional conference which was held at Carnegie Mellon on April 5th.

Engineering)
Benjamin Som-Pimpong (Mechanical Engineering)
Gaurav Verma (Undecided)
Bradley Yoo (Undecided)
Justin Yi (Mechanical Engineering)
Paul Kim (Mechanical Engineering)
Bradley Hall (Mechanical Engineering)
Michael Cushman (Mechanical Engineering)
Jacob Coffelt (Mechanical Engineering)
Daniel Shope (Mechanical Engineering)
Advisor: John Wesner (Mechanical Engineering)
Kirr Commons-1st Floor, Window side
12-2:30
Dowd
Oral 2, 12:20pm

Autonomous Quad-Rotor Helicopter Stability Control

Daniel Pehush (Electrical & Computer Engineering)
Ilya Brin (Undecided)
Frank Costello (Computer Science)
Gaurav Verma (Undecided)
Paul Desiderio (Mechanical Engineering)
Scott Ridel (Mechanical Engineering)
Rajit Kumar (Electrical & Computer Engineering)
Advisor: William Messner
Hoch Commons-2nd Floor, Window side
3-5pm

This project will develop a flight controller for an autonomous quad-rotor helicopter, in order to maintain stable flight. This proposal is being presented with two other grants in order to develop a functional autonomous helicopter. A quad-rotor helicopter is a modification of the conventional-single rotor helicopter configuration. The quad-rotor helicopter has four motors arrange in at the corners of a square, each of which turns its own rotor independently. The sum of the thrusts from the four rotors produces the thrust perpendicular to the plane of the rotors. The difference in the thrusts from the left and right rotors produce a pitch moment. The difference in the thrusts from the front and back rotors produce a roll moment. The pitch and roll dynamics of the quad-rotor helicopter are inherently unstable, and thus active control of the rotor speeds is needed to produce stable flight. This will be achieved through the use of a gyroscope for sensing angular velocity and accelerometer for sensing orientation and angular velocity in tandem with a stabilizing control scheme, which will be implemented upon a gumstix© miniature motherboard.

Consumer Preference Modeling: The Value of the "Hybrid" Name

Andrew Hamilton (Mechanical Engineering)
Advisor: Jeremy Joseph Michaels
Rangos 1
CIT Poster, 12-2:30pm

As consumers become more environmentally conscious, hybrid vehicles seem to wield a relatively new source of consumer value: personal pride in choosing a "greener-looking" alternative. This study intends to determine whether consumers value the hybrid name and image by itself, or whether the real source of consumer value comes from the improved fuel economy. This study will quantify these consumer values through choice-based conjoint survey analysis, and it will compare the validity of this data to that of market data regression methods.

Cooperative Manipulation in a Robot Colony

Kevin Woo (Electrical & Computer Engineering)
Eugene Marinelli (Computer Science Department)
Gregory Tress (Electrical & Computer Engineering)
James Kong (Electrical & Computer Engineering)
Jaime Bourne (Mechanical Engineering)
Jason Knichel (Computer Science Department)
Austin Buchan (Electrical & Computer Engineering)
Brian Coltin (Computer Science)
Justin Scheiner (Electrical & Computer Engineering)
Siyuan Feng (Computer Science)
Christopher Mar (Electrical & Computer Engineering)
Bradford Neuman (Physics)
Advisor: George Kantor (Robotics Institute)
Rangos 2 & 3
Sigma Xi Group 4, 11:45am

Object manipulation and interaction with the environment is a critical application in the field of mobile robotics. In situations where multiple robots cooperate, sensor data can be shared allowing any robot within the colony to find objects located by other robots. Once an object is identified, robots can cooperatively manipulate the object by coordinating movement. While many current robots utilize vision to aid with object detection, this incurs a prohibitive cost for many researchers. By developing the necessary sensory capabilities and coordination algorithms based on inexpensive light sensors, the Colony Project has demonstrated that cooperative manipulation can be feasibly performed within a low-cost robot colony.

Creating Integrated Polymerase Chain Reaction Devices Using Droplet-Based Microfluidic Technology

Ramya Ramesh (Mechanical Engineering)

The goal of polymerase chain reaction is to efficiently amplify DNA for use in gene analysis, forensic testing and medical diagnostics. The project entitled "Creating Integrated Polymerase Chain Reaction Devices Using Microfluidic Technology", has evaluated existing technologies for miniaturizing PCR, exploring their pitfalls, and proposing a different methodology for accomplishing automated, integrated, and miniaturized PCR reactions. In the past, PCR devices have been created by using a stream of PCR solution

Advisor: Dr. Shelley Anna
(Mechanical Engineering)
Hoch Commons-2nd Floor,
Rangos side
12-2:30

flowing through long, heated capillary tubes. Disadvantages of these devices include large pressures needed to drive flow in very long channels, complicated device design and operation, cross-contamination, and fouling of the tube walls. To address these problems, my research has focused on designing a new device that uses a continuous stream of droplets in a microfluidic device. The principal advantage of droplets as carriers for PCR reactants is that samples are protected from cross-contamination and contact with nearby surfaces. Microchannels are fabricated in PDMS using soft lithography techniques. Droplets containing PCR mix (or an aqueous simulant) are generated at a T-shaped junction due to the cross-flow of an immiscible oil, which subsequently surrounds the droplets as they flow downstream. The initial device demonstrates that PCR can be accomplished within droplets by performing PCR in batch in a stream of droplets that fill a long microchannel. Once formed, the droplets experience thermal cycling via global temperature control on the entire device. We have also begun to design on-chip thermal cycling to move toward continuous PCR reactions. With further development, the device presented here has the potential to perform PCR in a continuous stream, increasing DNA throughput and efficiency, and reducing the amount of time needed to complete the reactions.

Dammed Energy

Rachel Cawley (Electrical & Computer Engineering)
Anna Lenhart (Civil Engineering)
Eric Couphos (Mechanical Engineering)
Advisor: Susan Finger (Civil Engineering)
Connan
12:30-4pm

The goal of our project is to engage children in a fun and educational activity: "Dammed energy." Through the activity, students will learn that water held behind a dam has potential energy. We will tie this into the purpose and basic construction of dams. We will discuss how dams are usually used for flood control by forming a reservoir behind the dam. A byproduct of this reservoir is the available potential energy gained from the height of the water behind the dam. This is usually harnessed with hydroelectric generators.
The activity will consist of a Rubbermaid model of a reservoir and a hydropower dam. The dam will consist of a foam barrier, holding the water back in the reservoir. The barrier will have multiple holes at different heights, each initially blocked. The girls will decide which hole they want to uncover so the water can flow through it. As this water flows through the hole, it will spin a waterwheel. The waterwheel will be connected to a meter which measures the rotational velocity of the waterwheel. A higher velocity is correlated with more energy. The students will see that by increasing the elevation head, more power is generated in the waterwheel.

Design of a Controller to Synchronize Multiple High Powered Motors

William Wedler (Mechanical Engineering)
Hemant Sikaria (Electrical & Computer Engineering)

To gain wide-spread use, systems powered by alternative fuels, such as wind or solar power, must use that energy as efficiently as possible. In particular, the precise control of electric motors in high-performance alternatively-fueled systems is critical to increase efficiency due to limitations in available power. This study included the development of a control algorithm to synchronize multiple electric motors. The algorithm was designed based on control theory using feedback from motor sensors. PID and Fuzzy Logic control algorithms were considered and compared in this study. The motor controller was

Winston Wan (Undecided)
Advisor: Susan Finger (Civil Engineering)
Hoch Commons-2nd Floor, Window side
12-2:30

designed to manage battery voltage and current to two coupled DC electric motors.

Design of a Propeller and Gearing System for an Electric Boat

William Wedler (Mechanical Engineering)
Giridhar Pathak (Mechanical Engineering)
Mark Fuge (Mechanical Engineering)
Advisor: Susan Finger (Civil Engineering)
Kirr Commons-1st Floor, Window side
3-5pm

Modifying population systems of recreational boats from gasoline driven to electric driven allows for alternative fuels to power these vessels. However, a switch from gasoline engine to electric motor will result in a major loss in efficiency if the entire propulsion system is not correctly modified. A case study has been completed on the design of a propeller and gearing system for an electric drive train of a solar powered boat. This work included hull characterization, theoretical propeller calculations, testing of viable propellers and finally drive train gearing to minimize power loss.

Design of Lightweight Braking System for a FSAE Car

Robert Keelan (Mechanical Engineering)
Michael Lin (Mechanical Engineering)
Advisors: Kenji Shimada
John Wiss (Mechanical Engineering)
Kirr Commons-1st Floor, Window side
12-2:30

The Final Brake Caliper, and hub assembly will be displayed. A summary of the design manufacturing and testing process will also be given.

Design of Nanocomposite Solid Barriers with High Thermal Resistance

Takahiro Matsuura (Mechanical Engineering)
Advisor: Alan McGaughey (Mechanical Engineering)

The thermal resistances of silicon-germanium alloy layers of varying composition, thickness, and quality will be predicted using molecular dynamics simulations. The results will be used to build a simple model that will allow for the specification of a structure with a desired thermal resistance.

Hoch Commons-2nd Floor,
Rangos side
3-5pm

Detection of X-Ray Sources

Jason Waddell (Mechanical Engineering)
Jeremy Doo (Economics)
So Young Park (Mathematics)
Gregory Hallenbeck (Physics)
Advisors: James Delaney (Statistics)
Peter Freeman (Statistics)
Hoch Commons-2nd Floor,
Window side
3-5pm

We analyze two-dimensional binned images of x-ray levels from satellite-based cameras. Our project seeks to detect and classify x-ray sources amidst a field of varying background levels, noise, which can be modeled by the Poisson distribution. We have developed algorithms that produce unbiased background estimates across the matrix and identify source pixels. As sources often cover multiple pixels, these identified source pixels are then grouped and clustered. This clustering allows us to make inferences on each source in our image, listing an x-ray source's total brightness, size, and location.

Development of an Extreme Speed and Load Tribometer for Studying In Situ Powder Lubrication

Jonathan Kyle (Mechanical Engineering)
Advisor: Cecil Higgs (Mechanical Engineering)
Rangos 2 & 3
Sigma Xi Group 5, 10:30am

Tribologists are working to develop an oil-free, solid lubrication technology for abating friction and wear in sliding contacts. Therefore, it has been proposed that compacted powder pellets can deliver lubricious transfer films in situ. A pellet-on disk with slider tribometer was constructed to test and model the tribological performance of various powder candidates. Using LabView, a data acquisition system was also designed to primarily record the frictional data being measured at the pellet/disk and slider/disk interfaces and the vertical wear of the pellet during testing. The results of the experimental setup, calibration, and preliminary testing will be presented.

Drag Forces

Ioannis Goutakis (Civil Engineering)
Alexander Kalberer (Mechanical Engineering)
Nicholas Burkholder (Mechanical Engineering)
Advisor: Susan Finger (Civil Engineering)
Connan
12:30-4pm

The goal of our experiment is to teach children about how drag forces affect energy loss in vehicles such as airplanes. In order to illustrate this concept our group is going to build a wind tunnel a few feet long out of Plexiglas. We are then going to instruct the students to build two different models of airplanes with distinct differences in plane wing surface area. The one plane will have a large wingspan and total wing area. The second will be smaller and more stream line. Then the students will be instructed to calculate the wing surface area using basic geometry calculations. The concept of conservation of mass between the 2 planes will be reinforced throughout the entire process. The students will be shown that all though the wing surface area differs, the same amount of volume is displaces in the wind tunnel by both planes. Then when the students finish their calculations they will be able to their planes in the wind tunnel and test the flying. They will be able to compare the aerodynamics and will learn about how smaller wing area and more streamline designs, will cause the smallest loss in energy. We will then teach the students about how a small

loss in energy translates into a large overall efficiency. The students will learn all of this by being able to measure the turbulent flow when smoke is added to the wind tunnel.

Effect of Boundary Layer Mesh on Total Mesh Performance for Computational Fluid Dynamics

Adam Seibert (Mechanical Engineering)
Advisor: Kenji Shimada
Rangos 1
CIT Poster, 12-2:30pm

The purpose of this project is to investigate the effects of the boundary layer mesh on the total mesh performance for Computational Fluid Dynamics (CFD). The project is focused on creating an unstructured tetrahedral mesh with a prism boundary layer that will accurately predict the fluid flow over a body. This type of mesh reduces the total cost of the CFD process by reducing the time spent meshing the geometry. Specifically, a thorough look at the prism boundary layer of the mesh will be considered. The boundary layer of the mesh influences the accuracy of the drag and lift calculations. Meshes will be created for a variety of geometries to test the mesh in real world situations. These geometries include a Boeing airplane model and the body of Carnegie Mellon Racing's Formula SAE racecar. The effects of the boundary layer mesh on key design criteria like drag and lift will be looked at. The results of the study will be used to develop a boundary layer meshing program in the Computational Engineering and Robotics Lab (CERlab).

Electro-Mechanical Design for a Quadrotor Helicopter

Zohar Bhagat (Mechanical Engineering)
Daniel Pehush (Electrical & Computer Engineering)
Mikhail Charkin (Computer Science)
Ilya Brin (Undecided)
Matthew LaTorre (Mechanical Engineering)
Gaurav Verma (Undecided)
Chaman Saron (Electrical & Computer Engineering)
Paul Desiderio (Mechanical Engineering)
Scott Ridel (Mechanical Engineering)
Rajit Kumar (Electrical & Computer Engineering)
Harkirat Singh (Electrical & Computer Engineering)
Adam Lederer (Electrical & Computer Engineering)
Advisor: James C. Hoe (Electrical &

Information of the ECE side of the helicopter

Computer Engineering)
Pake
Oral 8, 3:00pm
Hoch Commons-2nd Floor,
Rangos side
3-5pm

Faster, Further, for Less - Practical Aerodynamics in Action

Scott Moorby (Mechanical Engineering)
Vitaly Cherednichenko (Electrical & Computer Engineering)
Paul Kim (Mechanical Engineering)
Advisor: Susan Finger (Civil Engineering)
Connan
12:30-4pm

This activity is designed to facilitate hands-on learning about the effects of drag on moving vehicles, through a series of wind tunnel experiments and a practical road test of miniature toy cars, which are designed by the participants.

Children will have the opportunity to mix and match different car components and test them in a small wind tunnel. They can then modify their design to make improvements, re-testing and enhancing their designs until they are satisfied with their vehicles. At that point, their final design may be tested on a track, powered by its own tiny CO2 container, in order to evaluate its practical performance on the test course.

The children will be able to use hands-on experiments to develop an intuitive understanding for the practical ways in which a vehicle's geometry and cross sectional area is related to the amount of drag exerted upon it. Also, the iterative cycle of design, testing, and modification will encourage the students to develop a better understanding of the engineering discipline in general.

Friction Car

Andrew Zagoren (Civil Engineering)
Alex Au (Mechanical Engineering)
Michael Barako (Undecided)
Advisor: Susan Finger (Civil Engineering)
Connan
12:30-4pm

The goal of this activity is to illustrate the relationship between energy loss and friction. Children will roll a car down a track and vary parameters on both the car and the track. The car will have different sets of wheels varying in hardness. The flat portion of the track is interchangeable to allow for different surfaces, altering the coefficient of friction. When doing the iterations for the track, the children will monitor the maximum height of the car on the exit ramp. The children will observe patterns in energy loss by noticing how the height reached varies for different wheel and track combinations. Using the collected data, the children will attempt to construct setups with specific goals such as the setup that loses the most amount of energy (most friction), the setup that loses the least amount of energy (least friction) and some goals in between. From the patterns, the children can see that the frictional forces cause a loss in energy. They will also be able to gain a small understanding of automobile efficiency. Automobiles require a substantial amount of grip on the road surface but cannot lose more energy than necessary so as not to waste energy from the engine.

Homemade Electric Generators

Ryan Yates (Mechanical Engineering)
Christina Daup (Civil Engineering)
Heeyong Kang (Physics)
Advisor: Susan Finger (Civil Engineering)
Connan
12:30-4pm

This activity is designed to demonstrate a method of converting mechanical energy to electrical energy to middle school girls. Each team will assemble a basic electric generator with loops of copper wire, magnets, and a hand crank. Students will use the crank to manually spin the magnets in the center of several loops of wire. This changes the magnetic flux through the loops and current will flow through the wires. Students will learn that mechanical energy can be converted to electrical energy by using the induced current to operate electronics such as light bulbs.

Hyperredundant Bridge Inspection Robot

Stephen Kuhn (Mechanical Engineering)
Tristan Trutna (Mechanical Engineering)
Advisor: Kenji Shimada
Rangos 1
CIT Poster, 12-2:30pm
Rangos 2&3, Sigma Xi Group 6, 10:30 am

The inspection of America's aging infrastructure has become of increasing importance in recent years, in light of high-profile accidents and the established failure of many current methods to adequately detect flaws, defects and other precursors to failure. The federal government has mandated improvements in inspection methods, which most significantly include the adoption of new technology, where such technology has proven benefits. It is the intent of this project to design a highly mobile robot capable of carrying a sensor suite to examine signs of deterioration on steel bridges. The platform, consisting of several rotating linkages, with extremely accurate positioning provided by encoder chains, has already been successfully implemented in a project in Professor Kenji Shimada's CERLAB. Its adaptation to a bridge inspection robot is therefore highly promising.

Imaging Cryoprotectant Crystalization during Freezing

Alexander Williams (Mechanical Engineering)
Advisor: Yoed Rabin (Mechanical Engineering)
Rangos 1
CIT Poster, 12-2:30pm

The ultimate goal of this project is to study the effects of freezing living tissue. The current study focuses on imaging of physical events during freezing of cryoprotective agents. A cryoprotectant is a substance that is used to protect biological tissue from crystallization caused by freezing. In order undertake this research, it was necessary to modify a "cryomacroscope," a proprietary imaging device used to explore thermal and mechanical effects associated with large-scale vitrification and crystallization in cryopreserved specimens, and to make it computer-controlled. The modified device was then used in a temperature-controlled cooling chamber to record the freezing history of cryopreserved specimens.

Imperfect Recycling

Naomi Eduardo (Drama)
Kay Csuri (Mechanical Engineering)
Michael Whiston (Philosophy)
Advisor: Susan Finger (Civil Engineering)
Connan
12:30-4pm

Our group proposes an exhibit that teaches students about the imperfections of recycling. In particular, we would like students to learn that recycling is an imperfect process because it requires that all of the materials contained in a product be returned to their raw states, and that this is sometimes impossible or detrimental to the raw material. Consequentially, it is sometimes more worthwhile or beneficial to reuse products by incorporating them in new applications. In the exhibit students will create a cast of plaster of Paris as well as another cast made with reused plaster. The activity will test and compare the strengths of the material in its original application and subsequent reuse.

Improved Frequency Response Visualization Tools

Christine Appleby (Mechanical Engineering)
Advisor: William Messner
Rangos 1
CIT Poster, 12-2:30pm

The term "frequency response" in science and engineering refers to the relationship between the sinusoidal steady-state response of a system and a sine wave input as a function of frequency. The Bode plot is one of several visualization tools for graphically representing the frequency response. The Bode plot consists of two charts. The Bode magnitude plot is a log-log plot of the ratio of the amplitude of the output sine wave to the amplitude of the input sine wave. The Bode phase plot is a log-linear plot of the difference of phase of the output sine wave and the phase of the input sine wave. An advantage of the Bode plot is that the gain and phase relationships can be used to predict the stability of the system when a feedback control is applied. A disadvantage is the performance of the feedback system is difficult to predict from the Bode plot alone. Another disadvantage is that the effects of nonlinearities and variations in the system on the feedback control are difficult to predict from the Bode plot.

As part of the CIT Honors Research program, this project implements some modifications to the Bode plot to more clearly show the relationship between the frequency response and the performance of the feedback system when nonlinearities and variations are present. This project makes extensive use of MATLAB programming and incorporates recently and soon to be published results from Prof. Messner's research group. The project demonstrates the use of these new tools for control system design.

Insulated House - An Exploration of Recycled Materials and their Insulative Properties

Bryan Ward (Drama)
Michael Li (Mechanical Engineering)
John Johnson (Mechanical Engineering)
Advisor: Susan Finger (Civil Engineering)
Connan
12:30-4pm

The goal of this activity is to help children understand how recycled materials can be used to insulate a house effectively by assembling walls from post-consumer materials and measuring their efficiency in preventing heat transfer in a small model/simulation of a house. The children will be presented with a model of a house with one wall missing. They will use a prefabricated mold to make a wall out of a recycled, insulating material of their choosing. Materials that will be available will be granulated or in sheet form. The materials may include rubber, plastic, aluminum, paper, glass, sand, cement, styrofoam, and cotton/fabric. The children will place their wall in the house model. A heat lamp will be used to generate heat and focus it toward the newly created wall. Temperature probes on the inside and outside of the house will record the temperatures needed for calculation of the R-Factor.
The effectiveness of insulating (R-Factor) will be investigated and calculated for each of the removable walls that are built and compared to the R-Factors of existing, commonly used insulation. The children will discover that some materials are better at insulating than others, and through experimentation and calculations, will determine why through the experiment.

Molecular Dynamics Simulations of Multiple-Species Droplet Evaporation

The study of droplet evaporation is important due to its applications in atmospheric science and combustion technology. This study was focused on developing a water droplet evaporation model by using techniques learned from previous research in argon droplet evaporation. Molecular

Madhur Paharia (Mechanical Engineering)
Advisor: Alan McGaughey (Mechanical Engineering)
Hoch Commons-2nd Floor, Rangos side
3-5pm

dynamics simulation was used to model the water droplet evaporation. This study resulted in some interesting findings about the density profile, force distribution, and velocity distribution. These results and the conclusions drawn from them will be elaborated on in the poster.

Mouse Traps to Drive Engineers to Their Future

YoungJoo Jeong (Computer Science)
Jonathan Goettler (Mechanical Engineering)
David Torres (Mechanical Engineering)
Advisor: Susan Finger (Civil Engineering)
Connan
12:30-4pm

In this activity, the girls will face a common engineering problem: maximize the acceleration and distance traveled of a vehicle with a fixed power source. The power is provided by a string attached to the arm of a mousetrap. Through this interactive activity, they will learn about energy, torque, and the laws of motion. They will be able to adjust the string position on the moment arm connected to the mousetrap. By experimenting with this string position, they will develop their own understanding of how a constant torque can produce different forces in the string depending on its distance from the pivot point. This principle will be reinforced when they change the diameter of the wheels. Challenging the girls to produce the fastest acceleration possible and the longest distance traveled will encourage them to explore the different component combinations and learn engineering fundamentals along the way.

Optimization Algorithms for Hull Design

Ryan Yates (Mechanical Engineering)
Chunkit Yu (Electrical & Computer Engineering)
Riddhi Roy (Chemistry)
Andrew Moore (Mechanical Engineering)
Michael Barako (Undecided)
Advisor: Susan Finger (Civil Engineering)
Hoch Commons-2nd Floor, Window side
12-2:30

Finding the optimum design of a boat hull is difficult because there are many parameters that affect the overall hull performance such as the hull's width. One design approach would be to build models by varying physical parameters. Instead, this research aims to generate an alternative using software models. Using Computational Fluid Dynamics (CFD) software allows us to compute performance values such as drag force and lateral stability. Combining all of these values can produce an overall rating of a hull's performance. Finding the design which yields the greatest performance requires the use of CFD analysis over and over again. The use of a brute force approach to iteratively alter each physical parameter would result in too many combinations to be evaluated. With a response surface approach, we can create an optimization process to maximize a hulls performance using less CFD analysis. Through this research, we will learn how to optimize a hull design where many parameters make brute force techniques impossible.

Partical Flow and Tribology Lab: Granular

Martin Marinack (Mechanical Engineering)
Young Eun Choi (Mechanical

Solids and fluids are well understood in the field of mechanical engineering. Granular flows, however, have been much harder to understand and predict as they exhibit multi-phase behavior, as both a solid and a liquid intermittently. Interaction between rough surfaces and granular flows involves the flow of granular materials in sliding contacts such as annular or bearing-type. In particular, the studies performed deal with the friction, lubrication, and wear

Engineering)
Advisor: Cecil Higgs (Mechanical Engineering)
Rangos 2 & 3
Sigma Xi Group 5, 11:00am

the dry particulates cause between relative sliding surfaces. The study of the behavior of granular materials in rough, loaded sliding contacts, such as the granular lubricated journal bearing (GLJB), is important for two key reasons: the possibility of these particles being candidates as solid/particulate lubricants in extreme environments where oils can not lubricate; and, understanding planetary rover exploration where the wheel's traction behavior is important for negotiating granular like Martian terrain. The study of granular flow behaviors was done through both computer modeling with lattice-based cellular automata (CA), and "bearing" experiments using the GLJB. The undergraduates' tasks were three fold. First, rigorous single granule property testing was performed, in order to provide accurate inputs to models simulating the behavior of the granules. Properties such as the coefficient of restitution, coefficient of friction of the granule surfaces, hardness, and elastic modulus were all experimentally obtained. Second, a new module was added to the CA code that accounts for friction and its effects. Friction causes spin and changes in tangential velocity of granules that collide with the boundary, as well as with other granules. Finally, support was provided to the work being done with the GLJB. Technical drawings were prepared for production of an enlarged journal. Other solutions dealt with determining an optimal configuration for the novel shaft. Ultimately, an optimal combination of mechanical and granular values was found to give an initial "lubrication lift". In other words, the granular flow was able to provide a load carrying capacity and support the load of the journal in the same manner as a liquid lubricant would. Ultimately, this work will serve as a precursor to graduate studies of the candidates, to be pursued here at Carnegie Mellon.

Performance Based Hull Design

Andrew Moore (Mechanical Engineering)
Michael Barako (Undecided)
Advisor: Susan Finger (Civil Engineering)
Rangos 1
CIT Poster, 12-2:30pm
Dowd
Oral 10, 3:40pm

The design of a hull for a boat must be tailored to the performance desired of the boat. Some designs allow for a boat that has a very great stability where others focus more on decreasing drag. In order to create a hull that performs as desired, it is necessary to incorporate many different features to the hull that affect the performance in different ways. The goal of this project is to research how common hull features affect performance of a boat under several criteria and how these features can be implemented together to create a hull that operates as desired. The research will utilize Computational Fluid Dynamics (CFD) analysis in order to accomplish this goal. By completing this research, we will learn what design choices to make when designing a hull for a specific task.

Physical Testing of Racecar Aerodynamics (Continued)

Jicai Chow (Electrical & Computer Engineering)
Richard Zuckerman (Mechanical Engineering)

The purpose of this research project is to physically model the airflow over a racecar using fluid visualization techniques in an attempt to improve aerodynamics. The model for the racecar is based on the 2007-2008 Formula SAE car body and chassis design. Additional aerodynamic elements were added and tested to verify improvements to aerodynamics, if any.

Advisors: Kenji Shimada
John Wiss (Mechanical Engineering)
Wean Commons-1st Floor, Connan side
12-2:30

Power Your Car

Kristie Bennett (Electrical & Computer Engineering)
Insoo Jung (Civil Engineering)
Meehyun Jang (Mechanical Engineering)
Advisor: Susan Finger (Civil Engineering)
Connan
12:30-4pm

The goal of this activity is for the girls to experiment and learn about the energy supplied from difference power sources. By comparing the amount of energy produced by various power supplies, the girls can draw conclusions about which are the most effective. We plan to demonstrate this concept by allowing the girls to use different power sources to race cars on a straight track. They will design ?engines? for their cars using given materials. We will also teach them about cost efficiency by giving them game money they may use to buy the needed materials. We will have markers on the track to test how far each power supply moves the car. Each trial will be recorded on a white board so the girls can compare their results. Game money will be awarded if a team?s car reaches a certain marker. The power supplies will include balloons, springs, rubber bands, and a sling shot mechanism.

RobOrchestra III

Erica Sandbothe (Computer Science)
Richard Pantaleo (Mechanical Engineering)
Justin Scheiner (Electrical & Computer Engineering)
Laura Abbott (Computer Science)
Daniel Shope (Mechanical Engineering)
Advisor: Roger Dannenberg
Wean Commons-1st Floor, Connan side
3-5pm

The RobOrchestra project is dedicated to the creation of robots that combine musical artistry and new technology to gain a greater understanding of both the human creative process and robotic interaction and development. In its third year of being, the RobOrchestra team has extended its existing robots to interact with human musicians. This gives the robots a greater understanding of harmony, rhythm, and real-time improvisation. The group has constructed a new stringed instrument to increase the scope and breadth of its ensemble and introduced motion-capture technology to allow for humans to influence the creation of the robots' music. In this way, RobOrchestra illustrates the creative process of both humans and machines and the ways in which they may interact for both the instruction of the robot and the enjoyment of the human musician.

Rotary Electrothermal Bimorph Actuator for Head Skew Compensation in Disk Drives

Matthew Salac (Mechanical Engineering)
Advisor: William Messner
Rangos 1
CIT Poster, 12-2:30pm

The focus of this project is to create an aluminum/silicon electrothermal bimorph actuator for a read/write head in a hard drive disk which will allow for a rotation of the head +-15 degrees to compensate for the skew that occurs in the standard hard disk configuration. With compensation for skew, a hard disk drive can have the potential to read/write to the same data track without motion of the arm. The first layout was sent to the CMOS foundry and the chips have been sent back. Currently, the layout contains seven actuators. The actuators have been released and testing is underway. Preliminary results show that one of the seven actuators is a successful design. Future iterations will

improve the design and the theory involved in designing rotary electrothermal bimorph actuators.

Rubber Band Racers

Michael Ricci (Mechanical Engineering)
Po-Yu Chou (Mechanical Engineering)
Marcus Ruggiero (Mechanical Engineering)
Alex Timmons (Mechanical Engineering)
Advisor: Susan Finger (Civil Engineering)
Connan
12:30-4pm

This activity introduces children to the fundamentals of springs/rubber bands and how they store potential energy. The children will measure the spring constants of different rubber bands by hanging weights and noting the static displacements. They will then use these rubber bands to power small toy cars. They will measure the distance traveled by the cars and correlate the distances.

Sailboats

Edward Yuen (Civil Engineering)
Samson Debela (Civil Engineering)
Chris Stubbs (Mechanical Engineering)
Advisor: Susan Finger (Civil Engineering)
Connan
12:30-4pm

The sailboat activity engages children in learning about wind power ¿ specifically how people can turn wind energy into kinetic energy. The activity also teaches children how force can be split into different components, which move the sail in a desired direction. In the beginning of the activity the children will listen to a short lesson about the effects of the size of the sail and the centerboard of the boat. After working with a scale model of a sailboat, the children will design and build their own boat using recycled materials. The children will be able to change the size of the sail and its angle to the wind so they can see how these parameters affect the speed and direction of the boat. The children will try to create a sailboat that is faster than the target time.

Shape Optimization and Sensitivity Analysis for Use in Designing Optimal Solid Structures

Andrew Choate (Mechanical Engineering)
Mark Fuge (Mechanical Engineering)
Advisor: Susan Finger (Civil Engineering)
Hoch Commons-2nd Floor, Rangos side
3-5pm

Engineering Design is concerned not only with creating a product to meet a set of criteria, but also with finding the optimal solution to a given design which minimizes cost and resource input. To this end, techniques such as Shape Optimization and Sensitivity Analysis have been created in the hope of locating an optimal design given a set of models and constraints. However, such techniques are still in their infancy and have not become widely spread enough to make them truly user friendly. The goal of this grant is to investigate these two techniques and determine their potential, as well as their limitations, in terms of optimizing the design of small scale systems typically encountered by students. Our hope is that by studying how these two techniques are implemented in available tools, we will be able to determine a way in which current and future students can take advantage of Shape Optimization and Sensitivity Analysis within their design process. We will also demonstrate the advantages of Shape Optimization and Sensitivity Analysis through optimizing an existing aluminum tubing structure and noting the difference in performance/cost when compared with a non-optimal structure.

Sketch-Based 3D Automotive Styling Design

Sarah Marmalefsky (Mechanical Engineering)
Advisor: Kenji Shimada
Rangos 1
CIT Poster, 12-2:30pm

In the early stages of automotive design, designers produce a rich set of concept sketches to develop and communicate their ideas. These sketches convey useful information regarding the desired shape and style of the final product. Creating a 3D digital model consistent with the sketch is a useful tool for enhancing and visualizing the design; however, it a laborious process with existing CAD tools, limiting most conceptual explorations to 2D. To address this challenge, a system has been developed that helps car designers transform their 2D concept sketches into 3D geometry using simple, interactive techniques. The foundation for this approach is an optimization-based shape deformation algorithm that takes as input the user?s definition of key points in the sketch, and aligns and deforms a base template model to fit these points. Additionally, using the newly shaped template model as a substrate, the designer can explore different styling ideas by sketching and modifying 3D curves directly on the template. Demonstrations of the use and effectiveness of this approach will be presented, along with a discussion of the optimization algorithm.

Tip Based Dielectrophoretic Traps for Micro/Nano-Manipulation

Andrew Baisch (Mechanical Engineering)
Advisor: Metin Sitti (Mechanical Engineering)
Rangos 1
CIT Poster, 12-2:30pm

Here we present the design, fabrication and testing of a micro-manipulation tip based on a dielectrophoretic trap. As opposed to other micro-manipulation techniques, which are usually limited to one degree of functionality, dielectrophoresis (DEP) provides forced grasping and release of objects The goal of this project was to develop a probe that illustrates that micron-scale objects can be isolated and manipulated in 3-D using DEP. The future goal is to fabricate arrays of DEP micro-manipulation tips for large-volume 3-D manipulation.

Using the Nintendo Wii to Promote Physical Activity

Heather Tomko (Mechanical Engineering)
Advisor: Anind Dey (Human Computer Interaction Inst.)
Kirr Commons-1st Floor, Window side
12-2:30
Wright
Oral 13, 4:40pm

Physical activity is vital to many aspects of a person's well-being; not only is it associated with lower mortality rates, but it also improves health in a number of ways. It can reduce the risk of developing diabetes and high blood pressure, help maintain a healthy weight, and help maintain healthy bones, muscles, and joints. Physical activity is even more important for people with muscle weakness due to disease. For people with muscle weakness, physical activity is imperative to help maintain joint movement, prevent disuse and contractures, and maximize ability. However, the types of exercise that are available to people with muscle weakness is often severely limited due to their abilities; stretching and light weight lifting make up the majority of their exercises. The study, however, will look at using the Nintendo Wii as a way to increase physical activity for people with muscle weakness, by making the exercising more interactive and inviting.

Van de Graaff Generator

Ian Norman (Mechanical Engineering)

We would the students to learn that electrons can build up on materials and objects. By the end of the activity, they should understand that this happens by transferring elections from one type of material to another. Not only this, but already built-up electrions can disperse, effectively discharging the object,

Lucy Terrell (Civil Engineering)
Advisor: Susan Finger (Civil Engineering)
Connan
12:30-4pm

taking the object back to neutral.

In this activity, they will first experience well-known phenomena, like static-laden clothing and hair sticking to combs. This concept will be extended to other phenomena such as the electric shocks that people feel when walking in dry rooms on carpets and lightening. They will see the build up of electrons on a large Van de Graff generator. Finally, the students will assemble smaller do-it-yourself Van de Graff generator kit which they can take home.

Waalbot Mechanism

Brian Rose (Mechanical Engineering)
Advisor: Metin Sitti (Mechanical Engineering)
Rangos 1
CIT Poster, 12-2:30pm

The Waalbot is a small-scale wall climbing robot that uses a gecko adhesive fiber material. In this project, a new set of prototype leg mechanisms was developed in order to improve the robot's robustness and design for manufacture and assembly. This redesign of the leg mechanisms serves potentially as a mechanical solution to a number of the Waalbot's movement issues, including poor transitions while climbing low adhesion surfaces and its inability to transition over certain types of obstacles such as outside corners.

Wah-BOOM

Alexander Hanna (Mechanical Engineering)
James Langhauser (Mechanical Engineering)
Advisor: Susan Finger (Civil Engineering)
Connan
12:30-4pm

This activity will engage students in active learning about momentum and stopping distance. In this activity, students will roll cars from various heights, dropping them down and having them hit a stationary wall. The object inside the car (a Pringles potato chip representing the passenger) might break when the car hits the wall depending on whether the "bumper" works or not. Then, the children will add different materials to the wall to cushion the car as it hits. These materials will include a zip-lock bag filled with air, a sponge, a sock, and foam.

After testing and noting the effects of height, the children will experiment with different bumpers to see which ones work and which ones do not. They will then analyze the differences in the material and learn about how different materials change the stopping distance and thereby change the effect on their Pringle potato chip passenger.

Water-Running Project

Sang Ho Yoon (Mechanical Engineering)
Advisor: Metin Sitti (Mechanical Engineering)
Rangos 1
CIT Poster, 12-2:30pm
Rangos 2&3, Sigma Xi Group 5, 11:45 am

The project is called "Water-Runner Robot". Current water-running robot prototype has problems with roll over. My job is to build a new prototype based on improved design. I am doing fabrication, laser cutting, and assembly for new prototype. Besides, I do the stress test on each part to ensure the durability.

Wormbot

Timothy Sandy (Mechanical Engineering)
Advisor: Metin Sitti (Mechanical Engineering)
Rangos 1
CIT Poster, 12-2:30pm

The goal of this project is to develop and design a small-scale mobile robot capable of navigating a wide range of surfaces. This robot?s structure and movements mimic those of an inchworm, which allow the robot to easily transition between surfaces of different orientations. It uses dry adhesives on its footpads to eventually allow for the navigation of vertical walls and ceilings. Additionally, its design is fully modular, which extends its capabilities by allowing the adjustment of the number of links used as the navigational situation changes.

SELF-DEFINED

Technology Consulting in the Global Community

Adrienne White (Self-defined)
Advisor: Joe mertz (Computer Science Department)
Rangos Hallway, 2nd Floor
12-2:30

Technology Consulting in the Global Community (TCinGC) is a collaborative partnership between Carnegie Mellon students and faculty and governmental and non-governmental organizations throughout the world. A select group of Carnegie Mellon students travel abroad each summer to enhance their own technical, management, and communication skills by helping to develop locally sustainable uses for information and communications technology. The focus of this independent study is to research best-practice solutions to the development partner's problems. This study consists of researching the culture, language, customs, and history of the partner for the purpose of discovering any constraints or challenges in developing technological, yet sustainable, solution for their problem.

UNDECIDED

3D Body Position Measurement Using Accelerometers

Yush Gupta (Electrical & Computer Engineering)
Andrew Strat (Undecided)
Advisor: Tsuhan Chen (Electrical & Computer Engineering)
Hoch Commons-2nd Floor, Rangos side
12-2:30

The purpose of this project is to see if it is possible to use accelerometers to detect body movement and changes in body positioning. To test this hypothesis, this project will attempt to use the AXDL330 accelerometers (the same sensors that are used by the Nintendo Wii remotes) to create a wearable system that can detect changes in position. In the system, a user wears two sensors on a headpiece which capture the 3 dimensional acceleration at the front and back of the user's head. This information is digitized and then sent to a laptop. With it, the computer calculates any positional changes such as translations or rotations of the user's head. This research will eventually assist Dr. Tsuhan Chen's study of camera image stabilization using accelerometers.

ASME Student Design Project: Robotic Window Washer

Richard Pantaleo (Mechanical Engineering)
Victor Marmol (Computer Science)
Jaime Bourne (Mechanical

The ASME student design project is a group of undergraduate engineers and computer scientists who meet every year to compete in the ASME student design competition. This year the project was to build a robotic window washer while adhering to the ASME guidelines. Our group met that challenge and competed in the 2008 ASME regional conference which was held at Carnegie Mellon on April 5th.

Engineering)
James Forbes (Electrical & Computer Engineering)
Michael Menchaca (Mechanical Engineering)
Katherine Coste (Mechanical Engineering)
Benjamin Som-Pimpong (Mechanical Engineering)
Gaurav Verma (Undecided)
Bradley Yoo (Undecided)
Justin Yi (Mechanical Engineering)
Paul Kim (Mechanical Engineering)
Bradley Hall (Mechanical Engineering)
Michael Cushman (Mechanical Engineering)
Jacob Coffelt (Mechanical Engineering)
Daniel Shope (Mechanical Engineering)
Advisor: John Wesner (Mechanical Engineering)
Kirr Commons-1st Floor, Window side
12-2:30
Dowd
Oral 2, 12:20pm

Assisting in the Development of a Sensor-Andrew Prototype

Peter Trocha (Undecided)
Advisor: James Garrett (Civil Engineering)
Hoch Commons-2nd Floor, Rangos side
12-2:30

With the parallel growths of infrastructural dilapidation and technological development, the massive Sensor Andrew project was launched in 2006 aiming to create a prototype test-bed for the creation of multifarious sensing applications. The ultimate goal of this project is the provision of a viable nervous system for the built-world. My research in this endeavor has primarily concentrated on the Firefly sensing platforms nodes capable of forming a scalable network and equipped with a general array of sensors. With these nodes, I have delved into experimental calibrations of temperature and sound sensors, code manipulations and implementation of calibration corrections, and sensor data analysis leading to increased sensor functionality.

Autonomous Quad-Rotor Helicopter Stability Control

Daniel Pehush (Electrical & Computer Engineering)

This project will develop a flight controller for an autonomous quad-rotor helicopter, in order to maintain stable flight. This proposal is being presented with two other grants in order to develop a functional autonomous helicopter. A quad-rotor helicopter is a modification of the conventional-single rotor

Ilya Brin (Undecided)
Frank Costello (Computer Science)
Gaurav Verma (Undecided)
Paul Desiderio (Mechanical Engineering)
Scott Ridel (Mechanical Engineering)
Rajit Kumar (Electrical & Computer Engineering)
Advisor: William Messner
Hoch Commons-2nd Floor, Window side
3-5pm

helicopter configuration. The quad-rotor helicopter has four motors arrange in at the corners of a square, each of which turns its own rotor independently. The sum of the thrusts from the four rotors produces the thrust perpendicular to the plane of the rotors. The difference in the thrusts from the left and right rotors produce a pitch moment. The difference in the thrusts from the front and back rotors produce a roll moment. The pitch and roll dynamics of the quad-rotor helicopter are inherently unstable, and thus active control of the rotor speeds is needed to produce stable flight. This will be achieved through the use of a gyroscope for sensing angular velocity and accelerometer for sensing orientation and angular velocity in tandem with a stabilizing control scheme, which will be implemented upon a gumstix© miniature motherboard.

Design of a Controller to Synchronize Multiple High Powered Motors

William Wedler (Mechanical Engineering)
Hemant Sikaria (Electrical & Computer Engineering)
Winston Wan (Undecided)
Advisor: Susan Finger (Civil Engineering)
Hoch Commons-2nd Floor, Window side
12-2:30

To gain wide-spread use, systems powered by alternative fuels, such as wind or solar power, must use that energy as efficiently as possible. In particular, the precise control of electric motors in high-performance alternatively-fueled systems is critical to increase efficiency due to limitations in available power. This study included the development of a control algorithm to synchronize multiple electric motors. The algorithm was designed based on control theory using feedback from motor sensors. PID and Fuzzy Logic control algorithms were considered and compared in this study. The motor controller was designed to manage battery voltage and current to two coupled DC electric motors.

Electro-Mechanical Design for a Quadrotor Helicopter

Zohar Bhagat (Mechanical Engineering)
Daniel Pehush (Electrical & Computer Engineering)
Mikhail Charkin (Computer Science)
Ilya Brin (Undecided)
Matthew LaTorre (Mechanical Engineering)
Gaurav Verma (Undecided)
Chaman Saron (Electrical & Computer Engineering)
Paul Desiderio (Mechanical

Information of the ECE side of the helicopter

Engineering)
Scott Ridel (Mechanical Engineering)
Rajit Kumar (Electrical & Computer Engineering)
Harkirat Singh (Electrical & Computer Engineering)
Adam Lederer (Electrical & Computer Engineering)
Advisor: James C. Hoe (Electrical & Computer Engineering)
Pake
Oral 8, 3:00pm
Hoch Commons-2nd Floor, Rangos side
3-5pm

Friction Car

Andrew Zagoren (Civil Engineering)
Alex Au (Mechanical Engineering)
Michael Barako (Undecided)
Advisor: Susan Finger (Civil Engineering)
Connan
12:30-4pm

The goal of this activity is to illustrate the relationship between energy loss and friction. Children will roll a car down a track and vary parameters on both the car and the track. The car will have different sets of wheels varying in hardness. The flat portion of the track is interchangeable to allow for different surfaces, altering the coefficient of friction. When doing the iterations for the track, the children will monitor the maximum height of the car on the exit ramp. The children will observe patterns in energy loss by noticing how the height reached varies for different wheel and track combinations. Using the collected data, the children will attempt to construct setups with specific goals such as the setup that loses the most amount of energy (most friction), the setup that loses the least amount of energy (least friction) and some goals in between. From the patterns, the children can see that the frictional forces cause a loss in energy. They will also be able to gain a small understanding of automobile efficiency. Automobiles require a substantial amount of grip on the road surface but cannot lose more energy than necessary so as not to waste energy from the engine.

Intel Claytronics Project

Adithya Krishnaprasad (Undecided)
Rangos 1
CIT Poster, 12-2:30pm
Rangos 2&3, Sigma Xi Group 6, 10:15 am

My work with the Intel Claytronics Project mostly has dealt with modifying encoder circuits to generate valid data. This data is used to monitor and program the robotic arm's movement.

ISADS

Soojin Jeong (Computer Science)
Benjamin Poole (Undecided)
Kyri Baker (Electrical & Computer Engineering)
Advisor: Mei Chen
Kirr Commons-1st Floor,
Window side
12-2:30

The Interactive Search Assisted Decision Support (ISADS) project aims to help doctors make more informed decisions about pigmented skin lesions by analyzing dermoscopic images automatically, and presenting relevant data from a large, annotated repository. This project uses machine learning to determine similarity between images, which requires a substantial amount of training data. There are certain protocols that need to be followed when collecting data to protect patient confidentiality. My task is to collect dermoscopic images of pigmented skin lesions and their diagnostics (from International Society of Dermoscopy) and create filters using Java for ImageJ to analyze the images.

Local Quality Assessment of Optical Coherence Tomography Images

Benjamin Poole (Undecided)
Wean Commons-1st Floor,
Connan side
12-2:30

Optical Coherence Tomography(OCT) is a non-invasive scanning technology used to visualize the retina. Ophthalmologists rely on OCT images for the diagnosis of various eye pathologies. When OCT images are of poor quality, it is very difficult for physicians to identify these pathologies and diagnose patients. Research has been done in determining local OCT quality, but the results do not always mimic how human experts classify the images. In order to closely match the experts' labeling, we design a classifier that identifies where there are large changes in the local quality of the OCT image. Experiments show that this approach increases the similarity between our automated assessment and human experts' labeling.

Mechanical Properties of Polymer Nanoparticle Thin Films

Aanchal Raj (Undecided)
Advisor: Michael Bockstaller (Materials Science Engineering)
Wean Commons-1st Floor,
Connan side
3-5pm

The purpose of this experiment is to determine the unique mechanical properties of polymers coated with silicon (SiO2) nanoparticles. Polystyrene serves as the polymer substrate for the silicon nanoparticles. The silicon nanoparticles were obtained from the chemistry department and the thin polymer films were fabricated using a spin coater. To test for properties such as morphology of the material, transmission electron microscopy (TEM) samples of the silicon-coated polymer were prepared. Elastic modulus measurements using Brillouin Scattering were conducted at the Max Plank Institute in Germany. Also, nano-indentation tests will help characterize the polymer¿particle interactions. Additionally, interactions between polymer-coated particles and matrix polymers were studied. The two variations of the polymer surface are, brush and mushroom regimes. The brush regime consists of 1) grafted polymers larger than matrix polymers and 2) grafted polymers smaller than matrix polymers. The matrix polymers can penetrate the brush in case 1, however not in case 2. Further studies involving polymer interactions and nanoparticle-polymer interactions will yield more information about useful mechanical and even optical properties of thin silicon nanoparticle-coated polymer films for future applications.

Nonlinear Dynamics in MEMS Sensors

Kahini Shah (Undecided)
Advisor: Dr. Gary Fedder (Electrical

We are investigating the operation and theory behind Non-Linear Micro Electro Mechanical Oscillators. These are parametric resonators that oscillate between unstable and stable states making them useful for high sensitivity gravimetric and vibration sensing; the workingof the device is governed by the

& Computer Engineering)
Wean Commons-1st Floor,
Connan side
3-5pm

Mathieu equation. The research process includes MATLAB simulation, design and testing of the device fabricated by CMOS process.

Optimization Algorithms for Hull Design

Ryan Yates (Mechanical Engineering)
Chunkit Yu (Electrical & Computer Engineering)
Riddhi Roy (Chemistry)
Andrew Moore (Mechanical Engineering)
Michael Barako (Undecided)
Advisor: Susan Finger (Civil Engineering)
Hoch Commons-2nd Floor,
Window side
12-2:30

Finding the optimum design of a boat hull is difficult because there are many parameters that affect the overall hull performance such as the hull's width. One design approach would be to build models by varying physical parameters. Instead, this research aims to generate an alternative using software models. Using Computational Fluid Dynamics (CFD) software allows us to compute performance values such as drag force and lateral stability. Combining all of these values can produce an overall rating of a hull's performance. Finding the design which yields the greatest performance requires the use of CFD analysis over and over again. The use of a brute force approach to iteratively alter each physical parameter would result in too many combinations to be evaluated. With a response surface approach, we can create an optimization process to maximize a hulls performance using less CFD analysis. Through this research, we will learn how to optimize a hull design where many parameters make brute force techniques impossible.

Performance Based Hull Design

Andrew Moore (Mechanical Engineering)
Michael Barako (Undecided)
Advisor: Susan Finger (Civil Engineering)
Rangos 1
CIT Poster, 12-2:30pm
Dowd
Oral 10, 3:40pm

The design of a hull for a boat must be tailored to the performance desired of the boat. Some designs allow for a boat that has a very great stability where others focus more on decreasing drag. In order to create a hull that performs as desired, it is necessary to incorporate many different features to the hull that affect the performance in different ways. The goal of this project is to research how common hull features affect performance of a boat under several criteria and how these features can be implemented together to create a hull that operates as desired. The research will utilize Computational Fluid Dynamics (CFD) analysis in order to accomplish this goal. By completing this research, we will learn what design choices to make when designing a hull for a specific task.

System Modeling for Mems

Kelly Frank (Undecided)
Advisor: Dr. Gary Fedder (Electrical & Computer Engineering)
Wean Commons-1st Floor,
Connan side
3-5pm

Microelectromechanical systems (MEMS) were modeled using Verilog-AMS, a mixed-signal, multi-domain hardware description language (HDL). The physical frequency response of a mass-spring-damper system was investigated for ranges of mass, spring constant and damping constant, and compared to analytic predictions. The same methodology was applied to a simple beam, and structures comprised of interconnected beams.

COLLEGE OF FINE ARTS

ARCHITECTURE

A Conflation of Perceptual and Physical Space

David Eskenazi (Architecture)
Advisor: Dee Briggs (Architecture)
UC Gallery
3-5pm

There has been a great deal of research examining the illusory effects of images. Methods exploring perceptual understanding began with cubist spatial explorations, where perception of time and depth became an important pursuit of artists and researchers. Previous investigations analyzed the incidents where the ability to discern an image leads to a spatial understanding of the image. Effects like optical illusions and trompe l'oeil have examined the relationships of shapes to gestalt perceptions. I want to explore how this mental space affects our understanding of our physical environment by placing spatially provoking images in physically demanding spaces.

Egg Ceremony: Interdisciplinary Performance Installation

Julia Stein (BHA)
John Eastridge (Architecture)
Advisor: Catherine Moore (Drama)
UC Gallery
3-5pm

Death and the emotions of guilt surrounding grief will be performed in a public performance installation. It is a cross-disciplinary live performance-installation exploring guilt and recurring memory in the context of grief and the ancient ritual of egg decoration. The relationship of guilt and grief will be looked at specifically through the lens of the narrative art book, "Swell" by Julia Stein. This book will act as a framework and serve as the inspiration for the project.

The performance will be an interpretation of the 'egg ceremony' scene in the book. During this scene a fight occurs between two sisters, one of which is having a goodbye party where she and her friends are decorating eggs. The scene is filled with resentment, anger, physical and psychological violence. Soon after in the narrative one of the sisters dies. Therefore the egg ceremony becomes an event of significance. For the surviving sister, this memory reoccurs over and over as a reminder of her loss and her regret. The performance and installation will reflect this confluence of abstract memory, emotion and event.

ART

American Identity in the Era of the Global War on Terror

Daniel Buchanan (Art)
Advisor: Ron Bennett (Art)
UC Gallery
3-5pm

The relatively recent paradigm shift in global politics (i.e. the rise of U.S. global dominance after the collapse of the Soviet Union) has fundamentally changed instantiated notions of American identity at the cusp of the twenty first century. While questions of communism and capitalism have decreased in significance, issues of national origin, religion and ethnicity have come to the forefront of political discourse after the calamity of 9/11. Through this project, I am examining the state of American identity in the context of the post 9/11 world and America's 'Global War on Terror.' This issue is addressed through an art installation comprised of a triptych of two sculptures and a poster series that combine to create an inquiry based on Americans' sense of national identity

and their view of their new enemy as 'the other.'

"National Umbrellas" is an installation of 18 hand made umbrellas, each with the covering of the national flag of one of the countries involved either peripherally or directly in the War on Terror. The umbrellas are hung above the heads of viewers at the height at which one would normally hold an umbrella. The viewer is intended to contemplate the symbolic value of the umbrella and gauge their reactions to standing underneath the different flag-coverings.

"War Posters for the Global War on Terror" is a series of posters that address the language of the War on Terror as it has been constructed since the events of 9/11. The series uses appropriated World War Two 'war poster' imagery from both Allied and Axis nations using their universal familiarity as state propaganda. The text inserted are popular phrases and concepts taken from Bush Administration press conferences and speeches relating to the War on Terror.

"Flight" is a quiet, contemplative work that reinforces the universal desire for peace and tranquility. "Flight" is a large glass sheet upon which the silhouettes of birds have been added in colored glass with stencils, the entire sheet then being fired in a kiln. "Flight" has no didactic message embedded within it, rather, the work is intended to spur the viewer to meditate on the importance of peace, the most universal value held among the world's cultures.

An Escapist World

Theresa Chen (Art)
Advisor: James Duesing (Art)
Gallery/Wean Commons Area-downstairs
3-5pm

"Escape" is a 3D zoetrope that looks into the human culture of escaping reality through alternate identities. Escape from reality causes us to create alternate worlds in which we can find identity. However, our individual solutions, when unified in a single category, create culture, the social reality from which are we trying to escape from.

This piece shows the repetitive cycle of escape and culture through the cyclical animation of a 3D zoetrope. The 3D zoetrope is created with a constructed turntable and synchronized strobe light. The sculptures used for the animation were created in Autodesk Maya and then exported and printed using a 3D model printer.

Art Against Genocide

Benjamin Saalbach-Walsh (English)
Brenda Battad (Art)
Tokiea Fitzgerald (Psychology)
Advisor: Jane McCafferty Peter
Oral 1, 12:00pm

Art Against Genocide, Art For Peace calls for a large number of people to submit pieces across a variety of artistic disciplines, all dealing with issues of genocide and peace. These pieces are then variously released in a magazine, a CD, and a website. The goal is to help raise awareness of modern genocides and genocide-like situations, promote a hopeful consciousness that change can happen, and then suggest ways in which we can make change happen.-

But I Must

Jonathan May (Art)
Advisor: Andrew Johnson (Art)
UC Gallery
3-5pm

The bathroom is an exciting place where the mundane or the extraordinary can happen. It's a room shrouded in shadow and I find myself drawn to what happens within its walls. Inevitably, the actual space is going to be warped by my perspective, revealing aspects not meant to be seen or that cater to my curiosity. Though my pieces aren't specifically dealing with the bathroom, I am still involved with the language of the space-- the awkwardness in forcing voyeurism and viewing another's personal life. I will have three paintings that depict worlds expressing the peculiarities of certain bizarre relationships that I wish to see and make seen. I invite the audience to create there own narrative and relationship with the paintings through hyper-realistic elements and instances that stretch beyond the surface of the canvas and introduce the works to the physicality of this world.

Casting an Iron Fire

Raymond Tripodi (Art)
Advisor: Clayton Merrell
McConomy Auditorium
3-5pm

As an artist I study how objects are made. I have found the process of making to be as important an artform as the finished art product. The process of metal casting is the inspiration for my current project where I hope to make not only an object but also a meaningful experience. I propose to construct the implication of a present fire in cast iron using unusual methods to devise the finished sculpture. I will begin with a carved wooden form that approximates fire were it a solid substance. I will then create a wax positive of this work using plaster moulds. This wax can then be invested and emptied to provide a cavity for casting. I will then construct an outdoor foundry using pre-industrial technology to melt a pot of iron and recreate the fire that is working on all of these materials in a solid metal form. This artwork reflects the concept of process as art where the narrative of the object is as important as its finished form. My research will take me into the history behind our refined process of metallurgy and back to more basic processes of metal smelting.

Contemporary Panorama

Ryan Woodring (Art)
Advisor: Christopher Sperandio (Art)
UC Gallery
3-5pm

I will be presenting the enormous painting that my fellow painter, Brian Brown, and I completed through digital photography and perhaps video and will hopefully connect with the audience on the importance of painting it in Braddock. In Braddock, I helped renovate an old Catholic High School to make it an acceptable art studio. The themes of the work deal with my engaging experience with those in Braddock who are attempting to make change. I hope my painting efforts here helped develop their artistic community and I hope to strengthen these bonds with mayor John Fetterman and deputy mayor Jeb Feldman.

Crater Eraser

Ben Bigelow (Art)
Advisor: Osman Khan (Art)
UC Gallery
3-5pm

Ben Bigelow exhibits a visceral installation that collapses our emotionally violent childhood into a cacophony of videos, performances, sculpture, balloons, toys, sound and light. Come child... explode yourself with the wrath and rage that has been corked for too long. Exhale to the breaking point, endure a vicious balloon rain from clouds of toys, and fight back with mother nature's most awesome weapon: the volcano.

Experimental Narratives

Emilia Edwards (Art)
Advisor: Joe Mannino
UC Gallery
3-5pm

I will present a book containing two mirrored narratives that explore visual accounting through memories and experiences. With funding from the URO I have created two pictorial narratives that examine visual sensation relative to time, memory, environment, and emotion. I drew inspiration from a semester of studying in Bilbao, Spain, and from being an outsider within the nationalist culture of the region. The book format lends itself to working with sequential images and the realization of a final product to distribute.

Family Tree Paintings: Generational Cycles of Patterns and Silhouettes

Yvonne Chan (Art)
Advisor: Clayton Merrell
UC Gallery
3-5pm

Family, heritage, and tradition often serve as motifs throughout my art practice. My various interests in childhood, familial roles, and culture both inform and dictate my creative process. I explore the themes of family and generational cycles - specifically, the continuity of daughters becoming mothers - in combination with the aesthetics of pattern. In order to demonstrate this concept of role progression, I utilize the cultural and periodic associations of patterns as well as the visual and metaphorical themes of their repetition.

In continuing my exploration of the repeated silhouette within these generational cycles, I propose to create a series of paintings. I will continue with the same style and aesthetic of my previous Mother-Daughter painting series, but also expand upon the ideas of family, heritage, and the significance of pattern. Through the emphasis on silhouettes and the manipulation of pattern, these paintings will help me decipher my heritage. This series will be a map of the women in my family - who we are, how we've changed, and how we've stayed the same - but will also serve as a visual metaphor for the patterns of inheritance and culture that link all families.

HOUNDS AT THE BARRIER

Spencer Longo (Art)
Advisor: Andrew Johnson (Art)
McConomy Auditorium
11-12noon

I will be making an installation based upon research and the examination of cults and subcultures, and how they function in a modern setting. The physical space will be a room within a gallery that will represent the living space of a hypothetical cult member. My objective is to create a space where an individual has attempted to mediate their own personal identity through a collective group identity. I am specifically interested in alternate forms of identity, subculture, and pop-culture resistance and the hope for transcendence of some sort through them. The room will simultaneously exist as a documentation of the fabricated group, with physical objects important to the cult, photos and video of rituals and activities the cult members participated in, and the evidence of an internal "breakdown" or endpoint to this group as well.

iLand

Gene Kim (Art)
Advisor: Andrew Johnson (Art)
UC Gallery
3-5pm

The project addresses issues of isolation and integration within cultural contexts. The cultural exchange of ideas from maintaining sovereignty to dialogues between dominant and subgroup entities will be explored. By understanding the relationships and pressures enacted within hierarchical constructs, it allows for systematic spaces to open up and consider the conflicts and change in the homogenous/heterogeneous tendencies of our culture.

This project fuels out of the conflicts in perspective that exists in the study of different cultural forms and how these issues are directed in terms of dominant discourse. The project extends from my artistic practice in that I am highly interested in the control and influence of language in the broadest sense. Various themes of such marginalization, the exchange of ideas, anthropological perspectives, politics, and etc. are to be considered.

Inconsumable Fashion

Jose Baez (Art)
Audrey Szeto (Art)
Advisor: Joe Mannino
UC Gallery
3-5pm

What is the psychology behind the trend? How do we form ideas about people based on what they wear and where do these ideas come from? Fashion is and always will be a universal form of communication. In the French Renaissance high fashion was the sign of an elite family, possessing an abundance of material wealth. When fashion exceeds necessity it becomes conspicuous consumption, as defined by Thorstein Veblen in The Leisure Class. Conspicuous consumption is a way in which individuals use their possessions to define themselves socially. Our clothing will define our models, leaving the audience to decide their situation before they finish their performance. The outfits are made to excite the audience with fear, ugliness, ambiguity, anger and sexuality. Our outfits are crafted so that each model will have a designated partner and they will perform a ritual together. Their actions will represent their relationship together as dependent, destructive, elite or subordinate.

We are constructing clothes while incorporating our artistic practice and research into our designs. The final form of our research will be a performance piece presented at the Lunar Gala fashion show. Although our work will be presented in a fashion show setting, our goal is not to just show clothes. Our complete body of designs will bring an experience that will cause viewers to question and challenge their previous notions of what being fashionable means.

Pittsburgh: History through Sculpture

Laura Miller (Art)
Advisor: Andrew Johnson (Art)
Class of '87
Oral 8, 3:00pm
UC Gallery
3-5pm

Several forts were built in Pittsburgh to protect the city from confederate attack during the civil war. One such fort was constructed of mud, yet survived longer than the other civil war forts and stood until the late 1930's. I used the mud from this very fort to make several artworks related to Pittsburgh's involvement in the Civil War and issues like slavery in Western PA.

Pony Legs Online Magazine

Taylor Shields (Art)
Advisor: Golan Levin (Art)
Hoch Commons-2nd Floor,
Rangos side
12-2:30

With my small undergraduate research grant I intend to research the best way to collect and present current artists' works to the widest audience possible, while also creating a network of artists, art venues, and supporters in order to foster the art community in a way that enables more artworks to be produced. These goals will be accomplished through the creation of an online art magazine called Pony Legs Online Magazine.

Sequence and Perception

Chin-Chiang Tseng (Art)
Advisor: Christopher Sperandio (Art)
UC Gallery
3-5pm

I will present my sequential art book and talk about my summarization of cubist abstraction and space-time, and how the two affect the way we perceive and rationalize.

Testing my testosterone: Frame Gallery Show

Terry Boyd (Art)
Advisor: Suzie Silver
McConomy Auditorium
3-5pm

As a young male, I have found myself in a constant questioning of masculinity. More specifically, I am attracted to the unwritten laws to "what constitutes manliness". Since there is no unit of measurement, or a wide known standard to define masculinity, individuals are expected to identify it for themselves. And because we are individuals and we each have our own opinion, a grey/neutral area is created by a viewer on a sexuality spectrum. This spectrum maps out one's comfort and insecurities in dealing with their own sexuality. And on this spectrum lies a particular spot where comfort transforms into discomfort. This is where the role or an action of a man on the masculine side becomes the feminine. I am interested in the play of these boundaries or the uncertainty of these ever-changing limits that define masculinity/femininity. I believe that in performance, the artist's body becomes and the action prevails. In my performance, I am attempting to merge the feminine action of sewing with the masculine action of hunting, I will accomplish this by using the tools of the male provider (a hunting compound bow) and transforming it into the female crafting tool (needle and thread).

The Entropic Vision of Greek Culture

Dawn Weleski (Art)
Advisor: Patricia Maurides Wright
Oral 4, 1:00pm
Ellis Gallery, CFA
3-5pm

For over two thousand years, Greece and her people have endured spontaneous transformations amongst civil and international war, natural disaster, and religious amalgamations. Because of these conflicts, Greek culture has contributed robust aesthetic, philosophical, and political pillars of culture, which make up our global conscious. Adhering to Aristotle's assertion that "[n]ature requires us not only to be able to work well but also to idle well", these now keystones of our contemporary society emerged from a discourse of play within the Greek community and sometimes violent exchange between its Eastern neighbors, specifically Turkey. With all of the conflict that continues worldwide, specifically in the Middle East, a dynamic momentum actuates the Greek community through a liturgy of principles, within religion, international policy, and casual society.

After the forest fires in the summer of 2007 that devastated the Peloponnese in Greece, I was struck not only by the impact of the natural disaster on the people of Greece, but the way in which the tragedy resonated in the systems of Greek government and religion, as well as the shock to the physical landscape. Utilizing the materials that are products of fire, charcoal and ash, I propose to investigate the dual nature of Greek culture that sustains Greece's singular presence in our world. Through the architectural and aesthetic systems of

the dome and the column, I propose to illustrate symbolic meaning of these materials and forms, their aspects of play and liturgy, and attempt to uncover the engagement of balance between Dionysian play and Apollonian liturgy which sustain Greek culture during times of contemporary conflict.

DESIGN

"The energy we have," tangible visualization of abstract energy use.

Charles Patterson (Design)
Advisor: Stephen Stadelmeier (Design)
McConomy Auditorium
3-5pm

I trying to create a public knowledge about energy the energy we use in our appliances and how much that energy is actually worth. I feel that most electrical energy is taken for granted as it comes from wall into our devices. I want to make this energy visceral on a small scale and from here users will be able to extrapolate their experience into all of their electrical uses.

Developing Physical Typography

Eamae Mirkin (Design)
Advisor: Mark Baskinger
Wean Commons-1st Floor, Connan side
12-2:30
Peter
Oral 3, 12:40pm

This project aims to explore typographic communication and interaction through form, material, tactile sensation, and physical relationship. Developing physical typography is a way for me to explore my creative interest in merging industrial design and communication design, and will promote the growth of interdisciplinary design at large.

Selvage: Eco-Conscious Couture, Part II

Joannie Wu (Design)
Advisor: Kristin Hughes (Design)
Class of '87
Oral 7, 2:00pm

In a culture where the burgeoning image of green and sustainable living have resonated with the financially more well-off, how do we begin to teach the same values to social groups that may not feel compelled to be as conscious of their environment and their consumption of materials?

The Explanatoids Project: Seeding Science in the City

Jessica Kaercher (Design)
Advisor: Kristin Hughes (Design)
Kirr Commons-1st Floor, Window side
12-2:30
Wright
Oral 2, 12:20pm

This project involved the design of a signage system that presents scientific content to children in a play environment. It is part of the Explanatoids project, which has been an ongoing initiative in the Pittsburgh area. The Explanatoids are a creative signage system that exist in public places in Pittsburgh and encourage children in the Pittsburgh community, particularly middle school aged girls, to become actively engaged in discovering scientific principles in the

world around them. The Explanatoids attempt to address an apparent crisis in our nation and in the Pittsburgh community, that of an ever-decreasing number of women who chose to pursue a higher education in math and the sciences. The intention behind the Explanatoids is to provide that encouragement and inspiration in the sciences to these impressionable young people. The signs that I developed were for the new playground at the Colfax Elementary School of Pittsburgh.

The signs engage children in exploring simple physics and science principles on the playground while encouraging fun and healthy play. They demonstrate that science can be found in everyday life and help the child to be independent in their learning experiences.

Urban Irrigation- Stormwater Management Practices in Western PA

Neha Thatte (Design)
Advisor: Mark Baskinger
Class of '87
Oral 6, 1:40pm
Kirr Commons-1st Floor, Window side
3-5pm

Through research executed by interviewing members of Pittsburgh neighborhoods, speaking with specialists in the field, and exploring the physical needs and limitations of Pittsburgh land, I would like to investigate how industrial design and problem solving can determine an approach to stormwater mitigation on urban lands. In regions of frequent wet weather such as Pittsburgh and Western Pennsylvania, sewer overflow is a visible and on-going problem- spilling pollutants into city streets and the three rivers. As an Industrial Design student I have always wondered how I can apply the skills I have honed at CMU to combat this problem, and develop the solution as a successfully designed product or system. Majority of products considered "eco-friendly" in today's market lack aesthetically or interactively desirable qualities: I have yet to see an elegant compost receptacle that does not require maintenance. The link between sustainable practices and industrial design is an intriguing, unique, and rare connection, and I would like to portray design as a field that provides resources, instead of depleting them.

I wish to design a series of 3 aesthetically desirable rainwater collection tools- perhaps ranging from a sculptural vessel, to a reservoir, to an irrigation system. One can see a few rain barrels dispersed throughout Allegheny County, but they are often unsightly and mar the appearance of one's property. I would like to investigate a variety of materials and their abilities to capture water and illustrate water, addressing its flow, its capabilities, its emotional language. By reflecting on the resource itself, the design of rainwater collection units can go beyond sustainability and become truly beautiful on an emotive level.

Young Story Bag's

Luther Young III (Design)
Advisor: Laura Vinchesi (Design)
UC Gallery
3-5pm

My proposal is to create a line of bags that begin to examine the unification of two dimensional images on a three dimensional form. To examine this unification I will illustrate a variety of stories using different bags as canvases for the graphic images. As the user begins to manipulate the bag they will interact with the character's illustrated story. These illustrations consist of a character who reflects young people and the actions and situations that occur on a daily basis. These include completing school work, feeling homesick and socializing

with friends/family. A combination of screen printing and stenciling techniques will be used to transfer the illustrations from paper to fabric. The final collection will consist of five unique bags each illustrating a different story with a unique set of actions and environments.

DRAMA

Imperfect Recycling

Naomi Eduardo (Drama)
Kay Csuri (Mechanical Engineering)
Michael Whiston (Philosophy)
Advisor: Susan Finger (Civil Engineering)
Connan
12:30-4pm

Our group proposes an exhibit that teaches students about the imperfections of recycling. In particular, we would like students to learn that recycling is an imperfect process because it requires that all of the materials contained in a product be returned to their raw states, and that this is sometimes impossible or detrimental to the raw material. Consequentially, it is sometimes more worthwhile or beneficial to reuse products by incorporating them in new applications. In the exhibit students will create a cast of plaster of Paris as well as another cast made with reused plaster. The activity will test and compare the strengths of the material in its original application and subsequent reuse.

Insulated House - An Exploration of Recycled Materials and their Insulative Properties

Bryan Ward (Drama)
Michael Li (Mechanical Engineering)
John Johnson (Mechanical Engineering)
Advisor: Susan Finger (Civil Engineering)
Connan
12:30-4pm

The goal of this activity is to help children understand how recycled materials can be used to insulate a house effectively by assembling walls from post-consumer materials and measuring their efficiency in preventing heat transfer in a small model/simulation of a house. The children will be presented with a model of a house with one wall missing. They will use a prefabricated mold to make a wall out of a recycled, insulating material of their choosing. Materials that will be available will be granulated or in sheet form. The materials may include rubber, plastic, aluminum, paper, glass, sand, cement, styrofoam, and cotton/fabric. The children will place their wall in the house model. A heat lamp will be used to generate heat and focus it toward the newly created wall. Temperature probes on the inside and outside of the house will record the temperatures needed for calculation of the R-Factor.

The effectiveness of insulating (R-Factor) will be investigated and calculated for each of the removable walls that are built and compared to the R-Factors of existing, commonly used insulation. The children will discover that some materials are better at insulating than others, and through experimentation and calculations, will determine why through the experiment.

The Current State of Disability Performance in Pittsburgh

Brianna Allen (Drama)
Advisor: Michael Chemers (Drama)
Wean Commons-1st Floor, Connan side
3-5pm

The Pittsburgh and Carnegie Mellon Unviersity art communitites both are creating a fast-paced and innovative environment to foster accessibility of the disabled.

ECONOMICS

Anti-Foreign Sentiment in the California Gold Rush

Robert Jefferson (Economics)
Advisor: Karen Clay (Economics)
Dowd
Oral 1, 12:00pm

In this paper, I provide a quantitative and historical analysis of the "California thesis" of anti-foreign legislation (Sandmeyer 1991; Gyory 2000). In other words, were the conditions during the Gold Rush a significant precursor to federal policies starting with the Chinese Exclusion Act of 1882? While there are competing theories for the development of anti-immigrant legislation, most notably the political influence of unions and a racist social and political climate, I suggest that these are not immediately contrary to the Gold Rush argument.

The Gold Rush provides a context for mass migration into California that otherwise would not have occurred to such a strong degree. That influx of immigrants, especially Chinese, provided a significant labor base for the Transcontinental Railroad, which became a primary vector for Chinese migration from California to the rest of the United States. By examining voting patterns in light of conditions in California during the Gold Rush compared to the national patterns over subsequent decades, I attempt to shed light on the similarities between the California and national experiences.

Detection of X-Ray Sources

Jason Waddell (Mechanical Engineering)
Jeremy Doo (Economics)
So Young Park (Mathematics)
Gregory Hallenbeck (Physics)
Advisors: James Delaney (Statistics)
Peter Freeman (Statistics)
Hoch Commons-2nd Floor, Window side
3-5pm

We analyze two-dimensional binned images of x-ray levels from satellite-based cameras. Our project seeks to detect and classify x-ray sources amidst a field of varying background levels, noise, which can be modeled by the Poisson distribution. We have developed algorithms that produce unbiased background estimates across the matrix and identify source pixels. As sources often cover multiple pixels, these identified source pixels are then grouped and clustered. This clustering allows us to make inferences on each source in our image, listing an x-ray source's total brightness, size, and location.

Estimating Early Exercise Premiums in Cash Settled American-Style Options

Jeremy Doo (Economics)
Martin Nemaric (Mathematics)
Advisor: James Delaney (Statistics)
Kirr Commons-1st Floor, Window side
3-5pm

In many American-style options, there is an inherent "wildcard" option at the end of the trading day. Option holders are allowed to lock in the closing price of an underlying security for 15-30 minutes after trading stops. We model the frequency distribution of the underlying price changes during this time in order to estimate the daily early exercise premium of index options. We also extrapolate upon this to address larger time periods.

Art Against Genocide

Benjamin Saalbach-Walsh (English)
Brenda Battad (Art)
Tokiea Fitzgerald (Psychology)
Advisor: Jane McCafferty
Peter
Oral 1, 12:00pm

Art Against Genocide, Art For Peace calls for a large number of people to submit pieces across a variety of artistic disciplines, all dealing with issues of genocide and peace. These pieces are then variously released in a magazine, a CD, and a website. The goal is to help raise awareness of modern genocides and genocide-like situations, promote a hopeful consciousness that change can happen, and then suggest ways in which we can make change happen.

Before&After

Isabel Gardocki (English)
Advisor: Jane McCafferty
Wright
Oral 8, 3:00pm

An exploration of the issues that emerge in the aftermath of war, immigration, and an education barrier in the author's immediate family.

City Behind the Eyes: Poems

Michael Hartwell (English)
Advisor: James Daniels
Peter
Oral 2, 12:20pm

I will be reading selected poems from my senior thesis manuscript, "City Behind the Eyes."

Ghosted Ophelia: Liminality and Social Displacement in the Elizabethan Gender System

Julianne Mentzer (English)
Advisors: Michael Witmore
Allyson Creasman (History)
Peter
Oral 5 1:20pm

My thesis examines Ophelia from Shakespeare's Hamlet through a historical/feminist lens. I examine her situation of societal displacement through the death of her father, the betrayal of her lover, and the absence of her brother. My main conclusion is that Ophelia's situation leads her to exhibit ghost-like qualities through her liminal status in the Elizabethan gender system represented in the work.

Images of Captivity: The impact of broadcast news on the collective memory of the Iranian Hostage Crisis

Brittany McCandless (English)
Advisor: Andreea Deciu Ritivoi (English)
Kirr Commons-1st Floor,

From November 4, 1979 to January 21, 1981, radical students in Iran held 52 Americans hostage. For each of the 444 nights, Americans at home watched and waited as evening newscasters tallied the number of days without progress. Marking the first encounter with radical Islam and Iranian resistance, the event remains a milestone in American history. And, importantly, it was the television media that cemented this fact into the American conscious every evening, recalling the agonizing weeks of slow progress and failed attempts at rescue. The volume of media coverage for the event was unprecedented, shaping not only the way Americans understood the hostage situation, but

Window side
3-5pm
Pake
Oral 12, 4:20pm

Iran and its people in general. What narrative frames did broadcast journalists use to cover the hostage crisis, and did these frames persist with coverage of Iran thereafter? Have there been attempts to cement our memory of the event through commemorative stories, or did the story - so prevalent in its time - fade from memory shortly thereafter? With regards to current events in Iran, has the way in which the events were portrayed at the time of America's first public clash with Iran and radical Islam influenced the response to current events in Iran? To answer these questions, my thesis will first examine the way the media covered the event in its time. To do this, I will use ABC News transcripts and air histories as a case study to determine the frames of coverage first thrust into the American collective conscious through language, images and narratives. Furthermore, I will examine a second corpus, again using transcripts and air histories from ABC News. I will analyze the means by which the Iranian Hostage Crisis has reappeared in recent news to see how journalists have recalled and referenced the event. Do journalists themselves "remember" the hostage crisis in their current reports? Finally I will examine these corpuses through a theoretical lens, applying the basics of both framing and collective memory studies, primarily those influenced by media.

Locke & Nietzsche: God as the Distinction between Two Epistemological Perspectives

Ari Klein (English)
Advisor: David Danks (Philosophy)
Peter
Oral 10, 3:40pm

My research examines John Locke's (1632-1704) pre-Kantian empiricism in relation to Friedrich Nietzsche's (1844-1900) post-Kantian proto-nihilism. Though Locke and Nietzsche purport to be located on opposite sides of the philosophical spectrum, their respective theories of knowledge are actually more similar than they may initially appear to be. In fact, I argue that the role of God in each epistemology stands as the substantive distinction between Locke's empiricism and Nietzsche's proto-nihilism. My research shows how the removal of God from Locke's empirical epistemology forces the deconstruction of his argument, negating the universality of our simple ideas, our knowledge of the world, and any potential for absolute truth; thus ultimately conforming to Nietzsche's proto-nihilistic assertions. The purpose of such research is not simply to provide the foundations for a philosophical comparison, but rather to consciously identify the actual distinction that is centered at the root of two, seemingly incompatible philosophies. My goal is to show that with considerable thought and analysis, one may potentially come to understand the possibilities of transforming one argument into another through the removal of a basic, yet specific, concept. I will begin this process by examining Nietzsche's epistemology, namely his theory of truth. I argue that Nietzsche's epistemology resides as the positive account of the philosophical transformation of Locke's empiricism. I will discuss Nietzsche'sssertions on the superficiality of our ideas, the existence of truth as created within perspectives, and our perpetual unconsciousness of the physical world. Once I have thoroughly outlined Nietzsche'stheory of truth, I will explore Locke's epistemology, namely his theory on the acquisition of knowledge through sensory experience. I will show how Locke uses God as the basis for the process of sensation and reflection, a process that constitutes the origin of all our simple ideas. From this, I will

examine Locke's assertions as to why we have real access to an understanding of the outside world and thus why, though incomprehensible to us, there is an implied potential for absolute truth. Then, I will explain the groundings of Locke's argument for the existence of God. Finally, I will show how Locke's epistemology falls apart without God and how the new account of Locke (i.e., his previous argument, without God) results in an epistemology that resembles Nietzsche's theory of truth.

Pittsburgh Food & Drink: Shown through words and photographs.

Erin Goldberger (English)
Advisor: Jane McCafferty
Peter
Oral 12, 4:20pm

Forget the food rating guides. Unless Zagat suddenly has a fourth category called nostalgia, the only way you're going to find the low down and dirty delicious restaurants and bars is to go out and look for them. Unfortunately, the once hidden treasures of our American cities are slowly being morphed into tofu trendy spots with velvet-ropes and necessary entrance connections involving the owner's sister-in-law, Lisa. Yet while other cities are receiving these massive makeovers, and attempting to re-create the restaurant formally known as retro, Pittsburgh has managed to balance the silver with the gold.

By writing essays and poetry, and developing my own photographs of this wonderful spots, I hope I can give the reader a greater insight on what is right under their noses.

Storytime! A Collection of Screenplays

Jason Kaleko (English)
Advisor: Sharon Dilworth (English)
Hoch Commons-2nd Floor,
Window side
3-5pm

This May, my shiny new diploma from Carnegie Mellon University will read: "Jason Kaleko. BA in Creative Writing." Based on that alone, I will try to convince future employers in the film industry to give me a job. Truth be told, that probably won't cut it. Therefore, for my senior honors thesis, I created a portfolio of three feature-length screenplays to both demonstrate my story-telling ability and market myself to potential employers.

I also plan to pitch these ideas to potential producers when I move to Los Angeles in the summer. With this in mind, I've written in a variety of genres to emphasize different strengths and styles in my writing. This poster presentation provides a brief overview of each storyline and the varying challenges I encountered in writing each screenplay.

The Price We Pay

Scott Gibson (English)
Advisor: Barbara Johnstone (English)
Class of '87
Oral 1, 12:00pm

The pursuit of knowledge is a necessary and vital component for human society and culture. "The most important responsibility of each generation is to pass on the civilization it has inherited to future generations" (Vedder, 115). Ideally, every individual would have an equal opportunity to achieve the highest education consistent with his or her ability. Unfortunately, the immense financial costs of seeking higher education severely limit the options for many students in the United States. This heavy financial burden is a harbringer of negative consequences for anyone and everyone who recognizes the importance of higher education.

Higher education has always been expensive, but recently there has been a significant spike in the price of college tuition. For public state institutions alone, average tuition costs have increased by forty percent since 2000. Those privileged and capable enough to attend more prestigious private universities face even greater costs. There have been attempts by both the government and academic institutions themselves to address this worsening problem. Unfortunately, neither the government nor the academic institutions have been able to find a solution. The problem is plagued by fundamental conflicts of interest which have thus far prevented a resolution.

In this paper, I will analyze higher education dilemma. First, I will explore some of the primary contributing factors which are causing the problem, in an attempt to explain why costs are increasing at such an alarming rate. Secondly, I will describe some of the existing and potential consequences of allowing the current system of higher education to remain unchanged. Finally I will suggest some new alternatives that can be taken to solve the problem, or at least improve the situation.

The Role of Masterplots and Counterstories in the Construction of Irish Identity

Christine Beaty (English)
Advisor: Andreea Deciu Ritivoi (English)
Dowd
Oral 11, 4:00pm

In the first half of the 19th century, Irish writers repeatedly made use of the same character types to embed common narratives of English incompetence and Irish suffering into literate Irish society, with the fundamental goal of improving Irish life. As the decades progressed, the writers' arguments returned again and again to the same kinds of characters in traditional dichotomies ¿ for example, landlord vs. peasant, Catholic vs. Protestant, and English vs. Irish. In my analysis of Irish literary production from 1800 to 1848, I seek to examine the use and creation of such character types in both fiction and non-fiction works. On one hand, these types were familiar to both readers and writers, and thus provided a point of reference for much political and social discourse. On the other hand, though, the characters were often based in historical and traditional divisions; in relying on such stock characters, the writers may have drawn attention away from the contemporary state of Ireland, and worked to inhibit the very change their writings aimed to effect.

Untitled fiction

Marshall Roy (English)
Advisor: Jane Bernstein (English)
Wright
Oral 1, 12:00pm

My project, a long work of fiction, seeks to probe the complexity of shame as an agent of the moral imperative. It follows a small group of individuals who discover and expose pedophiles operating in cyberspace, and its psychosexual drama hinges on the fact that opposition demands engagement--in other words, the characters cannot curtail behavior they find horrific without repeatedly subjecting themselves to said behavior.

ETHICS, HISTORY & PUBLIC POLICY

Nigeria is gaining recognition as one of the premier countries for potential growth in Africa. Amid government turmoil Nigeria continues to grow financially as natural resources have helped to create economic growth. Challenges to keep Nigeria's democratic government stable, Islamic influence, and natural resources have presented a lot of opportunity for native Nigerians, and foreign born, to make an impact on policy and shape the future of the country.

Akaabo: An Introduction to the Yoruba Language

Abiola Fasehun (Ethics, History & Public Policy)
Advisor: Edda Fields (History)
Kirr Commons-1st Floor, Window side
3-5pm

With the recent creation of the African and African Studies Minor at Carnegie Mellon University, the Carnegie Mellon community has shown a vested interest in learning more about African history and culture. The goal of my project is to aid in the creation and dissemination of African scholarly work at Carnegie Mellon by researching breakthroughs in non-native language acquisition and creating an introductory Yoruba language guide.

According to the CIA World Factbook, the population of Nigeria is 135,031,164. Nigeria is home to over 200 ethnic groups, with Hausa, Igbo, and Yoruba being the largest. Yoruba is the name for both a language and a distinct group of people. Although Nigeria has long been one of the most controversial and popular African countries, not much work has been done to understand the Yoruba people and cultures; and more specifically, to help non-native Yoruba people learn the language. Hausa and Fulani make up 29% of Nigeria's population, and Yoruba make up 21% of Nigeria's population. A great deal of scholarly work has been done on the Hausa language and culture, making Hausa language acquisition easily accessible. However, the same amount of scholarly focus on Yoruba language and culture is limited due to the vast number of dialects within the Yoruba language. Access to the Yoruba language can be difficult and confusing to those that are not aware of the dialectic differences. Although emersion is always the best way to learn a language, basic language skills taught at an introductory level are also critical.

HISTORY

From the Ashes, Arose Justice: The Irish Judicial Branch, 1922-1937

James Dougherty (History)
Advisor: David Miller
Peter
Oral 4, 1:00pm

A democracy's legal system is the mechanism that insures a nation is a land where justice is provided for all. Despite the legal system's importance in a young democracy, it is often overlooked by historians in favor of a study of politics. This unfortunately has been the case in Irish history and historians have devoted little time to this topic since Ireland's independence. The lack of work in this field is not due to lack of resources as parliamentary debates, letters between political leaders, memoirs of people in the legal profession, and newspapers are available. This project aims to help fill this gap in the

study of Ireland's history. Besides being useful for Irish history, it will also be helpful when looking at emerging democracies today. Ireland was an oppressed nation for 800 years, but it had a just and functional legal system by the end of its first decade of independence. This project will hold this truly remarkable accomplishment up as an example.

The Assimilation of Russian Jewish Immigrants in Pittsburgh

Joanna Bresee (History)
Advisor: Laurie Eisenberg Peter
Oral 13, 4:40pm

Between 1881 and 1914 approximately two million Eastern European Jews immigrated to the United States, with roughly 20,000 settling in Pittsburgh. Between 1901 and 1909 the editor of Pittsburgh's Jewish Criterion, Charles Joseph, expressed the attitudes of the established Pittsburgh Jewish community towards the newcomers. Over this seven-year period Joseph's opinion on immigrants in Pittsburgh changed from hostile to accepting. Increasing concern for the safely of Jews in Eastern Europe, decreasing belief that Jews provoke anti-Semitism through their behaviors, and a growing appreciation for immigrants potential contribution to the Pittsburgh Jewish community explain the shift in Joseph's opinion.

The Political Poetry of Haim Gouri: Reflections of a Shifting Israel, 1967

Jennifer Johnson (History)
Advisor: Naum Kats Wright
Oral 3, 12:40pm

Hebrew poet Haim Gouri used political poetry as an avenue of expression to mirror the progression of attitudes within Israeli society throughout the tumultuous times of the late 1960s. From the trepidation and doubt shortly before the Six Day War, the joy and mourning during the 1967 War period, and the confusion and questioning voiced by the Israeli people after the war, Gouri used his work to reflect the sentiments of the Israeli masses.

IS

Competitive analysis of green Facebook applications

Devin Blais (IS)
Advisor: Jennifer Mankoff (Human Computer Interaction Inst.)
Kirr Commons-1st Floor, Window side
3-5pm

In an attempt to make Facebook users more environmentally friendly, many "green" Facebook application have emerged in the past few years. Some of these applications have failed, while others have done very well, attracting thousands of users. This project looks at the different factors that caused certain green Facebook application to flourish, in an attempt to create a green Facebook application that actually has a positive effect on both people's lives and the environment.

How much easier is not programming your own sampler?

Keita Fukue (IS)
Advisor: Tanzy Love (Statistics)
Wean Commons-1st Floor, Connan side
3-5pm

Non-statisticians frequently want to use statistical methods. They have the choice of using a preexisting software package or programming their own code. For Markov Chain Monte Carlo (MCMC) samplers, some software can be much slower than a hand-programmed version. However, there are many opportunities for error in writing the code by hand whereas the software has built-in checks and has been debugged. In real world situations, such as simulating clinical trial characteristics, the difference can be between 25 days of run time on software to 4 hours of run time on a hand-programmed sampler.

This project will start with an introduction to simple Bayesian models for which MCMC samplers can be used. Then, several software packages will be compared on simple examples. Of interest is the difference in speed of each implementation, while checking that the answers should be correct. Finally, as time allows, we will program a sampler by hand to compare the running time to that of the various software packages.

We have been using different software to generate the MCMC samplers such as R(Library(BRugs)), WinBUGS, and JAGS. We used simple examples and clinical trial simulations. We found that even within the different software, there was a difference in the speed of generating the samples. We compare those running times to the time of writing the code by hand and running them.

LunchMeet

Kevin Kwan (Business Administration)
Eugene Gaysinskiy (IS)
Advisor: Anthony Stanton
Kirr Commons-1st Floor, Window side
3-5pm

It seems that as one goes further into their college career, the harder it is for one to meet someone new - either spontaneously or through a function. Events such as lunch become more and more routine every day - same group of people, same type of food. We embarked on a social experiment: we built a website that selects sets of random strangers to eat lunch together every week. We hope to create a new channel through which strangers at Carnegie Mellon from very different backgrounds can meet each other.

Neighborhood-Aware Networking

Dexter Rietman (IS)
Vijay Reddy (Undecided)
Advisor: Mike Kaminsky (Computer Science)
Rangos 2 & 3
Sigma Xi Group 6, 11:15am

Recently, there has been a trend for homes with broadband internet connections to install wireless networks to enable the use of the internet throughout the home. These 802.11 wireless networks have not yet been tapped as a means of networking between households in a neighborhood. We have collected map and connectivity data of wireless networks in Pittsburgh. This data will then be used to design and implement new network and application-level protocols and services that are "neighborhood-aware." This provides the benefits of a connection between homes that is faster than broadband internet and is becoming readily available.

MODERN LANGUAGES

From the Geisha to the Maid-san: Cultural Substitution and the Evolution of Power-Selling Entertainment in Japan.

David Lettieri (Modern Languages)
Advisor: Keiko Koda (Modern Languages)
Class of '87

In Japanese society, the traditional geisha, and the modern day maid are linked via many commonalities. They are both cultural icons, both are attractive as lifestyles / jobs to young women for the same reasons, and most importantly, they both sell the same product: power. This sale of power and its continuity across over 250 years of Japanese history indicates an evolutionary connection between the two institutions. It also points to a sociological phenomenon, termed ¿cultural substitution¿ or ¿cultural replacement.¿ This phenomenon is the replacement of one social institution with another that better physically matches the current stage in that culture¿s evolution but fulfills the same

Oral 2, 12:20pm
Hoch Commons-2nd Floor, Rangos side
3-5pm

cultural need, when the original social structure/institution becomes obsolete or ceases to mesh with the structure of the society.

The Nature of Japanese Modernization since World War II

Dorothy Holland-Minkley (Modern Languages)
Advisor: Yasufumi Iwasaki
Peter
Oral 6, 1:40pm

It is frequently said that Japan has Westernized tremendously since World War II, and on the surface, it does appear that traditional Japanese restaurants, clothes, bathhouses, and homes are rapidly being replaced by their Western counterparts. These changes, however, may be surprisingly superficial. While the outward trends are towards Westernization, close examination shows that the specific changes are not because of a desire to completely emulate the West, but instead because of the pressures of modernization that are felt by all countries. This project takes several specific examples with strong Japanese backgrounds and examines the forms they have taken as they have modernized.

PHILOSOPHY

Constraints on Language Acquisition in Infants and Adults

Alexandra Kronstein (Philosophy)
Advisor: Erik Thiessen (Psychology)
Wright
Oral 10, 3:40pm

There is a large corpus of evidence to suggest that for both infants and adults to learn, there must be constraints on either the mechanism by which they learn or constraints on the input they receive (e.g. Saffran et al, 1996; Thiessen, in press). One study in particular (Fiser & Aslin, 2005) explores how adults use statistical learning to acquire internal representations of passively viewed multi-element visual scenes. Fiser and Aslin propose a constraint that governs statistical learning by guiding adults to focus solely on the relevant statistical parts of the whole scene. My research explores whether this constraint is specific to visual materials, or can also be seen when adults receive linguistic input. The results of this project will provide new insight into whether language is learned via domain specific mechanisms, or via mechanisms that are domain general in nature, operating over a wide variety of input, both linguistic and nonlinguistic. In particular, evidence that the same constraints operate in both linguistic and nonlinguistic domains would support domain general accounts of language acquisition.

Impact of Flanged Diffuser on Turbine Performance

Michael Whiston (Philosophy)
Advisor: Mr. Battle Brown (Physics)
Wean Commons-1st Floor, Connan side
3-5pm

In our research, we investigated the influence of a flanged diffuser on the power output of a wind turbine. We found that the shrouded turbine produced several times more power than the un-shrouded turbine in higher winds. These results verify previous research by Bet & Grassman and Ohya, Karasudani, Sakurai, et al., who show that that a shrouded turbine is optimal for power generation. Furthermore, we found that the ratio of the power output of a shrouded turbine to that of an un-shrouded turbine is higher in stronger winds. In other words, the power amplification of the shrouded turbine increased with wind speed. We also found that the average power output of both turbines (shrouded and un-shrouded) is greater in variable winds than in smooth winds (for the same wind speed), and the diffuser enabled the shrouded turbine to

respond more quickly to variable winds. Therefore, our results suggest that the optimal way to extract power from light and variable winds is to use a shrouded wind turbine sited in more (rather than less) turbulent locations.

Imperfect Recycling

Naomi Eduardo (Drama)
Kay Csuri (Mechanical Engineering)
Michael Whiston (Philosophy)
Advisor: Susan Finger (Civil Engineering)
Connan
12:30-4pm

Our group proposes an exhibit that teaches students about the imperfections of recycling. In particular, we would like students to learn that recycling is an imperfect process because it requires that all of the materials contained in a product be returned to their raw states, and that this is sometimes impossible or detrimental to the raw material. Consequentially, it is sometimes more worthwhile or beneficial to reuse products by incorporating them in new applications. In the exhibit students will create a cast of plaster of Paris as well as another cast made with reused plaster. The activity will test and compare the strengths of the material in its original application and subsequent reuse.

PSYCHOLOGY

A Study of Relational Aggression in College-Age Romantic Couples

Abigail McUmber (Psychology)
Advisor: Vicki Helgeson
Rangos 2 & 3
Sigma Xi Group 8, 10:30am

Relational aggression is defined actions, covert or overt, aimed at manipulating relationships to achieve a desired goal or in retaliation for a wrong done. While studied extensively in children, researchers have rarely examined relational aggression among romantic relationships. This study had four goals: (1) create a comprehensive romantic relational aggression measure, (2) examine sex differences of romantic relational aggression, (3) explore the implications of romantic relational aggression on relationship quality and well-being, and (4) characterize perpetrators and victims of romantic relational aggression. Sixty-one college age couples completed self reports of romantic relational as well as physical and verbal aggression use and victimization, relationship quality measures, and several proposed personality correlates. Romantic relational aggression was shown to moderately overlap with both physical and verbal aggression. Males and females reported equal use of romantic relational aggression, yet males reported higher victimization than females. Analyses showed romantic relational aggression use and victimization to be associated with poor relationship indicators. These associations were more common for females, suggesting that romantic relational aggression is more hazardous for females than males. There were few significant associations between romantic relational aggression and proposed personality correlates.

Art Against Genocide

Benjamin Saalbach-Walsh (English)
Brenda Battad (Art)
Tokiea Fitzgerald (Psychology)
Advisor: Jane McCafferty Peter
Oral 1, 12:00pm

Art Against Genocide, Art For Peace calls for a large number of people to submit pieces across a variety of artistic disciplines, all dealing with issues of genocide and peace. These pieces are then variously released in a magazine, a CD, and a website. The goal is to help raise awareness of modern genocides and genocide-like situations, promote a hopeful consciousness that change can happen, and then suggest ways in which we can make change happen.

Developmental Change in P300 of the Event Related Potential inBoys at High and Low Risk for Substance Use disorder

Neha Mehta (Psychology)
Advisor: Marcel Just
Wean Commons-1st Floor, Connan side
3-5pm

Objectives: This study investigated the differences in neuromaturation of the P300 waveform among adolescents at high or low risk for substance use disorder (SUD). Past studies have demonstrated that P300 amplitude is attenuated in adolescents high at risk (HAR) for SUD determined on the basis of having a parent with this disorder. Hypothesis: We hypothesized that HAR adolescents would exhibit less neuromaturation of the P300 waveform than lower risk (LAR) adolescents. Furthermore, we hypothesized that HAR adolescents P300 amplitude would correlate with neurobehavioral disinhibition (ND) score, another factor which mediates risk for substance abuse, in HAR adolescents. Methods: Sixty-eight boys recruited through their proband biological fathers participated in the study. They were tested at ages 10-12 and again 4 years later. P300 amplitude was measured from five electrode sites (Fz, Pz, Cz, P3, P4). Results: HAR adolescents and LAR adolescents did not differ on P300 amplitude at baseline, follow-up or magnitude of change between these assessments. HAR adolescents showed strong negative correlations between difficult tempermant and P300 amplitude differences at 3 sites : P3 (r= -.507, p=.032), Pz (r=-.588, p=.010), and Cz (r=-.502, p=.304). Although no differences in neuromaturation were found between groups, the findings suggest that certain facets of disinhibitory behavior may be related to the P300 waveform maturation and development of SUD.

Effect of Supporting Motor Ability on Infants' Goal-Directed Experience to Causal Action

Sarah DeWath (Psychology)
Advisor: David Rakison
Rangos 2 & 3
Sigma Xi Group 8, 10:00am

Previous studies have shown that an infant's direct experience of goal-related actions - whether they engage in such actions themselves - affect the way they interpret the actions of others. Because young infants lack the motor capabilities to grasp and interact with objects, we will provide infants between 4 and 5 months with mittens fitted with a Velcro surface that will attach to the Velcro surface on toys. This will allow a previously impossible causal interaction - in which infants make objects change state - to occur. It is believed that through experiencing an aided interaction, infants will gain an understanding of causal action that would not be acquired until later without such an interaction. This will be tested by using a habituation paradigm to investigate if infants are able to distinguish between causal and non-causal events. It is predicted that infants who act on toys with Velcro mittens will respond as older infants in the habituation test - they will perceive the difference between causal and non-causal events - whereas infants who do not have this experience in the lab will not. The findings of the research will be presented in relation to the early development of understanding agent and recipient roles.

Effective? Useful? Interesting? An Evaluation of the Carnegie Mellon Online Writing Tutor

Nicole Hallinen (Psychology)

This project investigates the effectiveness and practicality of using the Carnegie Mellon Online Writing Tutor to improve writing knowledge and skills. User knowledge gains, spontaneous commentary, and self-report provided a range of both quantitative and qualitative data that has been used to evaluate both the educational value and ease of use of the Writing Tutor. The conclusions of this

Advisor: John Hayes (Psychology)
Wean Commons-1st Floor, Connan side
3-5pm

research are directly applicable to the enhancement and future development of Writing Tutor modules and instrumental in the establishment of the Carnegie Mellon Online Writing Tutor as an academic resource.

Effects of short-term experience on auditory categorization: An event-related potential study

Ran Liu (Psychology)
Advisor: Lori Holt (Psychology)
Pake
Oral 1, 12:00pm
Kirr Commons-1st Floor, Window side
12-2:30

Research has shown that experience plays a major role in shaping the way the brain learns to categorize speech sounds, but the specific mechanisms by which this occurs are not well understood. To investigate this question, we gave participants short-term (5 days) training by having them play a multi-modal videogame designed to help them implicitly learn to categorize a set of non-speech sounds by associating them with four distinct visual stimuli. Pre-training and post-training electroencephalogram (EEG) recordings of subjects' mismatch negativity (MMN) responses were recorded as they passively listened to pairings of novel stimuli drawn from the video game categories. The changes in subjects' MMN responses following training show the extent to which their short-term experience in the videogame has shaped their auditory categorization at a perceptual level. Results provide insight into mechanisms through which auditory categories are formed and will be discussed in the context of issues of domain specificity of speech perception and acquisition.

Importance of Rigorous Implementation of Experimental Procedures in Developmental Research: A Case Study

Andrea Poon (Biological Sciences)
Samantha Creighan (Psychology)
Brian Goldfain (Electrical & Computer Engineering)
Advisor: Anna Fisher (Psychology)
Kirr Commons-1st Floor, Window side
12-2:30

It is crucial to any field of research to have standardized procedures when carrying out an experiment in order to eliminate confounding variables and ensure internal validity (we refer to this as experimental rigor). The proposed research will address the issue of experimental rigor using the paper by Shulz and Bonawitz (in press) as a case study. Shulz and Bonawitz examined exploratory play in 4-year-old children and found a reversal of the common novelty preference when participants lacked causal knowledge about how a toy operated. However, upon close examination of this study's experimental procedures, we identified two possible confounding variables stemming from a lack of standardization in each of the experimental conditions. The proposed research will replicate the experimental design used by Shulz and Bonawitz, using standardized procedures to control for the two variabes that we identified as potential confounds.

Infants Understanding of Causal Chain Agency with Moving Parts

Gabriel Smith (Psychology)
Advisor: David Rakison
Peter
Oral 8, 3:00pm

Infants have the ability to perceive events as causal by the time they are 7 months of age. By 15 months, infants perceive sequences of causal events in the same way as adults, responding to the first object in a chain of two launching events as the cause of the final action. Around the same age, infants also expect the agent in a simple causal event to have a moving part; this is consistent with what is found in the real word (e.g., a dog has moving legs). This project combined these ideas to address the question: What do infants understand about the parts of objects in sequences of causal events? Do they expect that the first object in a causal chain to possess moving parts?

Infants' Understanding of Self-Propulsion

Shelly Kucherer (Psychology)
Caroline Eckert (BHA)
Lauren Krogh (Biological Sciences)
Advisor: David Rakison
Wean Commons-1st Floor, Connan side
12-2:30

Research has shown that at the age of 20 months infants understand that objects that have moving parts - such as legs - are self-propelled, and that infants at the age of 18 months think that any object can be self-propelled. The aim of this study is to extend previous research to determine when infants generalize self-propulsion on the basis of movement alone. Infants will be shown an ambiguous clay object that moves without external contact from another object (it will be made to move by hidden magnets). After watching this demonstration, the infants will then be given two test objects and will be encouraged to move them in the same way as the ambiguous object. One of the test objects will be an animate object (a person or animal) and the other will be an inanimate object with wheels or an inanimate object without wheels. The results will provide a better understanding of how infants learn about self-propulsion in animate objects.

Infants Understanding of the Relationship of Dynamic Parts to Causal Roles of Real World Objects

Gabriel Smith (Psychology)
Advisor: David Rakison
Peter
Oral 9, 3:20pm

Infants have the ability to perceive causal events by the time they are 7 months-old. By 15 months-old infants perceive sequences of causal events in the same way that adults do¿thinking the first object in a chain is the cause of the final action. By 16 months-old infants expect the agent in a causal event to have a moving part. This project aims to combine these ideas to answer the question: What do infants understand about moving parts of objects in sequences of causal events?

Intentions for the Division of Labor

Jennifer Fillo (Psychology)
Advisor: Vicki Helgeson
Rangos 2 & 3
Sigma Xi Group 8, 10:15am
Peter
Oral 7, 2:00pm

The division of household and childcare labor among married and cohabiting couples has been studied extensively. While this research has shown that the division of labor has become more equal over the past 40 years, there is still an imbalance, with women performing the larger majority of work. Despite the large amount of research on the division of labor, research on college students' intentions for the future division of labor is lacking. It is unknown whether they intend for this imbalance prior to cohabitation or marriage. The present study explores college students' intentions regarding how they plan to divide household and childcare labor in the future, what factors predict these intentions, and the relation of the match or mismatch of intentions to relationship satisfaction.

LuckyCharms

Michael Pato (Psychology)
Advisor: Erik Thiessen (Psychology)
Peter
Oral 11, 4:00pm

When acquiring language one of the first steps is identifying where the words are when we talk. Though it may sound like there are pauses between words when we talk, there are in fact very few pauses between words in fluent speech. Humans use many different cues to parse out these words. In the current study we are examining stress-based cues and whether they are present in other domains of learning beyond language. We found that, when stress-based cues were added to visual patterns, participants were able to learn them better then without them.

Motivating Students: Does Creativity Matter?

Yuliya Rinberg (Psychology)
Advisor: Gayle Dow (Psychology)
Class of '87
Oral 3, 12:40pm

Although potential applications of creativity fostering classrooms are widely discussed in the literature, educators' insensitivity and even discouragement of creative thinking continues to be a problem throughout the world (Stoycheva, 1996) The goal of this study was to demonstrate the how fostering students' creativity affects student motivation and understanding of course material in a college setting. Fourteen Carnegie Mellon instructors who taught a course in the Fall of 2007 were separated into a high, medium, and low creativity group based upon the degree to which their course encouraged students' creativity. With alpha set at .05, MANOVA analysis across three groups revealed a significant main effect for motivation and understanding: $F(2, 69) = 9.8$, $np2 = .22$, power = .98, $p < .01$. Results supported the idea that encouraging creativity has positive effects on students' understanding of the course material and motivation to take similar courses in the future. Implications of these results are discussed.

The Effect of Veterinary Orthopedic Manipulation on the Biological Functions and Social Behaviors of Gibbons

Matthew Ward (Psychology)
Advisor: Lori Holt (Psychology)
Hoch Commons-2nd Floor, Rangos side
3-5pm

This experiment explores the effect of chiropractic adjustments to the spine of a one-armed Gibbon at the Pittsburgh Zoo and PPG Aquarium. The animal's feces will be sampled and analyzed for any changes in consistency as a result of the treatment, and changes in the animal's social behaviors will also be observed.

This project will provide valuable insight into the effectiveness of chiropractic in treating disease in primates. The information can then be applied to future care of similarly afflicted primates, including humans.

PSYCHOLOGY & STATISTICS

Walking to Work: A Longitudinal Analysis of Walking Patterns

Julie Savitt (Mathematics)
Charity Chen (Psychology & Statistics)
Joshua Jelin (Mathematics)
Karina Alvarez (Statistics)
Advisors: Joel Tarr
Marnie Bertolet (Statistics)
Chris Hendrickson
Wean Commons-1st Floor, Connan side
12-2:30
Class of '87
Oral 11, 4:00pm

We identified factors that effect an individual's probability of walking to work instead of other means of transportation using the 1990 and 2000 Census and the Allegheny County Real Property Inventory [Catalogue] (1937). The variables of interest include: socioeconomic status, population in a given area, other availablemethods of transportation such as: bus, driving, bicycle, and motorcycle, and household size. Preliminary linear regression models indicated that in 1999 and 2000, income, household size, and the percentage of neighbors that drove significantly predicted whether an individual walked to work. To analyze the three datasets together, linear mixed-effects models will be used to determine longitudinal relationships.

An Analysis of Marketing Messages in Popular Hispanic Media

Amanda Flynn (Social & Decision Sciences)
Advisor: Susan Polansky
Kirr Commons-1st Floor, Window side
12-2:30

As the Hispanic population in the United States has continued to increase, the number of Hispanic magazines and popular media has also continued to increase in both readership and importance. Based on advertising revenue, the two most popular Hispanic magazines were identified as People en Español and Latina. From these publications, individual advertisements were selected and the marketing messages, images, and word choices of these advertisements were analyzed. When possible, the advertisements appearing in Hispanic magazines were also compared to advertisements from the same company appearing in non-Hispanic magazines.

After noting the different marketing messages between advertisements targeted towards Hispanic audiences and those targeted towards non-Hispanic audiences, several observations were made. First, many advertisers continue to rely on common stereotypes and misconceptions to reach Hispanic audiences. Nonetheless, these advertisers recognize the growing financial muscle of this demographic and continue to spend millions each year to reach this audience. Second, the use of "code switching," in which a primary and secondary language are used in the same marketing message, has become a growing trend in advertisements appearing in Hispanic magazines. Lastly, there are some advertisers that recognize the enormous diversity within the Hispanic population and have targeted their advertisements accordingly.

Beauty Premia in Negotiation

Andrew Hafenbrack (Social & Decision Sciences)
Advisor: Francesca Gino (Business Administration)
Dowd
Oral 6, 1:40pm

Significant empirical inquiry has been devoted to the tendency for beautiful people to get preferential treatment in a variety of domains. We seek to expand the extant findings by investigating how beauty influences behavior in the context of negotiation. Contrary to our initial intuitions, we found that beautiful people received less advantageous outcomes than less attractive people. We have additional conclusions forthcoming regarding how beauty influences negotiation behavior in a market setting.

Carbon Footprint Modeling of Biofuels: Seeing the Invisible

Asa Watten (Social & Decision Sciences)
Advisor: Robert Bingham (Art)
UC Gallery
3-5pm

Many of us understand that burning petroleum to get around may not be a good thing. At the same time there is a growing appreciation that the most available alternatives, biofuels, may not be a silver bullet either. While fueling stations have yet to deploy an adequate metric for weighing the ecological costs and benefits of liquid transportation fuels, consumers are justifiably confused. What is the environmentally responsible driver to do?

Working with Steel City Biofuels, a local advocate for sustainable biofuel, I set out to model, in a format accessible to non-experts, the life-cycle impact of 4 transportation fuels available in Pittsburgh. To this end two analyses were necessary: first, it was necessary to map the life cycle, or the story, of the fuel

from oil exploration or land conversion to refining and combustion. Second, to tally the life cycle carbon-dioxide emissions per gallon of gasoline equivalent for each fuel.

A sculptural demonstration of the project was presented at the 2007 Hot House event, the Sprout Fund's annual benefit and showcase of projects. At the event there were 4 cars, each of which ran on a different fuel available in Pittsburgh: gasoline, ethanol, biodiesel, and vegetable oil. Each car had on it a life cycle sticker and, out of the tail pipe, a cloud of balloons equal in number to the volume of carbon-dioxide emissions associated with a gallon of gasoline equivalent for each fuel.

Direct Democracy and Affirmative Action

Elizabeth Alspector (Social & Decision Sciences)
Advisor: David Gerard (Engineering and Public Policy)
Hoch Commons-2nd Floor, Rangos side
3-5pm

A quantitative and qualitative analysis on direct democracy's effect on affirmative action, specifically regarding ballot initiatives. Analysis uses data from election banks, censuses, and economic databases. Discussion of upcoming election is included.

Does Objective Risk Matter When it Comes to Drugs?

Ryan Menefee (Social & Decision Sciences)
Advisor: Jonathan Caulkins (Heinz School)
Pake
Oral 3, 12:40pm

Mokdad et al. (2004) estimate that each year in the United States, 435,000 people die from tobacco use, 85,000 from alcohol, and 17,000 from all illicit substances combined. Yet American public appears far more concerned about illegal drugs than it is about tobacco and alcohol use, driving expansions in control efforts far beyond that which is part and parcel of prohibition. The central thesis of this paper is that some of this mismatch in concern may stem from differences in the types of deaths created, with deaths associated with illicit drugs being, on average, "scarier" to the public than are the deaths associated with legal substances in a way that can be grounded in the risk perception and communication literatures. We summarize literature documenting that people care about more than actual death risk. Factors such as voluntariness, control, and familiarity also play a crucial role in determining the perceived risk of an event, and some of those factors seem to be more salient for the illicit drugs than for tobacco and alcohol. Social amplification of risk may also play a role in explaining these perceptions, but may not by itself be the full explanation. We conclude that the mismatch between actual risks and public concern is not necessarily entirely wrong or irrational, but rather may, to some extent, embody stable preferences that should be reflected in policy.

Examining Economic Development Strategies for Women in the Developing World

Amy Shields (Social & Decision Sciences)
Pake
Oral 4, 1:00pm

Microlending has become an increasingly popular development strategy. This paper looks at several different microlending programs across the world. It investigates the impact microlending has on women and the ability of microlending to reduce poverty.

Good for the Self, Bad for Others: Self-Relevance Moderates Preferential Attention to Positive and Negative Information

Piper Lincoln (Social & Decision Sciences)
Advisor: Dr. Carey Morewedge (Social & Decision Sciences)
Kirr Commons-1st Floor, Window side
12-2:30

People exhibit a general negativity bias, whereby bad events, outcomes, and stimuli engage more of our attention, use more cognitive resources, and have a greater impact on our perception of other people than do good events, outcomes, and stimuli - even when of the same kind and intensity. The dominance of bad over good conflicts, however, with evidence showing that people are motivated to form and maintain a positive self-image, seeking more and better remembering positive than negative feedback about the self. Such positive illusions about the self include self-aggrandizing self-perceptions, the illusion of control over chance events, overconfidence, and unrealistic optimism, all suggesting a positivity bias specific to self-relevant information. I hypothesize that the self-relevancy of stimuli will moderate preferential attention biases for positive and negative information. In self-relevant contexts, positive stimuli will dominate and a positivity bias will occur. In contexts that are not self-relevant, negative stimuli will dominate and a negativity bias will occur. A modified emotional Stroop task in which positive and negative words are embedded in sentences that are self-relevant, other-relevant, or non-relevant is used to test this hypothesis.

The (Ir)Rationality of Voting

Paul Combe (Social & Decision Sciences)
Advisor: David Gerard (Engineering and Public Policy)
Class of '87
Oral 4, 1:00pm
Kirr Commons-1st Floor, Window side
3-5pm

First, I will review the economic models of individual incentive to vote in a large-scale democratic election and how conclusions are formed about the rationality of voting. After considering these in light of political debate outside of the field of Economics or Political Science, I will identify a number of phenomena that cannot easily be explained by the current voting model. Then I shall make a positive exploratory effort to refine the model, amending it to take into account desire to satisfy and set structural norms for the political system, which have been empirically identified, and other behavioral phenomena.

STATISTICS

A Comparison of Models for Overdispersed Insurance Data

Aaron DePonceau (Statistics)

Despite their seemingly simple nature, insurance claim count data remain difficult to model effectively. The two models used in practice, Poisson and negative binomial, fail to capture the overdispersion exhibited in the tails of the empirical distributions. This study evaluated fits of the geometric and

Jeffrey Dunn (Mathematics)
Steve Karolyi (Business Administration)
Rohan Chatterjee (Scholars Program for Humanites)
Akshaya Jha (Statistics)
Advisor: Tanzy Love (Statistics)
Kirr Commons-1st Floor, Window side
12-2:30

relatively unknown Conway-Maxwell Poisson (CMP) distributions against the aforementioned standard models for two separate insurance datasets. Although the CMP failed to capture the deviations more accurately than the negative binomial, the geometric exhibited significant improvement over the Poisson. Due to its appealing statistical properties and interpretability, the results suggest that the geometric distribution may remain a viable alternative.

Do different students learn at different rates?

Jennie Shoemaker (Statistics)
Rebecca Radkoff (Economics)
Davis Woo (Statistics)
Hyung Jae Kim (Mathematics)
Advisors: Brian Junker (Statistics)
James Delaney (Statistics)
Elizabeth Ayers (Statistics)
Wean Commons-1st Floor, Connan side
12-2:30

This semester we have been working with the HCI and statistics departments to analyze the effectiveness of the web based standardized testing assistance tool "Assistment". We are looking at data from several hundred eighth graders in Massachusetts who have been using the tutoring program to help improve their scores on the statewide MCAS exam. Our project focuses on examining the learning curves for both individual students and particular skills taught by the program. In order to do this we are running a logistic regression algorithm to determine the probability for success for each student on each problem. Our goal is to show for what skills and demographics "Assisment" is useful, and for what skills and demographics it needs improvement.

Exploring the Personal Projects of Adolescents: Those with and without Type 1 Diabetes

Akiko Takeda (Statistics)
Advisor: Vicki Helgeson
Wean Commons-1st Floor, Connan side
12-2:30

Adolescence is often a time of turmoil, stress, and conflict as children undergo tremendous pubertal, social, and emotional changes. During such transition, management of diabetes becomes especially difficult. In this study, we used the Personal Projects Analysis (PPA) as a way to examine types (e.g., academic) and dimensions (e.g., stressful) of personal goals that adolescents with diabetes and their healthy counterparts elicited. We then linked the nature and dimensions of those goals to psychosocial variables such as depression and self-worth. For adolescents with diabetes, we also focused on the implications that appearance goals and diabetes-specific goals can have on health outcomes such as self-care, self-efficacy, and metabolic control. One of the most interesting findings was that girls with diabetes had the highest number of appearance goals. While progress in appearance goals was associated with higher self-worth, sadness in pursuing appearance goals was related to worse self-care and more depression. Stress in pursuing appearance goals was correlated with more depression and lower self-worth. Interestingly, having a diabetes-specific goal was associated with worse self-care.

Progress in diabetes-specific goals was correlated with better self-care and better metabolic control. Happiness in pursuing diabetes-specific goals was also correlated with better metabolic control.

Galaxy Classification Using SDSS Spectra

Shawn Yoon (Statistics)
Michael Wang (Business Administration)
Sergey Bystritskiy (Mathematics)
Gerry Llaque (Mathematics)
XiaYi (Sandy) Shen (Electrical & Computer Engineering)
Advisor: James Delaney (Statistics)
Hoch Commons-2nd Floor, Rangos side
12-2:30

The primary problem under investigation is to accurately and automatically classify galaxies into either the star-forming or active galactic nuclei categories. Shawn Yoon, Sergey Bystritskiy, Xiayi(Sandy) Shen, Michael Wang, and Gerry Llaque worked together to create a program in R to automate the processes of classifying galaxies based on wavelength data collected from the Sloan Digital Sky Survey(SDSS). Part of the data is in the form of a continuum which is the underlying distribution of background "noise" in galaxies. There are also various emission lines which come from emitted photons from galaxies. Our code is designed to fit a distribution of the continuum while overlaying a normal distribution to model the emission spike.

Taking the ratios of the area under the distribution, we can then begin to classify the type of galaxy we are viewing.

Identifying functional clusters of neurons

Anthony Pileggi (Statistics)
Advisor: Robert Kass
Wean Commons-1st Floor, Connan side
12-2:30

Much computational neurophysiology has focused recently on the activity of groups, or ensembles, of neurons. Using a recently-developed algorithm for model-based variable clustering we have analyzed the responses of 44 neurons in primary visual cortex to grating stimuli presented in 12 different orientations. The method identifies some clusters of neurons that are consistent across orientations. It also identifies clusters whose membership changes with orientation, indicating dynamic patterns of functional connectivity.

Measuring the Effectiveness of an Online Statistics Course in Accelerating Student Learning

Nisha Phatak (Statistics)
Advisor: Oded Meyer (Statistics)
Rangos 2 & 3
Sigma Xi Group 7, 11:15am

Carnegie Mellon University was funded to develop a web-based introductory statistics course, openly and freely available to individual learners online. During the spring of 2007, an accelerated study was performed involving a group of students who volunteered to take the online course. The course spanned only half the semester; the students learned the material on their own using the online course, however, they met with a professor twice a week for focused lectures where the instructor gave additional examples on topics that the students were struggling with. To measure how successful the students were in learning the material, the CAOS test was used as both a pretest and posttest. Using the data from the students' performance on these tests, we have analyzed and pinpointed specific topics in which the course was successful and not successful in teaching the concepts. Another goal of the research was to compare these students' performance on the CAOS to the performance of students who took the traditional course. After further investigation, we hope to improve the course by targeting the areas in which it wasn?t successful in conveying the concepts clearly.

Removing the Physiological Effects of the Brain

Ryan Sieberg (Mathematics)
John Scarfutti (Scholars Program

It is very difficult to simplify the complexity of the brain, and to take reasonable measurements of it. Several tools are available to measure functions of the brain. Our project examines the effectiveness of optical imaging in identifying brain activity. However, as many physiological effects obscure the true

for Humanites)
Emil Shalmiyev (Statistics)
Martin Nemaric (Mathematics)
Shawn Mankad (Mathematics)
Advisors: William Eddy (Statistics)
Tanzy Love (Statistics)
Kirr Commons-1st Floor,
Window side
12-2:30

response to particular stimuli, these factors must be identified and addressed. We applied statistical methods to recognize the underlying periodicity of various major obfuscating effects, leading us to conclude that optical imaging indeed reveals the brain response to visual stimuli.

The Statistics of Jury Awards

Michael Dorko (Mathematics)
Mario Nunez (Statistics)
Advisor: Joseph Kadane
Rangos 2 & 3
Sigma Xi Group 7, 10:00am

The Supreme Court has ruled that District Courts must do an analysis of jury "pain and suffering" awards to see if the awards are too large. One such analysis was conducted by Judge Jack Weinstein in the case Geressy v. Digital Equipment Corporation (980 F. Supp. 640, 1997 US District Court). Judge Weinstein found 27 comparable cases, and analyzed the data using an (arguably inappropriate) normal distribution. The purpose of this project was then to find a more appropriate distribution to fit the given data and provide what the 95th percentile would be under the estimated distribution in order to determine at what point awards become "too large."

Using Assistment Measures to predict Student Proficiency

Eileen Tucker (Mathematics)
Mary Grace DeForest
(Mathematics)
Siu Him Kenneth Ip (Statistics)
Katherine Kardaras (Mathematics)
Mike Carney (Statistics)
Advisors: Brian Junker (Statistics)
Tanzy Love (Statistics)
Kirr Commons-1st Floor,
Window side
12-2:30

The ASSISTment system, an online benchmark testing system has been implemented by the State of Massachusetts to help students prepare for the Massachusetts Comprehensive Assessment System (MCAS) exams. The system guides students through the performance of solving appropriate grade-level mathematics problems. Using data from the 2004-2005 school year for 200 student scores on the 8th grade math tutorial, we explored the ability to use the Assistment tutor to predict students MCAS score. Given various parameters of students' performance, including speed, answers correct, number of questions attempted, and hinting metrics, we derive the difficulty level for each question that the students encountered. Using their results on these particular mathematics problems, we aim at finding the best fitting model to predict a student's proficiency score in the MCAS exam.

Using Clinical Data to Evaluate Gait and Balance in Patients

Shijong Ng (Electrical & Computer
Engineering)
Kelly Koser (Mathematics)
Iulia Degeratu (Statistics)
Margaret Hebner (Mathematics)
Advisors: Rebecca Nugent
(Statistics)

As today's population grows older and less independent, there is an increased risk of both hospitalizations and falls associated with a wide range of health factors. When doing this project, we want to determine which factors will accurately predict a patient's risk for future falls and hospitalizations. Information regarding demographics, lifestyle, and past and present health problems was recorded for 184 clinical outpatients. Each patient took a Tinetti test, a short, low impact physical test to determine one's overall health and independence based on a scale from zero to twenty-eight, and their gait speed was measured. Using correlations between variables and linear and logistic regression models, we are better able to predict a patient's Tinetti test score or

Marnie Bertolet (Statistics)
Wean Commons-1st Floor, Connan side
12-2:30

gait speed, thus helping to predict whether or not a patient will have a fall or hospitalization in the nearfuture.

Walking to Work: A Longitudinal Analysis of Walking Patterns

Julie Savitt (Mathematics)
Charity Chen (Psychology & Statistics)
Joshua Jelin (Mathematics)
Karina Alvarez (Statistics)
Advisors: Joel Tarr
Marnie Bertolet (Statistics)
Chris Hendrickson
Wean Commons-1st Floor, Connan side
12-2:30
Class of '87
Oral 11, 4:00pm

We identified factors that effect an individual's probability of walking to work instead of other means of transportation using the 1990 and 2000 Census and the Allegheny County Real Property Inventory [Catalogue] (1937). The variables of interest include: socioeconomic status, population in a given area, other availablemethods of transportation such as: bus, driving, bicycle, and motorcycle, and household size. Preliminary linear regression models indicated that in 1999 and 2000, income, household size, and the percentage of neighbors that drove significantly predicted whether an individual walked to work. To analyze the three datasets together, linear mixed-effects models will be used to determine longitudinal relationships

BIOLOGICAL SCIENCES

A modular system for analysis of intronic splicing enhancers and silencers in Drosophila melanogaster

Benjamin Williams (Biological Sciences)
Advisor: Javier Lopez
Rangos 2 & 3
Sigma Xi Group 1, 11:15am

Expression of genes in multicellular organisms requires excision of introns from the pre-mRNA and splicing of the exons. This process requires signals at the ends of introns (5- and 3- splice site motifs). However, these signals do not contain sufficient information to distinguish authentic splice sites from related sequences nor to specify their relative efficiencies. Auxiliary enhancers or silencers are required, and these can be located within exons or introns. Exonic enhancers and silencers have been studied intensively, but less is known about the intronic elements. A computational analysis was used to identify candidate intronic enhancers and silencers in the Drosophila genome. These were found near exons and also near non-exonic recursive splice sites. The function of one enhancer located near recursive splice site RP3 in the Ultrabithorax (Ubx) gene has been verified. This enhancer appears to activate both initial use of RP3 as a 3-splice site and subsequent use of the regenerated 5- splice site. In addition, a silencer has been verified that suppresses the use of pseudo-5-splice sites near RP3. Because Ubx RP3 is very well characterized, it provides an excellent test system for comparing the activity of predicted enhancer and silencer motifs from elsewhere in the genome. My project is to develop and apply this test system. This will be accomplished by making minigene constructs in which the native enhancers or silencers are susbstituted by members of other predicted families. The effects on function of RP3 will be analyzed in a transient transfection RT-PCR assay.

Analysis of ScFv Binding to Cyanine Dyes

Justine Harkness (Biological Sciences)
Tim Helbig (Biological Sciences)
Advisor: Peter Berget (Biological Sciences)
Rangos 2 & 3
Sigma Xi Group 1, 10:30am
Wright
Oral 7, 2:00pm

Single Chain Variable Fragments (scFvs), or artificially constructed antibodies, have been highly utilized in research lately due to their known potential for biosensor and other biotechnology related applications. This potential stems from the fact that these scFvs can be selected to bind a particular substrate of interest. In a previous project, ten scFvs candidates were magnetically and fluorescently sorted to bind Cy5.18, one of a family of cyanine dyes that has many experimental uses including fluorescence microscopy and protein/nucleic acid labeling. The purpose of this project was thus to determine the binding strengths of the scFvs for Cy5.18, test to see whether the candidates would bind other cyanine dyes, and find the binding strengths of the scFvs for all dyes to which they had affinity. Through use of Tecan fluorimetry, it was found that the candidates bound a variety of the cyanine dyes, and so dissociation constants (Kd values) were calculated by the fluorimeter for each scFv with each dye with most ranging from 10-500nM. With the structures of the dyes and the strength to which the candidates bind them known, it is hoped

that the scFv binding pockets can begin to be characterized and that they can begin to be used in application.

Assessing the Cellular Consequences of Loss of APC Function throughout Development of Drosophila Wings

Lauren Thorpe (Biological Sciences)
Advisor: Brooke McCartney (Biological Sciences)
Rangos 2 & 3
Sigma Xi Group 1, 11:00am
Dowd
Oral 3, 12:40pm

The colon cancer tumor suppressor adenomatous polyposis coli (APC) functions in both negative regulation of Wnt/Wingless (Wg) signaling and in cytoskeletal organization. Both Drosophila and humans have two APC proteins, APC1 and APC2, which have redundant function. Therefore, to study the consequences of the loss of APC function in Drosophila, both APC1 and APC2 must be mutant. APC2 APC1 double mutant flies are not viable, but mitotic recombination can be used to induce patches of APC2 APC1 double mutant tissue. APC2g10APC1Q8 (double null) clones in adult wings exhibit cell fate transformations consistent with induction of the Wg pathway. In wing imaginal discs, APC2g10APC1Q8 clones exhibit a phenotype reminiscent of colon polyps that is characterized by outpocketing of the mutant cells from the rest of the epithelium. While clones are numerous throughout larval discs, significantly fewer are seen in the adult wings. Most of these surviving clones are seen in the wing blade, with relatively few in the other adult structures which derive from the wing disc. To determine the fate of the APC2g10APC1Q8 clones we examined their number, location, and phenotype at stages of development between puparium formation and eclosion. Preliminary data suggest that clones near the hinge may pinch off and are lost, consistent with their absence in the adult wing, while some clones in the blade invaginate between the two epithelial layers of the wing. In addition, the outpocketing phenotype is observed in areas of the pupal disc where it is not seen in larval stages, suggesting that clones in different areas of the wing disc take on that phenotype at different times. Exploration of these results may contribute to further understanding of the basis of colon cancer development.

Detection of HHV8 LANA1 Protein in a Non-KS AIDS Patient

Danica Cowan (Biological Sciences)
Advisor: Fred Jenkins
Rangos 2 & 3
Sigma Xi Group 1, 10:15am

The purpose of this study was to identify human herpesvirus 8 (HHV-8) reservoirs in the body. Tissue samples from a non-KS AIDS patient were analyzed using Immunohistochemistry. Among the 25 tissue samples, 19 were stained for LANA-1, 25 were stained for vIL-6, and 25 were stained for K8.1. Of the LANA-1 samples 31.58% were positive, 60.00% of the K8.1 samples were positive, and 32.00% of the vIL-6 samples were positive.

Development of Neural Networks in Mouse Accessory Olfactory Bulb

Rohit Ramnath (Biological Sciences)
Advisor: Dr. Nathan Urban (Biological Sciences)

The Accessory Olfactory Bulb (AOB) is the region of the brain involved in pheromonal processing. Axons of sensory neurons originating in the Vomeronasal Organ (VNO) terminate in structures of neuropil called glomeruli in the Accessory Olfactory Bulb (AOB) of mice. The glomerulus is an interface between the axons of sensory neurons in the Vomeronasal Organ and Dendrites of Mitral Cells which are present in the Mitral Cell Layer of the Olfactory Bulb. Glomeruli are also innervated by dendrites from Inhibitory interneurons which express Tyrosine Hydroxylase (TH). Using mice which

Rangos 2 & 3
Sigma Xi Group 1, 10:45am

express Green Fluorescent Protein (GFP) in neurons that express a specific subset of pheromone receptors (V2R1b receptors), Immunohistochemistry techniques would be performed to determine the structure of glomeruli and the patterns of connectivity of the Tyrosine Hydroxylase cells in early development (1-4days postnatal). The results obtained would be compared to mice later in development (~30 days postnatal) to determine the structural development of glomeruli and Tyrosine Hydroxylase-expressing cells in the Accessory Olfactory Bulb.

Exploring the Use of an scFv, MG1.5, as an Alternative to GFP

Natalie Straight (Biological Sciences)
Advisor: Peter Berget (Biological Sciences)
Hoch Commons-2nd Floor, Rangos side
12-2:30

Green fluorescent protein has been a reliable and useful means of tagging proteins in vitro for analysis. Recent experimentation has shown the possibility that the single chain variable fragment, MG1.5 in conjunction with MG1.5 ethyl ester dye can be used as an alternative to GFP. DNA analysis of gene fusions indicate that the scFv can be successfully placed and initial images suggest successful tagging in some gene fusions.

Fluorescently Labeled Chitosan/Iron-Oxide Nanoparticles for Multimodal Tracking of Neural Stem Cells In Vivo

Eda Altiok (Biological Sciences)
Advisor: Stefan Zappe (Biomedical Engineering)
Rangos 2 & 3
Sigma Xi Group 2, 10:00am

Neural stem cell (NSC)-based therapies have tremendous potential for treatment of neurological disorders and injuries such as Parkinson?s disease, multiple sclerosis, and stroke. NSCs are self-renewing and multipotent cells, capable of generating all three major neural cell types of the brain. When transplanted in vivo, they have shown to be able to migrate to damaged regions of the brain, differentiate, integrate into neural tissue and restore functionality.

In order to analyze migratory behavior of implanted NSCs and to optimize efficacy of therapeutic strategies, it is highly desirable to be able to track implanted stem cells in vivo in non-invasive ways, e.g. through Magnetic Resonance Imaging (MRI). Iron-oxide nanoparticles give excellent contrast in MRI images and have been used to track implanted dendritic cells in vivo. Although dendritic cells naturally take up materials around them and simply ingest iron-oxide nanoparticles when exposed to them, other cell types do not uptake iron-oxide nanoparticles spontaneously, limiting use of MRI for tracking of implanted cells in general.

To overcome this, we have developed chemical conjugation schemes to coat iron-oxide nanoparticles with chitosan and label both the nanoparticle as well as the chitosan coating with fluorescent dyes. Chitosan is a positively charged molecule which enables nanoparticles to immediately stick tightly to the negatively charged cellular membrane regardless of the cell type. In an effort to remove attached nanoparticles from their membrane surfaces, cells rapidly internalize attached nanoparticles, most likely through endocytosis.

Fluorescent labeling of nanoparticles and chitosan enables us to locate nanoparticles through fluorescence microscopy and to quantitatively and qualitatively characterize nanoparticle uptake and fate beyond uptake. We have been able to verify that cells rapidly uptake large numbers of chitosan/iron-oxide nanoparticles within minutes after addition of our nanoparticles to culture media. Several cell types have been labeled efficiently, indicating widespread applicability of our technology.

Future research will be concerned with investigation of details of the uptake mechanisms, fate of nanoparticles beyond uptake, and MRI imaging of cells, first in hydrogel-based tissue models and later on in vivo in mice brains.

Functional Proteomics of Ribonucleoprotein Interactions: High Throughput Screen of Mutants Defective in Each of the Ribosomal Proteins

Chao Yang (Biological Sciences)
Lawrence Lin (Biological Sciences)
Advisor: John Woolford
Wean Commons-1st Floor, Connan side
3-5pm

The crucial cellular process of converting the genetic code into protein occurs in structures called ribosomes that are found inside every cell. Ribosomes are composed of a large and a small subunit that together contain 79 proteins and 4 rRNA molecules; these components are brought together during the assembly of ribosomes by approximately 170 other proteins known as ribosomal assembly factors. Our goal is to identify some of the protein-protein and RNA-protein interactions that occur in immature, precursor ribosomal intermediates that form transiently during the process of ribosome assembly. We accomplished such a task by using a genetic approach. We used Tandom Affinity Purification to tag assembly factor Nop7 in several mutant yeast strains, each deficient in producing one of the large ribosomal protein, then extracted pre-ribosomal complexes from these cells. By identifying the RNA and proteins that co-purify and are present in these extracted intermediate complexes through SDS-PAGE and Western blotting, we are able to identify what molecular interactions are dependent on each of the approximately 49 large ribosomal proteins. Such information gives insight into the mostly unexplored process of ribosome assembly.

Genetic Analysis of Yeast Assembly Factor Rpf2

Lawrence Lin (Biological Sciences)
Advisors: John Woolford
Jelena Jakovljevic
Jingyu Zhang
Hoch Commons-2nd Floor, Rangos side
3-5pm

The crucial cellular process of converting the genetic code into protein occurs in structures called ribosomes that are found inside every cell. Ribosomes are composed of a large and a small subunit that together contain 79 proteins and 4 rRNA molecules; these components are brought together during the assembly of ribosomes by approximately 170 other proteins known as ribosomal assembly factors. Our goal is to identify some of the protein-protein and RNA-protein interactions that occur in immature, precursor ribosomal intermediates that form transiently during the process of ribosome assembly. We accomplished such a task by using a genetic approach. We used Tandom Affinity Purification to tag assembly factor Nop7 in several mutant yeast strains, each deficient in producing one of the large ribosomal protein, then extracted pre-ribosomal complexes from these cells. By identifying the RNA and proteins that co-purify and are present in these extracted intermediate complexes through SDS-PAGE and Western blotting, we are able to identify

what molecular interactions are dependent on each of the approximately 49 large ribosomal proteins. Such information gives insight into the mostly unexplored process of ribosome assembly.

Importance of Rigorous Implementation of Experimental Procedures in Developmental Research: A Case Study

Andrea Poon (Biological Sciences)
Samantha Creighan (Psychology)
Brian Goldfain (Electrical & Computer Engineering)
Advisor: Anna Fisher (Psychology)
Kirr Commons-1st Floor,
Window side
12-2:30

It is crucial to any field of research to have standardized procedures when carrying out an experiment in order to eliminate confounding variables and ensure internal validity (we refer to this as experimental rigor). The proposed research will address the issue of experimental rigor using the paper by Shulz and Bonawitz (in press)as a case study. Shulz and Bonawitz examined exploratory play in 4-year-old children and found a reversal of the common novelty preference when participants lacked causal knowledge about how a toy operated. However, upon close examination of this study's experimental procedures, we identified two possible confounding variables stemming from a lack of standardization in each of the experimental conditions. The proposed research will replicate the experimental design used by Shulz and Bonawitz, using standardized procedures to control for the two variabes that we identified as potential confounds.

Infants' Understanding of Self-Propulsion

Shelly Kucherer (Psychology)
Caroline Eckert (BHA)
Lauren Krogh (Biological Sciences)
Advisor: David Rakison
Wean Commons-1st Floor,
Connan side
12-2:30

Research has shown that at the age of 20 months infants understand that objects that have moving parts - such as legs - are self-propelled, and that infants at the age of 18 months think that any object can be self-propelled. The aim of this study is to extend previous research to determine when infants generalize self-propulsion on the basis of movement alone. Infants will be shown an ambiguous clay object that moves without external contact from another object (it will be made to move by hidden magnets). After watching this demonstration, the infants will then be given two test objects and will be encouraged to move them in the same way as the ambiguous object. One of the test objects will be an animate object (a person or animal) and the other will be an inanimate object with wheels or an inanimate object without wheels. The results will provide a better understanding of how infants learn about self-propulsion in animate objects.

Investigating the RNA binding properties of yeast nucleolar protein Nop15

Chao Yang (Biological Sciences)
Advisor: John Woolford
Hoch Commons-2nd Floor,
Window side
3-5pm

The crucial cellular process of converting the genetic code into protein occurs in structures called ribosomes that are found inside every cell. Ribosomes are composed of a large and a small subunit that together contain 79 proteins and 4 rRNA molecules; these components are brought together during the assembly of ribosomes by approximately 170 other proteins known as ribosomal assembly factors. Our goal is to identify some of the protein-protein and RNA-protein interactions that occur in immature, precursor ribosomal intermediates that form transiently during the process of ribosome assembly. We accomplished such a task by using a genetic approach. We used Tandom Affinity Purification to tag assembly factor Nop7 in several mutant yeast strains, each deficient in producing one of the large ribosomal protein, then extracted pre-ribosomal complexes from these cells. By identifying the RNA

and proteins that co-purify and are present in these extracted intermediate complexes through SDS-PAGE and Western blotting, we are able to identify what molecular interactions are dependent on each of the approximately 49 large ribosomal proteins. Such information gives insight into the mostly unexplored process of ribosome assembly.

Leonard H. Eaton and the Western Pennsylvania Humane Society's Crusade to Protect Children, the Elderly, and Animals

Yael Klionsky (Biological Sciences)
Advisor: Steve Schlossman
Class of '87
Oral 9, 3:20pm

The Western Pennsylvania Humane Society was established in 1874 for the prevention of cruelty to animals. By the 1880s the Society decided to expand their scope of influence to also protect children and the elderly of Western Pennsylvania. Although there are many important and influential Pittsburghers who helped begin this society and establish its goals, Leonard H. Eaton was one of the founders of this Society and served as its President from 1880 until his death in 1886. As President, Eaton began publishing full annual reports that provide rich detail of his hopes and intentions for the Humane Society along with how these goals were achieved. There has only been limited research on Eaton and his relationship with the Western Pennsylvania Humane Society. In working with the Humane Society, I been able to access all of Eaton's annual reports, Minute books of meetings Eaton held during his Presidency, and Agent ledgers that document how cases of abuse were dealt with. In working with these primary documents, I hope to understand how Eaton was able to implement his philosophies in the Western PA Humane Society. Ultimately newly uncovered primary documents will advance the knowledge of how the Western Pennsylvania Humane Society helped government take greater responsibility towards the protection and care of children.

pax6 Expression and Function in Strongylocentrous purpuratus and Asterina miniata: Building a GRN for Neurogenesis

Charlotte Jennings (Biological Sciences)
Advisor: Veronica Hinman
Kirr Commons-Window Side
12-2:30

Such questions as "How did fins evolve into feet?" or "How have we evolved such complex sensory systems?" have perplexed humankind for ages. There is a need to understand what underlies the evolution and morphology of body plans and systems in animals. There is strong evidence that the process of development of animal body plans is directed primarily by gene regulatory networks (GRN). They are essentially a model, or schematic, that is used to describe how areas in the organism in which particular groups of genes are expressed are established during development. Since developmental GRNs represent the critical operations that direct the developmental process, changes in the architecture of these systems must underlie the evolution of animal body plans.

I am contributing to the building of a developmental GRN for neurogenesis in Strongylocentrous purpuratus, a purple sea urchin, and Asterina miniata, a common sea star, by focusing on the expression and function of the transcription factor PAX6 as well as the opsin1 and opsin4 genes. pax6 and opsins are related to the development of sensory systems, particularly photosensation, in nearly all animals. By delineating the expression and function of pax6 and opsin genes during development and incorporating this information into a GRN for development in the sea urchin and starfish

we will be able to understand and compare the complex interactions that regulate development in these two animals. The comparison of neurogenic developmental GRNs among species will offer a deeper understanding of how the evolution of animal body plans and sensory systems can occur and ultimately help us to understand what it means to be an animal.

The process of development of animal body plans is directed primarily by gene regulatory networks (GRN). GRNs consist of systematic connections between regulatory genes and cis-regulatory DNA. They are essentially a model that is used to describe how spatial restriction domains are established during development. Since GRNs represent the critical operations that direct the developmental process, changes in the architecture of these systems underlie the evolution of animal body plans. I plan to contribute to the building of a GRN for neurogenesis in Strongylocentrous purpuratus and Asterina miniata by focusing on the transcription factor Pax6. Major experimental techniques will include whole mount in situ hybridization, quantitative polymerase chain reaction (QPCR), and the use of morpholino anti-sense oligonucleotides (MASO) against Pax6. This research may shed light on the kinds of mechanisms that particular genes are associated with during development, and this may ultimately offer a deeper understanding of how evolution can occur through changes in the developmental process.

Proteomic Analysis of Early Visual Processing Structures

Xuewei Zhang (Biological Sciences)
Advisor: Justin Crowley (Biological Sciences)
Rangos 2 & 3
Sigma Xi Group 2, 11:45am

Proteomic differences between the nasal and temporal regions of the retina are required for the guidance of retinal axons to the left or right hemisphere of the brain. They are also likely to be critical for guidance of retinal axons to the correct termination zones in their target structures, including the lateral geniculate nucleus (LGN). An analysis of these differences is likely to provide insight to the developmental mechanisms driving formation of ocular dominance columns in primary visual cortex, as these have been hypothesized to form as a result of molecular cues and are a reflection of alternating nasal and temporal retinal input. In this project, proteins from the nasal and temporal parts of ferret retinas are isolated and examined along with their eye-specific laminar targets in the LGN using Differential Gel Electrophoresis (DIGE) analysis. Protein extracts from retinal regions or eye-specific LGN layers are run on two- dimensional DIGE gels, which allow the pair-wise separation of proteins based on both their iso-electric focusing point and their mass. Proteins that have differential expression in DIGE analysis, as measured by differential fluorescence, are then identified by mass spectroscopy. Identified candidates are verified by immunohistochemistry, in which an unlabeled primary antibody binds to the target protein, and a fluorescently-labeled secondary antibody will locate the primary antibody as well as the protein. We hope that the data we are collecting in these experiments will provide new clues to the identities of the molecular effectors of axonal targeting and eye-specific segregation of visual circuits in the brain.

Receptor for Advanced Glycation Endproducts: Purifying and characterizing RAGE, the link between cancer and inflammation

Denise Asafu-Adjei (Biological Sciences)
Advisors: Michael Lotze
Louis Sparvero
Rangos 2 & 3
Sigma Xi Group 1, 10:00am

The Receptor for Advanced Glycation End products, better known as RAGE, is a multiligand receptor found in high levels at sites of inflammation. RAGE-ligand binding activates signalling molecules and pathways that result in the amplification of host responses in pathological conditions such as chronic inflammation, diabetes, tumors, and neurodegenerative disorders.

Research and Development of Protease Biosensors Using scFv Constructs

Gregory Newby (Biological Sciences)
Advisor: Peter Berget (Biological Sciences)
Rangos 2 & 3
Sigma Xi Group 2, 11:00am

A single chain variable fragment (scFv) is a small protein derived from the variable portion of an antibody. We have isolated scFvs that are capable of binding to small, organic dye molecules and either cause them to fluoresce, or quench their innate fluorescence. I am using these scFvs as a platform for a new technology that can detect intracellular processes. By inserting an amino acid recognition sequence that is the substrate for a protease into the scFv, I can make the scFv's dye-binding capability dependant on the activity of the protease. If this tool is injected into cells, the activity of the protease can be detected by a change in fluorescence.

Role of Cullin in Centriole Overduplication

Leon Zheng (Biological Sciences)
Advisor: Gordon Rule
Rangos 2 & 3
Sigma Xi Group 1, 11:45am

Centrosomes organize the microtubule arrays and bipolar spindles required for chromosome segregation during cell division. Each maternal centrosome consists of two centrioles, which are normally duplicated once. Abnormalities in this duplication process contribute to mitotic dysfunction and genomic stability, which is detected in virtually all cancers. Although there have been many recent advancements in the study of centrosomes, the mechanism by which the protein degradation pathway affects centriole over duplication is still poorly understood. Cullin 1 (Cul1), a member of the skp, cullin, F-box (ScF) ubiquitination complex, plays a key role in the uniquitin-proteasome mediated protein degradation, and it is hypothesized to participate in the regulation of centriole duplication. We will examine the role of Cul1 in centriole overduplication using siRNA against Cul1 to acquire a better understanding of the mechanisms for centrosome aberrations in cancer.

Roles of Amino Acid Residues in the Distal Heme Pocket on the Structure-Function Relationship in Human Hemoglobin

Natalie Weir (Biological Sciences)

This study explores the structural and functional effects of amino acid substitutions at helical position E11, located 3.4 A away from the second bound oxygen atom in the -chain and 3.2 A away in the -chain of human normal adult hemoglobin (Hb A) . Four recombinant hemoglobins (rHbs), rHb (V62L), rHb (V62I), rHb (V67L), and rHb (V67I), have been expressed in Escherichia coli and purified. O2 affinity, Bohr effect, cooperativity of the oxygenation process, auto oxidation resistance, and 1H-NMR spectra

Advisors: Chien Ho
David Maillett (Biological Sciences)
Rangos 2 & 3
Sigma Xi Group 2, 11:30am

of the CO-bound, deoxygenated, and partially saturated states have been measured for each mutant. Substitution of Leucine(Leu) in either subunit, or Isoleucine(Ile) in the -subunit does not result in significant functional deviations in the O2 affinity, Bohr effect, and cooperativity from those of Hb A. However, rHb (V67I) shows a two-fold decrease in O2 affinity while maintaining the cooperativity. As expected, these mutations perturb the ligand-binding site of their respective subunits, as evidenced by 1H-NMR. rHb (V62L) and rHb (V62I) exhibit a small perturbation of the 1 2 interface in the deoxy state, showing that the quaternary structure of the tetramer is more sensitive to added volume at position E11 in the -chain than in the -chain. Partial saturation 1H-NMR spectra suggest a slight asymmetry of oxygenation for the rHbs, with earlier saturation of the -subunit. Auto-oxidation studies have shown that these mutants undergo faster oxidation than Hb A and exhibit a biphasic nature of auto oxidation. Study of these mutations enhances our understanding of the heme-pocket environment and will improve our understanding of the structure-function relationship of hemoglobin.

The Conditionalizing Identity Management Filter (CIMBaI)

Qirong Ho (Biological Sciences)
Advisor: Christopher Geyer (Robotics Institute)
Rangos 2 & 3
Sigma Xi Group 7, 10:15am

We present a large-scale data association tracker that can handle a variable number of targets. Large-scale data association problems arise in surveillance, wildlife monitoring, and applications of sensor networks. Several approaches have recently been proposed that represent the uncertainty in data association using a parameterized family of distributions on the set of permutations. Whereas these approaches were restricted to xed and known number of targets, we rigorously generalize these approaches to a variable number of targets. We also present a modification that allows one to focus on a set of targets of interest, while maintaining data association with all targets that may be confused with the original targets of interest. We justify the approach with an analysis and show experiments on a large-scale simulated tracking sequence.

The effects of memory enhancement drug: Bryostatin, on neurons in cultured brain slices

Ian Oldenburg (Biological Sciences)
Advisor: Justin Crowley (Biological Sciences)
Rangos 2 & 3
Sigma Xi Group 1, 10:30am

It is known that memory encoding involves complex molecular processes and result in physical changes in neurons. It has been shown that activation of Protein Kinase C, PKC, can enhance the longevity and encoding rate of new memories. It is becoming clear that dendritic spines, which make up the postsynaptic side of synapses, are modified as a result of learning events. Furthermore, there is evidence to suggest that PKC can duplicate the anatomical correlates of learning in vitro. The compound Bryostatin is a known activator of PKC. I am using Bryostatin to artificially activate PKC in live organotypic brain slices in order to observe morphological changes in the spines of individual neurons labeled with fluorescent proteins. We track the number and shape of these spines continuously for over an hour in time lapse two-photon experiments as well as in pairwise comparisons across experimental groups. Our in vitro and in vivo studies seek to analyze how PKC activation by Bryostatin increases the overall number of spines in multiple brain regions and alter the shape of these spines.

The Isolation and Purification of a Molecularly Engineered Biosensor to be Used in Asthma Patients

Jonathan Scholl (Biological Sciences)
Advisor: Gordon Rule
Rangos 2 & 3
Sigma Xi Group 2, 11:15am

A previously engineered single chain variable fragment (scFv) was designed to bind with a fluorescent dye in order to act as a biosensor. The protein/dye complex was intended to fluoresce once bound to the carbamate bonds that are created by isocyanates. Because occupational asthma results from exposure to isocyanates, this molecularly engineered biosensor will detect the isocyanate reaction products in a patient with occupational asthma. The scFv was purified using various affinity chromatography and isolation methods. Once the purified protein was obtained, compatible binding to the TO1-dye was tested. Finally, trials were conducted to crystallize the protein so that its exact molecular structure could be determined using nuclear magnetic resonance (NMR).

The Role of Experience in the Other-Race Effect

Kimberly Parks (Biological Sciences)
Advisor: Lynne Reder (Psychology)
Rangos 2 & 3
Sigma Xi Group 8, 10:45am

The Other-Race Effect (ORE) refers to the phenomenon that people are better at recognizing people of their own race. One possible explanation is that greater experience at processing faces of one's own race makes it easier to encode same-race faces, thereby increasing the likelihood that the face will be remembered later. To test the encoding and experience account, subjects in this experiment were asked to view two faces side by side (and judge which face seemed more tired). The two faces in a display could be both Asian, both White, or one of each. Later subjects were given a surprise recognition test that involved presenting one face at a time and deciding whether that face had been part of the previous tiredness judgment phase. We hypothesized that performance would be better for faces that matched the race of the participant, but this advantage would be modulated by the subject's prior experience with the other race faces and would also be affected by the race of the comparison face presented during the encoding (tiredness judgment) phase. This hypothesis was supported but the pattern is complex. We included subjects that were white with limited exposure to other races (rural Oklahoma), whites with more exposure to other races (i.e., attending Carnegie Mellon University), Asian Americans, Asians with limited experience to white faces (only a few years experience outside Asian) and East-Indians.

The Structure and Properties of DHPC

Debtirtho Ghosh (Biological Sciences)
Deren Guler (Physics)
Advisor: Dr. Stephanie Tristram-Nagle (Physics)
Rangos 2 & 3
Sigma Xi Group 2, 10:15am

Dipon Ghosh and I, Deren Guler, will present a poster about the phospholipid dihexadecylphosphatidylcholine, DHPC. We have been investigating many of the physical and thermodynamic propoerties and have been working to determine the structure of the lipid. We will be presenting the results of all of our experiments and explaining how we have reached our conclusions. We will also give an overview of the various techniques we have used for analysis. We have explored the various applications of our research and will be adding this to our poster to give the viewer a better idea of how our project ties into the fields of biophysics, medicine, and others.

A study of the effect of copper concentration on the polydispersity index in atom transfer radical polymerization

Allison Hannan (Chemistry)
Laura Mueller (Chemistry)
Advisor: Kris Matyjaszewski
Rangos 2 & 3
Sigma Xi Group 3, 11:00am

Synthesis of polymers with specific polydispersity indexes (PDI) is a key focus of polymer research. Currently, a theoretical relationship exists for PDI, which relies upon the concentration of the deactivator as well as the initiator and reaction conversion. This project seeks to find a relationship between specific reaction conditions and PDI for atom transfer radical polymerizations (ATRP) of styrene (St), methyl methacrylate (MMA) and n-butyl acrylate (BA). Through the use of activators regenerated by electron transfer (ARGET) ATRP, polymer synthesis is realized at initial Cu(II) concentrations of 1, 5, 10 and 50 ppm. Gel Permeation Chromatography (GPC) and Gas Chromatography (GC) are used to monitor the reactions and determine the PDI at specific conversions. Polymerizations of these monomers are also simulated through use of the PREDICI modeling program at Cu(II) concentrations of 1, 5, 10, 25, 50, 75 and 100 ppm. The PDI of these simulations are recorded at 25%, 50% and 75% conversion and compared to experimental results. Through this comparison, a relationship between the concentration of copper deactivator and PDI is determined.

Currency Reader for the Blind - Color Detection Chip

Jared Ross (Chemistry)
Advisor: Mark Friedman (Biomedical Engineering)
Rangos 2 & 3
Sigma Xi Group 3, 11:45am
Wright
Oral 11, 4:00pm

US currency is one of few that that does not incorporate a tactile feature to allow blind individuals to distinguish different denominations. The only device currently on the market that can perform this function is too slow to be easily used, and is too costly for the average blind person's budget. Using a unique fluorescence detection method, with established proof of concept, we plan to develop a simple and inexpensive devise to allow blind and visually-impaired individuals to identify the four most common denominations of US currency and provide audio or vibratory feedback to the user. By using off-the-shelf electronic components we plan to keep costs low enough, such that the device could be introduced to the retail market at or below $100 dollar price point.

Investigation of Biomacromolecules by Mass Spectrometry

Michele Anthony (Chemistry)
Advisor: Dr. Mark Bier (Chemistry)
Hoch Commons-2nd Floor, Rangos side
12-2:30

Two methodologies were used to study biomacromolecules by mass spectrometry (MS). A heavy ion mass spectrometer based on matrix-assisted laser desorption ionization/ time of flight mass spectrometer (MALDI TOF MS) with a cryodetector (Macromizer) will be used to analyze Mega Dalton mass ions directly and a heated capillary reactor was built and coupled to our ion electrospray trap mass spectrometer to study biomacromolecular thermal fragmentation. I studied both the capabilities of the heavy ion mass spectrometer to analyze large complex molecules and/or molecular complexes and the capability to break apart these complexes. I analyzed several potential macromolecules such as von Willenbrand protein complex, ferritin at 900 kDa, and Q-dot complexes and antibody/antigen complexes.

Optimization Algorithms for Hull Design

Ryan Yates (Mechanical Engineering)
Chunkit Yu (Electrical & Computer Engineering)
Riddhi Roy (Chemistry)
Andrew Moore (Mechanical Engineering)
Michael Barako (Undecided)
Advisor: Susan Finger (Civil Engineering)
Hoch Commons-2nd Floor, Window side
12-2:30

Finding the optimum design of a boat hull is difficult because there are many parameters that affect the overall hull performance such as the hull's width. One design approach would be to build models by varying physical parameters. Instead, this research aims to generate an alternative using software models. Using Computational Fluid Dynamics (CFD) software allows us to compute performance values such as drag force and lateral stability. Combining all of these values can produce an overall rating of a hull's performance. Finding the design which yields the greatest performance requires the use of CFD analysis over and over again. The use of a brute force approach to iteratively alter each physical parameter would result in too many combinations to be evaluated. With a response surface approach, we can create an optimization process to maximize a hulls performance using less CFD analysis. Through this research, we will learn how to optimize a hull design where many parameters make brute force techniques impossible.

Reduction of Au25 Nanocluster Cations by Micellar Electric Field Induction

Gerentt Chan (Chemistry)
Advisor: Rongchao Jin
Rangos 2 & 3
Sigma Xi Group 3, 10:15am

Gold Au25 nanoclusters have been developed to investigate physical and chemical properties that are distinct from bulk material. Here we show that cationic Au25 nanoclusters can undergo a chemically induced transformation to an anionic form via encapsulation with polyalkyl ammonium halide micelles. Here we report the photospectroscopic and physical effects of micellar composition variation.

Synthesis and Study of Multivalent Binding Peptides for the Detection of Spores

Jenny Kim (Chemistry)
Sabrina Lusvarghi (Chemistry)
Advisor: Bruce Armitage (Chemistry)
Rangos 2 & 3
Sigma Xi Group 2, 10:45am

Bacillus anthracis is a pathogenic bacterium which can cause the life-threatening disease called anthrax in animals and humans. Inhalation is the most serious form of the disease, therefore developing devices that can quickly detect the spores of such infectious bacteria is crucial for protecting human health. As a detection method, Biotinylated Tetrapeptide (BTP), which is able to bind Bacillus subtilis, a simulant of anthrax, was synthesized and characterized by reversed-phase HPLC and MALDI mass spectrometry. The significance of BTP lies on its four separate contacts which should significantly raise the affinity relative to the control peptide having only one contact point. In order to test the binding ability of BTP to spores, BTP was bound to fluorescently labeled streptavidin (F-STA) at first and then the spores were bound to the BTP-F-STA complex. Fluorescence intensity of the samples with the different concentration of the BTP-F-STA complex was measured by flow cytometer. Based on the results, 50% of the binding seems to occur at about 2 nM of the BTP-F-STA complex, which is a strong binding value. Also, fluorescence intensity of the BTP-FSTA complex is much higher than that of the complex with the control peptide with a random sequence. However, nonspecific binding of spores to the BTP-F-STA complex was evident at much higher concentrations of the BTP-F-STA complex. Further analysis of the data is expected after obtaining the additional data of the different control peptides.

The Analysis and Classification of Condensed-Phase Oxidation Products from the Ozonolysis of Limonene

Christina Maksymiuk (Chemistry)
Advisor: Neil Donahue (Chemistry)
Rangos 2 & 3
Sigma Xi Group 3, 11:30am

Limonene, a terpene that is the main component of the essential oil extracted from citrus rind, has considerable industrial use as a key ingredient in household products such as citrus air fresheners and cleaners. It is also one of the major organic compounds emitted directly into the air by vegetation. Ozone is a strong oxidizing agent that attacks the two double bonds of limonene to yield condensed-phase oxidation products, or secondary organic aerosol (SOA). These atmospheric aerosols have adverse visibility, climate, and health effects. Our results support the hypothesis that under excess limonene conditions, the endo-cyclic double bond of limonene is oxidized rapidly in the gas phase, and the exo-cyclic double bond is subsequently oxidized by heterogeneous uptake of ozone to fresh, unsaturated aerosol. Spectroscopic evidence shows that under excess limonene conditions, oxidation of the exo-cyclic double bond is suppressed, leading to secondary organic aerosol with a high degree of unsaturation. Decreasing the limonene to ozone ratio shows both a proportional decrease of unsaturation signal intensity and strong evidence for secondary ozonide formation from condensed-phase products of the initial oxidation of limonene's endo-cyclic bond. Analysis of 1HNMR and 13C HSQC spectra used in parallel with spectra-predicting software led to the identification and classification of major products and generalized functionality of a diversified mixture of aerosol formed under varying concentrations of limonene and ozone.

Thermal Stability of Various Hybrid Inorganic-PNA Complexes

Mark Langille (Chemistry)
Advisor: Dr. Catalina Achim (Chemistry)
Rangos 2 & 3
Sigma Xi Group 3, 11:15am

A great deal of everyday technology has been enhanced by the miniaturization of silicon-based electronics. Modern day technology is based on silicon's use as a semiconductor in electronic circuitry. Over time, technological advances in reducing the size of silicon-based technologies have resulted in the production of devices such as the personal computers and MP3 players which have an integral role in our lives. However, the increasing need for a higher information storage capacity can no longer be fulfilled by miniaturization of silicon-based electronics. A solution to this problem can be found in a bottom-up strategy to creating devices through the organization of molecules, which have a thousand times smaller dimension than their silicon counterparts. My research explores hybrid metal-nucleic acid supramolecular assemblies as candidates for novel electron transfer devices. The thermodynamics of complex formation is being investigated to better understand the factors affecting the stability of these devices for their use in practical applications.

Top-Down Atmospheric Thermal Dissociation of Proteins Using Electrospray Ionization Mass Spectrometry

Kevin Anderson (Chemistry)
Catherine Vinci (Chemistry)
Advisors: Dr. Mark Bier (Chemistry)

Protein fragmentation is essential for mass spectrometric identification and structural determination. We propose to develop an improved thermal method for top-down proteomics. Proteins that have been ionized by electrospray ionization will be sprayed into a ceramic tube that is heated electrically to temperatures sufficient for thermal fragmentation. The fragments near atmospheric pressure will then enter into a mass spectrometer for detection and analysis, leading to structural characterization of the proteins and or protein identification without the requirement of a prior trypsin digestion.

David Sipe
Hoch Commons-2nd Floor, Rangos side
12-2:30

MATHEMATICS

A Comparison of Models for Overdispersed Insurance Data

Aaron DePonceau (Statistics)
Jeffrey Dunn (Mathematics)
Steve Karolyi (Business Administration)
Rohan Chatterjee (Scholars Program for Humanites)
Akshaya Jha (Statistics)
Advisor: Tanzy Love (Statistics)
Kirr Commons-1st Floor, Window side
12-2:30

Despite their seemingly simple nature, insurance claim count data remain difficult to model effectively. The two models used in practice, Poisson and negative binomial, fail to capture the overdispersion exhibited in the tails of the empirical distributions. This study evaluated fits of the geometric and relatively unknown Conway-Maxwell Poisson (CMP) distributions against the aforementioned standard models for two separate insurance datasets. Although the CMP failed to capture the deviations more accurately than the negative binomial, the geometric exhibited significant improvement over the Poisson. Due to its appealing statistical properties and interpretability, the results suggest that the geometric distribution may remain a viable alternative.

Automated Proofs in Set Theory

Alexander Smith (Mathematics)
Advisor: Wilfried Sieg
Dowd
Oral 5 1:20pm

Finding a proof is often opaque and difficult even for mathematicians, yet there are methods and techniques that may be employed to find proofs quickly and efficiently. AProS, an automated theorem prover, finds proofs in a first-order natural deduction calculus using a set of strategies that produces natural, human-like proofs. I will explain an extension of these strategies to Zermelo-Fraenkel set theory, demonstrating that this method can be used to do "real mathematics" and that with it we can learn more about the process of mathematical inquiry.

Detection of X-Ray Sources

Jason Waddell (Mechanical Engineering)
Jeremy Doo (Economics)
So Young Park (Mathematics)
Gregory Hallenbeck (Physics)
Advisors: James Delaney (Statistics)
Peter Freeman (Statistics)
Hoch Commons-2nd Floor, Window side
3-5pm

We analyze two-dimensional binned images of x-ray levels from satellite-based cameras. Our project seeks to detect and classify x-ray sources amidst a field of varying background levels, noise, which can be modeled by the Poisson distribution. We have developed algorithms that produce unbiased background estimates across the matrix and identify source pixels. As sources often cover multiple pixels, these identified source pixels are then grouped and clustered. This clustering allows us to make inferences on each source in our image, listing an x-ray source's total brightness, size, and location.

Diamond Project

Anson Wang (Mathematics)
Advisor: Carlos Guestrin (Undecided)
Hoch Commons-2nd Floor, Window side
12-2:30

Over the summer I worked on research involving motion sensing. The goal was to create a scalable motion sensing system that related the information to the computer, displayed the information in an easy to read form, then record the data.

Do different students learn at different rates?

Jennie Shoemaker (Statistics)
Rebecca Radkoff (Economics)
Davis Woo (Statistics)
Hyung Jae Kim (Mathematics)
Advisors: Brian Junker (Statistics)
James Delaney (Statistics)
Elizabeth Ayers (Statistics)
Wean Commons-1st Floor, Connan side
12-2:30

This semester we have been working with the HCI and statistics departments to analyze the effectiveness of the web based standardized testing assistance tool "Assistment". We are looking at data from several hundred eighth graders in Massachusetts who have been using the tutoring program to help improve their scores on the statewide MCAS exam. Our project focuses on examining the learning curves for both individual students and particular skills taught by the program. In order to do this we are running a logistic regression algorithm to determine the probability for success for each student on each problem. Our goal is to show for what skills and demographics "Assisment" is useful, and for what skills and demographics it needs improvement.

Efficient Representations of Partially Ordered Knoweledge Structures

Eileen Tucker (Mathematics)
Advisor: Brian Junker (Statistics)
Rangos 2 & 3
Sigma Xi Group 7, 11:30am

Test questions and other cognitive tasks can be arranged in a partial ordering according to prerequisites (e.g. for most people, solving linear equations is prerequisite solving a quadratic equations, but there may be no prerequisite relationship between these tasks and formally differentiating polynomials). These relationships can be discovered from data using methods similar to cluster analysis. This project explores efficient ways to represent such partial orders in terms of a bipartite graph linking skills and other hypothetical pieces of knowledge to test questions and other cognitive tasks.

Estimating Early Exercise Premiums in Cash Settled American-Style Options

Jeremy Doo (Economics)
Martin Nemaric (Mathematics)
Advisor: James Delaney (Statistics)
Kirr Commons-1st Floor, Window side
3-5pm

In many American-style options, there is an inherent "wildcard" option at the end of the trading day. Option holders are allowed to lock in the closing price of an underlying security for 15-30 minutes after trading stops. We model the frequency distribution of the underlying price changes during this time in order to estimate the daily early exercise premium of index options. We also extrapolate upon this to address larger time periods.

Event Detection in Crowded Videos

Elaine Lee (Mathematics)
Advisor: Martial Hebert (Robotics Institute)
Rangos 2 & 3
Sigma Xi Group 7, 11:00am

Video technology has grown substantially, however it still remains challenging to efficiently obtain useful information from footage. A particular difficulty is event detection in crowded settings. While it is a relatively facile task for a human, it is also very time consuming. We instead utilize computational capabilities in conjunction with image segmentation principles to develop algorithms for processing video footage and detecting events of interest. A sample of video segmentation algorithms were executed on videos of crowded settings, the results of which were compared to determine the advantages of each algorithm, be it for a particular event or a particular setting.

Galaxy Classification Using SDSS Spectra

Shawn Yoon (Statistics)
Michael Wang (Business Administration)
Sergey Bystritskiy (Mathematics)
Gerry Llaque (Mathematics)
XiaYi (Sandy) Shen (Electrical & Computer Engineering)
Advisor: James Delaney (Statistics)
Hoch Commons-2nd Floor, Rangos side
12-2:30

The primary problem under investigation is to accurately and automatically classify galaxies into either the star-forming or active galactic nuclei categories. Shawn Yoon, Sergey Bystritskiy, Xiayi(Sandy) Shen, Michael Wang, and Gerry Llaque worked together to create a program in R to automate the processes of classifying galaxies based on wavelength data collected from the Sloan Digital Sky Survey(SDSS). Part of the data is in the form of a continuum which is the underlying distribution of background "noise" in galaxies. There are also various emission lines which come from emitted photons from galaxies. Our code is designed to fit a distribution of the continuum while overlaying a normal distribution to model the emission spike.

Taking the ratios of the area under the distribution, we can then begin to classify the type of galaxy we are viewing.

Natural Language Processing in Finance

Dimitry Levin (Mathematics)
Advisors: Noah Smith
Shimon Kogan
Bryan Routledge
Rangos Hallway, 2nd Floor
12-2:30

Volatility is a measure of how risky a stock is. Predicting and understanding volatility is one of the central problems in finance and is critical to portfolio management and option pricing. Previously, most techniques to predict future volatility have relied solely on past stock returns. While generally effective, such techniques can fail to see large changes in volatility and are fairly “black box”, in that they do not give much intuitive explanation to their predictions. In this project, we attempt to predict or explain the volatility of a stock based on the text of that company's financial report in a given year. Using support vector regression on word counts, we create a model that reads financial reports and predicts future volatility. While our model does not currently perform as well as a simple baseline that predicts volatility in year T to be the same as in year T-1, it does foresee large changes in volatility more effectively. Furthermore, it allows us to see which words in financial reports tend to suggest how risky a company will be.

Removing the Physiological Effects of the Brain

Ryan Sieberg (Mathematics)
John Scarfutti (Scholars Program

It is very difficult to simplify the complexity of the brain, and to take reasonable measurements of it. Several tools are available to measure functions of the brain. Our project examines the effectiveness of optical imaging in identifying brain activity. However, as many physiological effects obscure the true response to particular stimuli, these factors must be identified and addressed.

for Humanites)
Emil Shalmiyev (Statistics)
Martin Nemaric (Mathematics)
Shawn Mankad (Mathematics)
Advisors: William Eddy (Statistics)
Tanzy Love (Statistics)
Kirr Commons-1st Floor,
Window side
12-2:30

We applied statistical methods to recognize the underlying periodicity of various major obfuscating effects, leading us to conclude that optical imaging indeed reveals the brain response to visual stimuli.

The Statistics of Jury Awards

Michael Dorko (Mathematics)
Mario Nunez (Statistics)
Advisor: Joseph Kadane
Rangos 2 & 3
Sigma Xi Group 7, 10:00am

The Supreme Court has ruled that District Courts must do an analysis of jury "pain and suffering" awards to see if the awards are too large. One such analysis was conducted by Judge Jack Weinstein in the case Geressy v. Digital Equipment Corporation (980 F. Supp. 640, 1997 US District Court). Judge Weinstein found 27 comparable cases, and analyzed the data using an (arguably inappropriate) normal distribution. The purpose of this project was then to find a more appropriate distribution to fit the given data and provide what the 95th percentile would be under the estimated distribution in order to determine at what point awards become "too large."

Using Assistment Measures to predict Student Proficiency

Eileen Tucker (Mathematics)
Mary Grace DeForest
(Mathematics)
Siu Him Kenneth Ip (Statistics)
Katherine Kardaras (Mathematics)
Mike Carney (Statistics)
Advisors: Brian Junker (Statistics)
Tanzy Love (Statistics)
Kirr Commons-1st Floor,
Window side
12-2:30

The ASSISTment system, an online benchmark testing system has been implemented by the State of Massachusetts to help students prepare for the Massachusetts Comprehensive Assessment System (MCAS) exams. The system guides students through the performance of solving appropriate grade-level mathematics problems. Using data from the 2004-2005 school year for 200 student scores on the 8th grade math tutorial, we explored the ability to use the Assistment tutor to predict students MCAS score. Given various parameters of students' performance, including speed, answers correct, number of questions attempted, and hinting metrics, we derive the difficulty level for each question that the students encountered. Using their results on these particular mathematics problems, we aim at finding the best fitting model to predict a student's proficiency score in the MCAS exam.

Using Clinical Data to Evaluate Gait and Balance in Patients

Shijong Ng (Electrical
& Computer Engineering)
Kelly Koser (Mathematics)
Iulia Degeratu (Statistics)
Margaret Hebner (Mathematics)
Advisors: Rebecca Nugent
(Statistics)

As today's population grows older and less independent, there is an increased risk of both hospitalizations and falls associated with a wide range of health factors. When doing this project, we want to determine which factors will accurately predict a patient's risk for future falls and hospitalizations. Information regarding demographics, lifestyle, and past and present health problems was recorded for 184 clinical outpatients. Each patient took a Tinetti test, a short, low impact physical test to determine one's overall health and independence based on a scale from zero to twenty-eight, and their gait speed was measured. Using correlations between variables and linear and logistic

Marnie Bertolet (Statistics)
Wean Commons-1st Floor, Connan side
12-2:30

regression models, we are better able to predict a patient's Tinetti test score or gait speed, thus helping to predict whether or not a patient will have a fall or hospitalization in the nearfuture.

Using Statistical Techniques to Improve Disease Classification

Ryan Sieberg (Mathematics)
Advisor: Rebecca Nugent (Statistics)
Wean Commons-1st Floor, Connan side
3-5pm

When faced with a patient who suffers from breathing and pulmonary difficulties, a physician may order one or more pulmonary function tests to obtain information about the patient's lung function. These tests most commonly include non-invasive spirometry measures such as the amount of air exhaled in the first second of breathing, the total amount of air that can be forced out of the patient's lungs, total lung capacity, and the amount of air exhaled in the middle 50% of the breath's duration. These measures are standardized by the patient's height, weight, gender, and race to be "percent of predicted value" so that patients' values can be compared to commonly accepted standards across weight, age, and gender. Using rules of thumb, the physicians diagnose the patient as having an obstructive disease, a restricted disease, a combination of restricted with small airway disease, or no pulmonary disease. However, these rules can lead to a huge proportion of misclassification of disease; currently there is little published research showing effective statistical alternatives to these rules of thumb. We have been exploring combining statistical techniques and clustering algorithms with medical expertise to diagnose patients using data obtained from non-invasive pulmonary function tests. We also examine the sensitivity of the classification in order to optimize correctly identifying patients with pulmonary disease without misclassifying healthy patients. With this work, we hope to decrease current misclassification rates which will save hospitals and patients unnecessary expense and trauma. This interdisciplinary research is in collaboration with the statistics department at Carnegie Mellon University and the Department of Internal Medicine at Texas Tech University Health Sciences Center in Lubbock, Texas.

Walking to Work: A Longitudinal Analysis of Walking Patterns

Julie Savitt (Mathematics)
Charity Chen (Psychology & Statistics)
Joshua Jelin (Mathematics)
Karina Alvarez (Statistics)
Advisors: Joel Tarr
Marnie Bertolet (Statistics)
Chris Hendrickson
Wean Commons-1st Floor, Connan side
12-2:30
Class of '87
Oral 11, 4:00pm

We identified factors that effect an individual's probability of walking to work instead of other means of transportation using the 1990 and 2000 Census and the Allegheny County Real Property Inventory [Catalogue] (1937). The variables of interest include: socioeconomic status, population in a given area, other availablemethods of transportation such as: bus, driving, bicycle, and motorcycle, and household size. Preliminary linear regression models indicated that in 1999 and 2000, income, household size, and the percentage of neighbors that drove significantly predicted whether an individual walked to work. To analyze the three datasets together, linear mixed-effects models will be used to determine longitudinal relationships.

A Study and Application of the Magnetic Field of Leaky Solenoids

Maxwell Hutchinson (Physics)
Benjamin Morse (Electrical & Computer Engineering)
Advisor: Gregg Franklin (Physics)
Rangos 2 & 3
Sigma Xi Group 4, 10:45am

Solenoids are widely used as basic inductors and electromagnets. This study serves to model solenoids of spatially varying wrapping density computationally and derive a simple analytic approximation that is valid for most points within the solenoid. An iterative model is used. It is found that the axial field is directly proportional to the wrapping density, and the radial component of the field is directly proportional to the radial position and the spacial derivative of the wrapping density. The scope of the approximation is found to be similar to that of the long solenoid approximation.

One can conceive of using a solenoid of these properties to linearly accelerate a conducting core. The proposed system is computationally modeled. The model qualitatively confirms the acceleration, and provides a framework for optimizing the effect. A physical model is produced and tested. Results of the physical model are pending.

Cooperative Manipulation in a Robot Colony

Kevin Woo (Electrical & Computer Engineering)
Eugene Marinelli (Computer Science Department)
Gregory Tress (Electrical & Computer Engineering)
James Kong (Electrical & Computer Engineering)
Jaime Bourne (Mechanical Engineering)
Jason Knichel (Computer Science Department)
Austin Buchan (Electrical & Computer Engineering)
Brian Coltin (Computer Science)
Justin Scheiner (Electrical & Computer Engineering)
Siyuan Feng (Computer Science)
Christopher Mar (Electrical & Computer Engineering)
Bradford Neuman (Physics)
Advisor: George Kantor (Robotics Institute)
Rangos 2 & 3
Sigma Xi Group 4, 11:45am

Object manipulation and interaction with the environment is a critical application in the field of mobile robotics. In situations where multiple robots cooperate, sensor data can be shared allowing any robot within the colony to find objects located by other robots. Once an object is identified, robots can cooperatively manipulate the object by coordinating movement. While many current robots utilize vision to aid with object detection, this incurs a prohibitive cost for many researchers. By developing the necessary sensory capabilities and coordination algorithms based on inexpensive light sensors, the Colony Project has demonstrated that cooperative manipulation can be feasibly performed within a low-cost robot colony.

Detection of X-Ray Sources

Jason Waddell (Mechanical Engineering)
Jeremy Doo (Economics)
So Young Park (Mathematics)
Gregory Hallenbeck (Physics)
Advisors: James Delaney (Statistics)
Peter Freeman (Statistics)
Hoch Commons-2nd Floor, Window side
3-5pm

We analyze two-dimensional binned images of x-ray levels from satellite-based cameras. Our project seeks to detect and classify x-ray sources amidst a field of varying background levels, noise, which can be modeled by the Poisson distribution. We have developed algorithms that produce unbiased background estimates across the matrix and identify source pixels. As sources often cover multiple pixels, these identified source pixels are then grouped and clustered. This clustering allows us to make inferences on each source in our image, listing an x-ray source's total brightness, size, and location.

DHPC Research Project

Deren Guler (Physics)
Advisor: Dr. Stephanie Tristram-Nagle (Physics)
Hoch Commons-2nd Floor, Rangos side
12-2:30

Phospholipids form lipid bilayers which are the underlying structure of every plant and animal cell membrane. It is of great interest to correlate lipid structural differences with biological function. Ether lipids occur in all types of biological tissues primarily as plasmalogens, where the first hydrocarbon chain is attached via an ether linkage, while the second hydrocarbon chain is attached via the more common ester linkage. Our work studies the model lipid dihexadecylphosphatidylcholine, DHPC, which has both hydrocarbon chains attached via ether linkages. We compare DHPC to the well-studied ester-linked phospholipid DPPC, which is the primary lipid in the lung. The study uses data collected by low-angle (LAXS) and wide-angle (WAXS) x-ray synchrotron scattering. We find that fully hydrated oriented samples of DHPC exhibit diffuse low-angle scattering, like DPPC, which allows for determination of the material moduli, KC (the bending modulus) and B (the compressibility modulus), using non-linear fitting methods developed in the Nagle lab. We also determine the structure (electron density profiles) of DPPC and DHPC in both the non-interdigitated and interdigitated gel phases, and in the biologically relevant fluid phase. Through our collaboration with Drs. Zeidel and Mathai at Harvard Medical School, we compare our determined areas for DHPC and DPPC with permeability of water through membranes.

Effects of Radiation Reaction in Finite-Sized Objects

Christopher Brust (Physics)
Advisor: Ira Rotshtein (Physics)
Hoch Commons-2nd Floor, Rangos side
12-2:30

I will discuss the effects of the radiation reaction in finite-sized objects, and discuss various generalizations applicable to the upcoming LIGO experiments.

High Energy Cosmic Ray Experiment Design

Matthew Urffer (Physics)
Advisor: Manfred Paulini (Physics)
Hoch Commons-2nd Floor, Rangos side
12-2:30

Using high energy cosmic ray software to simulate skimming tau neutrinos.

High speed data capture card for radio astronomy

Stephen Schweizer (Physics)
Advisor: Jeff Peterson
Kirr Commons-1st Floor, Window side
3-5pm

A flexible and easily modifiable software interface designed for radio astronomy signal processing. The software performs fast Fourier transforms (FFT) and correlations using parallel and distributed techniques. The code is software and hardware optimized to run with high speed data capture cards. The design is both scalable and easily applicable to any field which does digital signal processing, whether it be radio, microwave, audio, or otherwise.

Homemade Electric Generators

Ryan Yates (Mechanical Engineering)
Christina Daup (Civil Engineering)
Heeyong Kang (Physics)
Advisor: Susan Finger (Civil Engineering)
Connan
12:30-4pm

This activity is designed to demonstrate a method of converting mechanical energy to electrical energy to middle school girls. Each team will assemble a basic electric generator with loops of copper wire, magnets, and a hand crank. Students will use the crank to manually spin the magnets in the center of several loops of wire. This changes the magnetic flux through the loops and current will flow through the wires. Students will learn that mechanical energy can be converted to electrical energy by using the induced current to operate electronics such as light bulbs.

Investigating Power Management in a Robot Colony

Kevin Woo (Electrical & Computer Engineering)
Eugene Marinelli (Computer Science Department)
James Kong (Electrical & Computer Engineering)
Aaron Johnson (Electrical & Computer Engineering)
Austin Buchan (Electrical & Computer Engineering)
Brian Coltin (Computer Science)
Justin Scheiner (Electrical &

Power management is a critical issue in the field of mobile robotics. Managing the supply of power for a team of robots becomes an increasingly difficult problem as the number of active robots increases. As the capabilities and complexity of robots increase, so do power requirements. The Colony project has worked to build a scalable power management platform upon which an increasingly large colony of robots can operate while efficiently completing its tasks. We focused our study on power management algorithms, including charging bay design and location, robot priorities, and battery charging.

Computer Engineering)
Siyuan Feng (Computer Science)
Christopher Mar (Electrical & Computer Engineering)
Bradford Neuman (Physics)
Advisor: George Kantor (Robotics Institute)
Pake
Oral 7, 2:00pm

The Physics of Figure Skating: A Computer-Aided Study of the Axel

Hayley Finley (Physics)
Advisors: Kunal Ghosh (Physics)
Richard Holman (Physics)
Wean Commons-1st Floor, Connan side
12-2:30
Pake
Oral 10, 3:40pm

The physics of the Axel figure skating jump is presented in an interactive computer program. A user learns how varying the initial speed impacts the height, rotational velocity, landing speed, distance covered and time in the air for the jump. This model of the Axel is based on data obtained from motion capture filming of figure skaters. The data set is generalized by using dimensional analysis and developing equations of motion. Modeling the jump yields a more thorough understanding of the dynamics than traditional comparisons of motion capture data.

The Structure and Properties of DHPC

Debtirtho Ghosh (Biological Sciences)
Deren Guler (Physics)
Advisor: Dr. Stephanie Tristram-Nagle (Physics)
Rangos 2 & 3
Sigma Xi Group 2, 10:15am

Dipon Ghosh and I, Deren Guler, will present a poster about the phospholipid dihexadecylphosphatidylcholine, DHPC. We have been investigating many of the physical and thermodynamic propoerties and have been working to determine the structure of the lipid. We will be presenting the results of all of our experiments and explaining how we have reached our conclusions. We will also give an overview of the the various techniques we have used for analysis. We have explored the various applications of our research and will be adding this to our poster to give the viewer a better idea of how our project ties into the fields of biophysics.

UNDECIDED

Neighborhood-Aware Networking

Dexter Rietman (IS)
Vijay Reddy (Undecided)
Advisor: Mike Kaminsky (Computer Science)
Rangos 2 & 3
Sigma Xi Group 6, 11:15am

Recently, there has been a trend for homes with broadband internet connections to install wireless networks to enable the use of the internet throughout the home. These 802.11 wireless networks have not yet been tapped as a means of networking between households in a neighborhood. We have collected map and connectivity data of wireless networks in Pittsburgh. This data will then be used to design and implement new network and application-level protocols and services that are "neighborhood-aware." This provides the benefits of a connection between homes that is faster than broadband internet and is becoming readily available.

COMPUTER SCIENCE

A Complete Robot AI System

Kaushik Viswanathan
(Computer Science)
Advisor: George Kantor
(Robotics Institute)
Wean Commons-1st Floor,
Connan side
12-2:30
Wright
Oral 5 1:20pm

This research seeks to capture the important features of human and animal intelligence and implement them on modern computers. Inspired by analyzing the human system, it intends to illustrate the importance of bringing together the different sub-fields of robotics and computer science. Interdependent modules - Perception, Control, Higher Intelligence along with a pervasive Associative Memory and Emotion system will serve as abstractions of similar features in animal intelligence. This is done in the belief that for a robot to perform even seemingly simple tasks in an autonomous, robust and efficient fashion, the backing of a complex system is required.

Current progress has been made on the Control module including low level actuator control, pattern generators and motor control programs; Perception including efficient reduction of a LIDAR image to a triangular mesh and quickly finding features in the environment to concentrate on; Associative Memory including objects and when and what to store and spatial maps. A simulation implementing most of these features has also been written.

A Hybrid Formulation of the Ordered Logical Framework

Chris Martens (Computer Science)
Advisor: Frank Pfenning
McKenna
Oral 1, 12:00pm

The logical framework LF is a powerful tool for encoding and carrying out the metatheory of logics and programming languages in a mechanized way. However, current work on LF has yielded little support for the metatheory of certain kinds of logic that are useful for reasoning about state. One fruitful approach (for the case of linear logic) has been to use hybrid logic, inspired by Kripke modal logic and temporal logic, to give the metareasoning tool access to how the object language context is being manipulated. The goal of this thesis is to apply the same approach to ordered logic, a setting capable of expressing even more constraints.

A Novel Input Device for Modeling 3D Computer Graphics - The Electric Clay

Peter Pong (Computer Science)
Yen-Wen Liu (Computer Science)
Advisor: Anind Dey (Human
Computer Interaction Inst.)
Hoch Commons-2nd Floor,
Window side
12-2:30

Motivated by a frustration with the limitations of conventional electronic input devices (such as the ubiquitous mouse and keyboard), we propose a novel input device, the "Electro-sphere", that allows users to input and control data through the use of a touch-sensitive sphere.

Advanced Maneuverability in a Human Operated and Autonomous Robot

Victor Marmol (Computer Science)
Jaime Bourne (Mechanical Engineering)
Advisor: William Messner
Rangos 2 & 3
Sigma Xi Group 6, 10:45am
Wright
Oral 6, 1:40pm

To build a robotic platform through which a variety of advanced drive systems can be tested. We have split our research into human controlled and autonomous operation. In human control we will experiment with drive and control systems to improve the efficiency of several current drive concepts. In the autonomous field we will implement a variety of sensors and sensor checking in order to successfully complete a line following course.

Analyzing EEG Signals For Use in Human-Aided Video Retrieval

Jonathan Wang (Computer Science)
Rangos Hallway, 2nd Floor
12-2:30

The Informedia Project's current Rapid Serial Visual Presentation (RSVP) -based video retrieval system relies on human input in order to attain more accurate results than would be possible using automated methods. Currently, the human operator of the system marks images that appear to be relevant to a given query by pressing a button on the keyboard. Although this is a simple and intuitive process for the operator, the time required to physically mark the image is much longer than the time required to simply recognize whether the image is relevant or not. One possible alternative to reduce the time lag would be to read the electroencephalogram (EEG) signals from the operator's brain to determine whether the operator believes an image to be relevant or not.

Several signal processing techniques were used to process the raw EEG data in order to extract appropriate features. These features were then analyzed using a variety of machine learning techniques, including logistic regression and decision trees, to create a classifier for these EEG signals.

ASME Student Design Project: Robotic Window Washer

Richard Pantaleo (Mechanical Engineering)
Victor Marmol (Computer Science)
Jaime Bourne (Mechanical Engineering)
James Forbes (Electrical & Computer Engineering)
Michael Menchaca (Mechanical Engineering)
Katherine Coste (Mechanical Engineering)
Benjamin Som-Pimpong (Mechanical Engineering)
Gaurav Verma (Undecided)

The ASME student design project is a group of undergraduate engineers and computer scientists who meet every year to compete in the ASME student design competition. This year the project was to build a robotic window washer while adhering to the ASME guidelines. Our group met that challenge and competed in the 2008 ASME regional conference which was held at Carnegie Mellon on April 5th.

Bradley Yoo (Undecided)
Justin Yi (Mechanical Engineering)
Paul Kim (Mechanical Engineering)
Bradley Hall (Mechanical Engineering)
Michael Cushman (Mechanical Engineering)
Jacob Coffelt (Mechanical Engineering)
Daniel Shope (Mechanical Engineering)
Advisor: John Wesner (Mechanical Engineering)
Kirr Commons-1st Floor, Window side
12-2:30
Dowd
Oral 2, 12:20pm

Assistive Automotive Intelligence Technology

Ethan Minogue (Electrical & Computer Engineering)
Ilya Kelner (Electrical & Computer Engineering)
Jason Mirra (Computer Science)
Advisor: George Kantor (Robotics Institute)
Rangos 2 & 3
Sigma Xi Group 4, 11:15am
Dowd
Oral 8, 3:00pm

Our project will be 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.

Automata Theory

Sam Tetruashvili (Computer Science)
Advisor: Klaus Sutner (Computer Science Department)
Rangos Hallway, 2nd Floor
12-2:30

General overview of automata theory, with emphasis on minimization algorithms and search algorithms.

Autonomous Quad-Rotor Helicopter Stability Control

Daniel Pehush (Electrical & Computer Engineering)
Ilya Brin (Undecided)
Frank Costello (Computer Science)
Gaurav Verma (Undecided)
Paul Desiderio (Mechanical Engineering)
Scott Ridel (Mechanical Engineering)
Rajit Kumar (Electrical & Computer Engineering)
Advisor: William Messner
Hoch Commons-2nd Floor, Window side
3-5pm

This project will develop a flight controller for an autonomous quad-rotor helicopter, in order to maintain stable flight. This proposal is being presented with two other grants in order to develop a functional autonomous helicopter. A quad-rotor helicopter is a modification of the conventional-single rotor helicopter configuration. The quad-rotor helicopter has four motors arrange in at the corners of a square, each of which turns its own rotor independently. The sum of the thrusts from the four rotors produces the thrust perpendicular to the plane of the rotors. The difference in the thrusts from the left and right rotors produce a pitch moment. The difference in the thrusts from the front and back rotors produce a roll moment. The pitch and roll dynamics of the quad-rotor helicopter are inherently unstable, and thus active control of the rotor speeds is needed to produce stable flight. This will be achieved through the use of a gyroscope for sensing angular velocity and accelerometer for sensing orientation and angular velocity in tandem with a stabilizing control scheme, which will be implemented upon a gumstix© miniature motherboard.

Battleship Project

Peter Edge (Computer Science)
Advisor: Leigh Ann Sudol (Computer Science)
Rangos Hallway, 2nd Floor
12-2:30

Designed and implemented project for introductory computer science students, letting students use their own algorithms to compete against each other online.

BlackSheep: Inferring White-Box Application Behavior Using Black-Box Techniques

Jiaqi Tan (Computer Science)
Advisor: Priya Narasimhan (Electrical & Computer Engineering)
McKenna
Oral 3, 12:40pm

We describe and evaluate a new technique for diagnosing performance problems in distributed systems in a scalable manner by exploiting and analyzing only local (i.e. intra-node) black-box system metrics, and inferring white-box application behavior. We study the novel method of correlating white-box application event logs with black-box system metrics to gain insight into the behavior of a distributed system, and validate our approach through experiments on the Hadoop open-source implementation of Google's Map/Reduce distributed programming model. We inject failures and real performance problems gathered from failure data recorded in Hadoop's bug database.

Combining Wireless Network Emulation and Simulation

Samuel Burnett (Computer Science)
Advisor: Peter Steenkiste
McKenna
Oral 4, 1:00pm

When developing new wireless networking technology, researchers often use network simulators and testbeds to perform experiments that demonstrate the correctness of their wireless systems. These experimentation platforms are often inccaruate or unscalable. We present a general method of combining wireless network experimentation platforms in order to improve accuracy and scalability. This technique is verified using a proof-of-concept system that combines two existing network experimentation platforms.

Contextual Web History - Spring 2008

Sungjoon Won (Computer Science)
Jing Jin (Computer Science)
Advisor: Jason Hong (Human Computer Interaction Inst.)
Kirr Commons-1st Floor, Window side
12-2:30
Wright
Oral 9, 3:20pm

People browse the web in a complex order, following multiple links per website, especially when they are searching for information. However, the browser's navigation and history only support a one dimensional, chronological view of the user's activity. It is time-consuming and difficult for the user to keep track of and to recall visited websites. In this project, we explored efficient ways for users to retrace their steps by designing, building, and user-testing an alternative solution.

Cooperative Manipulation in a Robot Colony

Kevin Woo (Electrical & Computer Engineering)
Eugene Marinelli (Computer Science Department)
Gregory Tress (Electrical & Computer Engineering)
James Kong (Electrical & Computer Engineering)
Jaime Bourne (Mechanical Engineering)
Jason Knichel (Computer Science Department)
Austin Buchan (Electrical & Computer Engineering)
Brian Coltin (Computer Science)
Justin Scheiner (Electrical & Computer Engineering)
Siyuan Feng (Computer Science)
Christopher Mar (Electrical & Computer Engineering)
Bradford Neuman (Physics)
Advisor: George Kantor (Robotics Institute)
Rangos 2 & 3
Sigma Xi Group 4, 11:45am

Object manipulation and interaction with the environment is a critical application in the field of mobile robotics. In situations where multiple robots cooperate, sensor data can be shared allowing any robot within the colony to find objects located by other robots. Once an object is identified, robots can cooperatively manipulate the object by coordinating movement. While many current robots utilize vision to aid with object detection, this incurs a prohibitive cost for many researchers. By developing the necessary sensory capabilities and coordination algorithms based on inexpensive light sensors, the Colony Project has demonstrated that cooperative manipulation can be feasibly performed within a low-cost robot colony.

Design and Implementation of an Ink-based Communication Program

I am designing an ink-based interface through which two tablet PC users can communicate with each other using drawing and writing. The project also involves shape and curvature recognition, human computer interaction

Caitlin Johnson
(Computer Science)
Rangos Hallway, 2nd Floor
12-2:30

components, and the use of Microsoft Ink resources.

DiaWear: Wearable Food and Activity Recognition System for Diabetes Patients

Geeta Shroff (Computer Science)
Advisor: Asim Smailagic
Rangos 2 & 3
Sigma Xi Group 6, 11:30am
McKenna
Oral 5 1:20pm

DiaWear is a wearable food and activity recognition system to monitor and aid medical patients with respect to calorie intake and consumption. Such a system is ideal for diabetes patients, as well as pancreatitis, and other patients with dietary restrictions. This system may also find use in fitness and weight management. Gathering data from sensors placed on different parts of the body using existing platforms such as the CMU e-Watch and the CMU ArmBand, and by using a cell phone equipped with accelerometers, information regarding the activity and exercise of the user will be recorded and analysed via machine learning algorithms. As part of an Undergraduate Senior Thesis project, the student has developed a context-aware Neural Network based approach for food recognition. The student has also studied the value in using contextual information to minimize user interaction time with DiaWear using CogTool. A cell phone based client-server model has also been implemented. User studies will be conducted shortly. Our system allows the user to take pictures and relays the corresponding calories. This allows the system to monitor and assist the user regarding calorie intake and management of their disease and health on a regular basis. Recorded data will also help medical professionals to provide more accurate forms of treatment and medications. =

Discovering Tractable Cellular Automata Questions

Kevin McInerney
(Computer Science)
Advisor: Klaus Sutner (Computer Science Department)
McKenna
Oral 6, 1:40pm

Cellular automata(CA) are a powerful computational device. CA's are interesting in that computation on a CA is both local and massively parallel. Moreover, even for complex, Turing-complete CA's the rule set is small and easily implementable on hardware. Using prepositional logic with the "steps to" relation, we can ask rather complex questions about the CA state space, such as: "Is this CA reversable?" "Does this CA have a three cycle?" "Is this CA surjective?" We can represent the steps to and inequality relations as finite state machines over infinite words, and use simple algorithms to combine these FSMs into larger FSMs that represent general prepositional statements. However, combining these FSMs can cause them to grow exponentially (specifically, to negate a machine, we must first determinize it, which expands the machine by an exponential in the worst case.) The goal of this thesis is to catalog the prepositional statements about FSMs that are tractably answerable.

Distributed Computer Cluster

Justin Pincar (Computer Science)
Shaun Hedrick (Computer Science)
Advisor: Robert Seacord
(Computer Science)
Pake
Oral 2, 12:20pm

As new manufacturing techniques are developed, faster multiple-core computer processors are becoming the standard. However, the most powerful processors still come at a high price, which some organizations simply cannot afford. One solution is to utilize the power of parallel computing. An enormous amount of processing power can be acquired for a relatively small cost by connecting several smaller computers into a cluster and having them work on problems

in parallel. State-of-the-art hardware is no longer needed, so this method has a phenomenally smaller price tag. The fiscal feasibility of this option was explored by building such a cluster in an attempt to set a new record for the performance/price ratio.

Efficient Data Storage, Retrieval, and Visualization for Dynamic Sensor Networks

Sonja Duric (Computer Science)
Advisor: Carlos Guestrin (Undecided)
Hoch Commons-2nd Floor, Window side
12-2:30

One of the central issues in wireless-sensor research is the need to visualize, store, and share data. Data can be shared in many ways and in this project a graphical user interface was designed for manipulating and visualizing data.

Electro-Mechanical Design for a Quadrotor Helicopter

Zohar Bhagat (Mechanical Engineering)
Daniel Pehush (Electrical & Computer Engineering)
Mikhail Charkin (Computer Science)
Ilya Brin (Undecided)
Matthew LaTorre (Mechanical Engineering)
Gaurav Verma (Undecided)
Chaman Saron (Electrical & Computer Engineering)
Paul Desiderio (Mechanical Engineering)
Scott Ridel (Mechanical Engineering)
Rajit Kumar (Electrical & Computer Engineering)
Harkirat Singh (Electrical & Computer Engineering)
Adam Lederer (Electrical & Computer Engineering)
Advisor: James C. Hoe (Electrical & Computer Engineering)
Pake
Oral 8, 3:00pm

Information of the ECE side of the helicopter

Hoch Commons-2nd Floor,
Rangos side
3-5pm

Flash Cards Application

YoungJoo Jeong (Computer Science)
Advisor: Ananda Gunawardena (Computer Science Department)
Rangos 2 & 3
Sigma Xi Group 6, 10:00am

Many people use flash cards to study for vocabulary quizzes, math tests, and anything that they want to study for. However, the physical flash cards are not the best method of study as they have to maintain the cards and manually sort the cards according to their familiarity. Wouldn't it be very nice if we can make the flash cards on computers so that we never have to lose the cards and the computer can effectively quiz us? If we could also draw and write on the cards as the way we do for the physical cards instead of typing or using the mouse, it would be easy for anyone to use the Flash Cards Application. Tablet PC gives us the flexibility to simply write or draw the content of the cards on the screen. The purpose of this study is to extend the Tablet Flash Cards Application that I developed as part of the course 15-397 in Fall 07 to an application that can be deployed in an educational setting. To understand the need of tablet flash cards in an academic setting, I observed the current use of Tablet Flash Cards at Ellis School using HCI methods.

Footprints Project

Karalyn Baca (Computer Science)
Advisor: Jennifer Mankoff (Human Computer Interaction Inst.)
Hoch Commons-2nd Floor,
Window side
12-2:30
Pake
Oral 6, 1:40pm

I joined the Footprints project in 2008 and have been under the mentorship of Dr. Jen Mankoff. StepGreen is a website application whose purpose is to encourage its users to make 'green,' or environmentally friendly, lifestyle choices. The main goal of the StepGreen project is to encourage people to reduce their impact on the environment, specifically their CO2 emissions. The majority of scientists agree that increased CO2 emissions are one of the largest contributors to global warming, the most pressing threat to our environment today. StepGreen allows users to track and commit to 'actions,' or green practices that will reduce a user's negative impact on the environment. The StepGreen application tracks the amount of CO2 a user has saved from being released into the environment. I have been working in conjunction with the StepGreen implementation team and my mentor Jen Mankoff to understand more about the project, which was well under way when I joined, and assist with any project components to the best of my ability.

Game for Good Purpose

Austin Sung (Computer Science)
Jenny Han (Computer Science)
Advisors: Jennifer Mankoff (Human Computer Interaction Inst.)
Amy Hurst (Human Computer Interaction Inst.)
Hoch Commons-2nd Floor,
Window side
12-2:30

Computer games are widely played, and people would try free games. If the free game is fun and enjoyable, people will keep playing the game. What if there is a game that is fun to play and also helps to solve research problems? There has been some work done in this field, however, there is still much more to be researched about this concept. Our goal for this research is to create a game that people can play and as a result photos in the albums will be labeled.

Hereditary Substitution for Sum Types

Arbob Ahmad (Computer Science)
Advisor: Robert Harper (Computer Science Department)
Wean Commons-1st Floor, Connan side
12-2:30

The purpose of this research is the investigation of hereditary substitution, which is the type theory analogue of cut elimination in logic, in a dependently typed language with sum types. Hereditary substitution was introduced in "A concurrent logical framework I: Judgments and properties" to eliminate beta and eta conversion in CLF (Watkins et al., 2002). In particular, it provides a mechanism for algorithmically determining the equality of programs. One significant application is in typechecking dependently typed languages where typechecking relies on equality reasoning.

The methodology for equality checking that hereditary substitution provides is based on translating programs in the external language to an internal language and then checking for the equality of programs in the internal language. The external language does not provide any restrictions on the form of a program so equivalent programs may be written very differently. In contrast, the internal language has a highly restrictive syntax so that there is only one canonical representative for each program. Therefore, equivalence of programs in the internal language is determined by straightforward equality checking. Hereditary substitution is used in the translation for substituting one canonical term into another and getting back a canonical term.

This technique has not been analyzed for languages with sum types, the analogue of unions in C. The extension of this methodology is of interest to anyone already using hereditary substitution for the normalization of terms so that they may be checked for equality as it would allow them to increase the expressive power of their languages.

Human-Robot Team Coordination

Victor Marmol (Computer Science)
Advisor: Mary Bernardine Dias (Robotics Institute)
Kirr Commons-1st Floor, Window side
12-2:30

The goal of this project is to learn about the challenges involved in the coordination of heterogeneous robots and to conduct preliminary research in the area of effective coverage for the treasure hunt domain. The treasure hunt domain involves a scenario where teams of humans and robots come together to efficiently search for an objective in an unknown environment. To understand how human-robot teams work, it is necessary to learn about the software and hardware capabilities of the different robotic platforms in the treasure hunt domain. Towards this, I start out by familiarizing myself with the various robot team members including LAGRs, Pioneers, and ER-1s. LAGRs are rugged robots capable of indoor and outdoor mapping and localization using lasers and GPS sensors. The Pioneers are smaller robots that are equipped with lasers and gyros and are predominantly used for mapping and localization in indoor environments. The ER-1s are sensor-limited robots that can only be tele-operated using low-resolution cameras. Furthermore, I was involved in developing the software to collect, plot and evaluate sensor data for the LAGR robots, assembling the sensors and computing on the Pioneer P2DX robots, and assisting in system evaluation by tele-operating the ER-1s during testing. Based on the experience gained, I have begun to explore research on understanding, identifying and subsequently implementing multi-robot

coverage algorithms for the human-robot treasure hunt domain. I believe the algorithm currently under development is designed to account for the limited sensing capabilities of each of the different robots in the teams.

IMPACT: Motivating Exercise Project

Yen-Wen Liu (Computer Science)
Advisor: Anind Dey (Human Computer Interaction Inst.)
Hoch Commons-2nd Floor, Window side
3-5pm

Using technology to provide people opportunities to have a healthier lifestyle is the very foundation of this project. More specifically, it targets people who would like to or need to be more physically active such as elders and patients. By monitoring the activities one has done, this person can get the generalizations of his exercising habits and activity levels by analyzing the history of the relationships between his energy expenditure and the corresponding activities. Thus, it is more motivating for him to have feedback that actually tells him how he can improve his lifestyle. Regular pedometer typically only shows the number of steps taken during a certain period. No further information is recorded. We can achieve the goal of the project by programming for our sample device, Nokia 5500, which is a cell phone that has a pedometer in it, and the web interface that actually reflects the necessary information that the user wants to know.

Implementing In-car Navigation System

Chanin Laohaphan (Computer Science)
Advisor: Anind Dey (Human Computer Interaction Inst.)
Hoch Commons-2nd Floor, Rangos side
3-5pm

Routing services that are offered by websites such as Google Maps and Mapquest have some flaws that make the routes produced by these websites not always optimal and sometimes not preferable to some users. For example, it does not take real-time traffic information into account, and it hardly adjusts itself to the user?s preferences. Therefore, we have developed the improved web-based routing system that gathers real-time traffic data from various sites, collects statistics on user?s preferences, and makes decision based on the data it collects. User can also manipulate the route generated by the system to make it better suit his need.

My research in the summer is to design and implement an in-car navigation system based on this improved web-based routing system. The navigation system will receive information from the web-based routing system and make use of an available GPS unit in the car to display the best route to a destination according to the driver?s preferences and real-time traffic information. It will, as in the web-based system, allow user to manipulate the route it generates. Should the driver go off the proposed route, the system will immediately generate a new proposed route for the driver, and at the same time keep track of the driver?s actual route and send the data regarding the actual route back to the web-based system, which will process the information to try to understand the preference of the driver.

With this in-car navigation system, we will be able to expand the capability of the web-based routing system as the integrated system will be able to find the optimal and preferable route for the user while driving, thus saving the user a considerable amount of time.

Improving Driving Directions and Mobile Navigation System

Chanin Laohaphan (Computer Science)
Advisor: Anind Dey (Human Computer Interaction Inst.)
Hoch Commons-2nd Floor, Rangos side
12-2:30

Driving directions services that are offered by websites such as Google Maps and Mapquest have one problem in common. They do not take contexts such as traffic and time of the day into account. The routes generated from these services tend to be fixed every time regardless of the time and traffic conditions, and therefore turn out to be slow and even incorrect in many situations. As a result, we are developing a new web-based routing system that eliminates these problems. This system processes the data that we collect from the taxi-cab drivers around Pittsburgh and generates the route based on the data. It is expected to perform better than most available systems in choosing the most appropriate route for any time in the day. However, the interface of the website is not yet fully developed so it cannot be used for practical purposes yet.

My research in the spring is to improve the interface of the website and integrate a mobile phone into the web service. Professor Anind Dey and I will be planning and focusing on the mobile navigation system development first, as the details of the user interface work may vary depending on other factors and therefore will be determined along the way. In developing the mobile navigation system, we will first learn how to use the GPS module and how to program basic mobile phone applications to be able to design and implement the system. We will then explore and evaluate the different mechanisms of notifying and informing the user by conducting some user studies and afterward integrate the best mechanisms into our system. When all is done, we hope that the improved driving directions service and the mobile phone navigation system will offer the user a great alternative and prove to be more useful than most routing services available.

Investigating Power Management in a Robot Colony

Kevin Woo (Electrical & Computer Engineering)
Eugene Marinelli (Computer Science Department)
James Kong (Electrical & Computer Engineering)
Aaron Johnson (Electrical & Computer Engineering)
Austin Buchan (Electrical & Computer Engineering)
Brian Coltin (Computer Science)
Justin Scheiner (Electrical & Computer Engineering)
Siyuan Feng (Computer Science)
Christopher Mar (Electrical & Computer Engineering)

Power management is a critical issue in the field of mobile robotics. Managing the supply of power for a team of robots becomes an increasingly difficult problem as the number of active robots increases. As the capabilities and complexity of robots increase, so do power requirements. The Colony project has worked to build a scalable power management platform upon which an increasingly large colony of robots can operate while efficiently completing its tasks. We focused our study on power management algorithms, including charging bay design and location, robot priorities, and battery charging.

Bradford Neuman (Physics)
Advisor: George Kantor (Robotics Institute)
Pake
Oral 7, 2:00pm

Investigating the use of Machine Learning in Go

Yucheng Low (Computer Science)
Advisor: Dr. Daniel Sleator (Computer Science)
McKenna
Oral 8, 3:00pm

The game of Go is practically the Holy Grail for computer game playing due to its massive branching factor and difficult evaluation. The current state of the art computer program is only able to play at an amateur level. Additionally, the computer programs tend to have specific weaknesses which can be targeted by professional human players. For this project, we constrain the problem to 9x9 Go and investigate the use of Machine Learning methods to train an evaluation function. Both supervised learning and reinforced learning schemes are considered. The resultant evaluation function can be directly applied to the game through an Alpha-Beta search, but other methods of applying it, such as in a Monte Carlo Go implementation, are also investigated.

ISADS

Soojin Jeong (Computer Science)
Benjamin Poole (Undecided)
Kyri Baker (Electrical & Computer Engineering)
Advisor: Mei Chen
Kirr Commons-1st Floor, Window side
12-2:30

The Interactive Search Assisted Decision Support (ISADS) project aims to help doctors make more informed decisions about pigmented skin lesions by analyzing dermoscopic images automatically, and presenting relevant data from a large, annotated repository. This project uses machine learning to determine similarity between images, which requires a substantial amount of training data. There are certain protocols that need to be followed when collecting data to protect patient confidentiality. My task is to collect dermoscopic images of pigmented skin lesions and their diagnostics (from International Society of Dermoscopy) and create filters using Java for ImageJ to analyze the images.

Lao Zi's Skepticism and the Development of Neo-Confucianism

Arthur Tu (Computer Science)
Advisor: Joseph Ramsey (Philosophy)
Pake
Oral 5 1:20pm

Taoism and Confucian are two of the most representative schools in the history of Chinese philosophy. The Taoist philosophy created by Lao Zi is a school that emphasizes the connection between metaphysical and ethical notions. Thus, given the elusive nature of the universal truth, the Tao, Lao Zi conceived a skeptical philosophy that defines the notion of good based on the absence of intentionality and beliefs. As Confucianism progressed, the Confucian scholars adopted many of Lao Zi's philosophical conceptions into their studies while retaining many classical Confucian methodologies, therefore creating a new school of Confucian philosophy in the Song Dynasty, often referred to as the "Song Neo-Confucianism" or "The School of Reason." This thesis is targeted at the interpretation and analysis of the skeptical ideas in Lao Zi's Taoism and their influences on the development of the Song Neo-Confucianism.

Model Checking Cellular Automata

Joe Gershenson (Computer

Assertions about the evolution of an infinite two-dimensional cellular automaton can be expressed in terms of zeta-automata and the Emptiness problem. We investigate the efficiency of this procedure, and suitable optimizations to the algorithm, by implementation.

Science)
Advisor: Klaus Sutner (Computer Science Department)
Rangos Hallway, 2nd Floor
12-2:30

Monitoring Wireless Networks using Wi-Spy

Garrick Chin (Computer Science)
Advisor: Peter Steenkiste
Hoch Commons-2nd Floor, Window side
3-5pm

Diagnosing interference problems with Wi-Fi networks is difficult for non-technical home users. This research seeks to provide an automated tool to detect common interference patterns in the Wi-Fi spectrum. The approach experimented with involves using a USB device Wi-Spy spectrum analyzer in conjunction with pattern analysis. The results of comparing the averaged, normalized shape of a RSSI/frequency graph of the Wi-Fi spectrum with that of known reference interference devices shows that automated detection of interference with a Wi-Fi network is achievable with this approach.

Mouse Traps to Drive Engineers to Their Future

YoungJoo Jeong (Computer Science)
Jonathan Goettler (Mechanical Engineering)
David Torres (Mechanical Engineering)
Advisor: Susan Finger (Civil Engineering)
Connan
12:30-4pm

In this activity, the girls will face a common engineering problem: maximize the acceleration and distance traveled of a vehicle with a fixed power source. The power is provided by a string attached to the arm of a mousetrap. Through this interactive activity, they will learn about energy, torque, and the laws of motion. They will be able to adjust the string position on the moment arm connected to the mousetrap. By experimenting with this string position, they will develop their own understanding of how a constant torque can produce different forces in the string depending on its distance from the pivot point. This principle will be reinforced when they change the diameter of the wheels. Challenging the girls to produce the fastest acceleration possible and the longest distance traveled will encourage them to explore the different component combinations and learn engineering fundamentals along the way.

Natural Language Understanding with Knowledge

Jiquan Ngiam (Computer Science)
Advisor: Dr. Scott Fahlman (Language Technologies Inst.)
McKenna
Oral 9, 3:20pm

We examine the problem of extracting structure knowledge from unstructured free text. The extraction process is modeled after construction grammars, essentially providing a means of putting together form and meaning. The knowledge base is not simply treated as a destination, but also an important partner in the extraction process. In particular, the ideas are implemented as a module closely tied to the Scone Knowledge Base system. We demonstrate that with a reasonable knowledge base and general construction rules, one can easily extract structured knowledge.

Qwerk Support Enhancement for Tekkotsu

Benson Tsai (Computer Science)
Advisor: Dr. David Touretzky (Computer Science)
Hoch Commons-2nd Floor, Window side
3-5pm

Tekkotsu was originally created as a library to interface with and control Sony's AIBO robots. The goal of this project is to enhance the support of Qwerkbots by exposing additional interfaces--such as analog and digital i/o. This project also added the support of a new robot called the Create and a new control mechanism called the Wiimote.

reCAPTCHA

Ben Maurer (Computer Science)
Advisor: Luis A Von Ahn
Rangos Hallway, 2nd Floor
12-2:30

reCAPTCHA is a web service that helps to stop spam and read books

RobOrchestra III

Erica Sandbothe (Computer Science)
Richard Pantaleo (Mechanical Engineering)
Justin Scheiner (Electrical & Computer Engineering)
Laura Abbott (Computer Science)
Daniel Shope (Mechanical Engineering)
Advisor: Roger Dannenberg
Wean Commons-1st Floor, Connan side
3-5pm

The RobOrchestra project is dedicated to the creation of robots that combine musical artistry and new technology to gain a greater understanding of both the human creative process and robotic interaction and development. In its third year of being, the RobOrchestra team has extended its existing robots to interact with human musicians. This gives the robots a greater understanding of harmony, rhythm, and real-time improvisation. The group has constructed a new stringed instrument to increase the scope and breadth of its ensemble and introduced motion-capture technology to allow for humans to influence the creation of the robots' music. In this way, RobOrchestra illustrates the creative process of both humans and machines and the ways in which they may interact for both the instruction of the robot and the enjoyment of the human musician.

Robotic Waypoint Navigation Using The Google Maps API

Joseph Gannon (Computer Science)
Advisor: Mr. Howie Choset (Mechanical Engineering)
Kirr Commons-1st Floor, Window side
3-5pm

This project entailed the development of an intuitive and widely usable interface for selecting, communicating, and traversing waypoints for robot navigation. The free global satellite imagery provided by the Google Maps API was used to provide the user with a highly detailed aerial view of their environment, as well as a sensible method of selecting waypoints and displaying them on the map. One side-effect of this research was the development of a low-cost robotic platform capable of carrying the required equipment and handling the outdoor environment.

Rule Based Question Answering with Wikipedia

David Todd (Computer Science)
Hoch Commons-2nd Floor, Rangos side
12-2:30

This is a system for specifically answering user queries using Wikipedia. It attempts to return sentences from Wikipedia that are most relevant to the user's query. This provides the user with the context to decide if the answer is actually relevant to their search. Sentences are scored by matching the phrases found in the query using synonyms, morphological, or exact matches, as well as by considering the order in which the phrases occur.

SASyLF

Matthew Rodriguez (Computer Science)
Advisor: Jonathan Aldrich (Inst. for

SASyLF is an educational theorem-proving tool. The purpose of SASyLF is to be more accessible than similar professional tools such as Twelf. One way it does so is by allowing users to write any kind of LR grammar rather than restricting them to LALR grammars. For this, I wrote the best kind of parser

Software Research Int'l)
Kirr Commons-1st Floor,
Window side
12-2:30

for the job, a GLR parser, which can handle any LR grammar and is the fastest algorithm that can. I also wrote a simple proof search algorithm that tries to prove things using the simplest technique possible. In the future, it may be able to use more advanced techniques such as induction and case splitting.

Scrabble

Mikhail Dhruv (Computer Science)
Advisor: Siddhartha Srinivasa
Wean Commons-1st Floor,
Connan side
12-2:30

We were able to create an algorithm which generates the list of all possible legal scrabble moves given a board state and a seven letter tile tray. Using this list we can evaluate which moves are the best for the given state. Incorperating this data with the computer vision aspect of th project dramatically increased the accuracy of the algorithm.

Scrabble Project

Grace Wong (Computer Science)
Advisor: Siddhartha Srinivasa
Wean Commons-1st Floor,
Connan side
12-2:30

In computing, vision can be a processing-intensive task with low accuracy. In an attempt to bridge the gap between computer vision and human vision, the Scrabble vision project integrates temporal and contextual information with raw image data to improve the success rate of tracking gameplay. It is easier to interpret a Scrabble board by analyzing changes on the board rather than repeatedly scanning the entire board. This project takes advantage of contextual information through assistance from the Scrabble learning project, which informs the program, narrowing the amount of necessary computation.

SOUR CREAM: a system to semantically parse recipes

Dan Tasse (Computer Science)
Advisor: Noah Smith
Rangos Hallway, 2nd Floor
12-2:30

We present SOUR CREAM, a system to help computers understand not only the syntax but also the semantics of a sentence. Our domain is cooking recipes, which contain widely varying data, but also represent a narrow enough domain that we can hope for useful results. We hope to advance the state of the art in semantic parsing by tackling this challenging domain.

Tile Identification for a Robotic Scrabble Player

Erica Sandbothe
(Computer Science)
Advisor: Siddhartha Srinivasa
Hoch Commons-2nd Floor,
Rangos side
12-2:30

Using advancements in computer vision, we were able to create an algorithm for determining the placement of letter tiles on the board of the game Scrabble. This, coupled with probabilistic analysis regarding the English language, created a system with a known environment in which we could determine the state of the board to allow for robot interactions.

Trinetran: An Assistive Technology for the Blind

Geeta Shroff (Computer Science)
Hemant Sikaria (Electrical &

Trinetra is an ongoing initiative within the Electrical and Computer Engineering Department at Carnegie Mellon University which aims to develop low cost smart systems using mobile devices integrated with assistive technologies to provide the blind and the visually impaired community with more independence in their daily lives. As a part of this initiative, we

Computer Engineering)
Advisor: Priya Narasimhan (Electrical & Computer Engineering)
Rangos 1
CIT Poster, 12-2:30pm
Rangos 2&3, Sigma Xi Group 4, 11:30 am

have developed the Trinetran system to assist visually impaired commuters with respect to their transportation and route planning needs, by creating a location and context-aware application on a mobile embedded cell phone platform. We aim to bring information regarding bus schedules, bus stops, and accessibility paths to the user's hand held device in real-time by harnessing available technology resources built into buses, bus stops, and transit authority monitoring systems. We have incorporated client contextual models into the user side requests to achieve our mentioned goals of ease of use and user independence. We will also be conducting deployments and user studies shortly to better understand the route planning needs of the blind.

Understanding Self-Interruptions on the Computer

Jing Jin (Computer Science)
Advisor: Laura Dabbish (Human Computer Interaction Inst.)
McKenna
Oral 12, 4:20pm

Interruptions can disrupt the work flow and hinder productivity. Two types of interruptions exist: external interruptions and self-interruptions. Much research has been conducted on external interruptions, but little is known about self-interruptions. This project studies how and why people interrupt themselves while working on the computer, defines types of self-interruptions, and presents a method of identifying self-interruptions.

Updating Alice 2.0: The Addition of a Moviemaker and a Multiple Platform Rendering Engine

Madeleine Pitsch (Computer Science)
Advisor: Wanda Dann (Computer Science Department)
Rangos Hallway, 2nd Floor
12-2:30

Alice 2.0 is a open source software programming IDE that uses 3D graphical objects to teach the fundamentals of programming. The 3D graphical objects make data visual and help make programming inherently motivating for students. In this project, long standing errors in the OpenGL renderer were fixed to make it the primary renderer, displacing the platform dependent DirectX renderer. A Moviemaker export feature was also added to allow users to export their programs as movie files.

User Interface for an Interactive Proof Assistant

Tianyuan Wang (Computer Science)
Advisor: Jonathan Aldrich (Inst. for Software Research Int'l)
Class of '87
Oral 10, 3:40pm

A major issue in mathematics education is the effective learning of how to build precise and correct proofs. I have developed a proof assistant plug-in for the Eclipse IDE that uses the Twelf logical framework to help users create proofs and provide immediate feedback on the correctness of a proof. This plug in provides an intuitive drag and drop format to create proofs: users can drag rules from a list of rules and drop them to fill in missing derivations. I will demonstrate the ability of my proof assistant to build a simple proof and I will discuss how this plug in will be extended to cover more complex proofs and induction.

Using Landmarks to Provide Directions to Visitors

WIng-Hong Andrew Ko (Computer Science)
Advisor: Peter Steenkiste
Kirr Commons-1st Floor, Window side
3-5pm

This project implemented landmarks within a directions giving program. These hints indicate the correctness of the traversal of a path.

Visibility Analysis to Improve Dynamic Scene Interpretation

Nicholas Heckman (Computer Science)
Advisors: Nicolas Vandapel (Robotics Institute)
Martial Hebert (Robotics Institute)
Hoch Commons-2nd Floor, Rangos side
12-2:30

The overall goal of this project is to study ways to use the visibility analysis of 3-D ladar data collected by a mobile platform in natural and urban environments to improve the synergy of terrain classification and mover detection, tracking, and prediction. Currently, terrain classification is negatively affected by moving objects in a scene. Motion causes a 'blur' of data in the scene, generating classification error in that portion of the scene. Techniques for the detection, tracking, and prediction of moving objects in a scene can be used to filter these moving objects, but a incomplete understanding of the natural environment can often interfere with this. Improvements in terrain classification yields improvements in results for Detection, Tracking, and Prediction and vice-versa.

In this project, we explore how visibility analysis can be used to improve both terrain classification and prediction, detection, and tracking.

COMPUTER SCIENCE DEPARTMENT

An Authorization Logic with Explicit Time

Henry DeYoung (Computer Science Department)
Advisor: Frank Pfenning
McKenna
Oral 2, 12:20pm

The problem of allowing access to data and resources without compromising their security is a fundamental one in today's increasingly networked society. We believe that proof-carrying authorization, with its basis in logic, can serve as a theoretically sound solution to the access control problem. But, for proof-carrying authorization to be viable, its underlying logic must be sufficiently expressive to support a wide array of natural access control policies, including single-use and time-dependent authorizations.

In this project, we have developed a novel authorization logic that permits reasoning about time-dependent authorizations. We have also extended the logic to account for single-use authorizations. Finally, we have formalized the logic's metatheory, including the admissibility of cut, in the Twelf logical framework and implemented a proof checker for the logic.

Cooperative Manipulation in a Robot Colony

Kevin Woo (Electrical & Computer Engineering)
Eugene Marinelli (Computer Science Department)
Gregory Tress (Electrical & Computer Engineering)
James Kong (Electrical & Computer Engineering)
Jaime Bourne (Mechanical Engineering)
Jason Knichel (Computer Science Department)
Austin Buchan (Electrical & Computer Engineering)
Brian Coltin (Computer Science)
Justin Scheiner (Electrical & Computer Engineering)
Siyuan Feng (Computer Science)
Christopher Mar (Electrical & Computer Engineering)
Bradford Neuman (Physics)
Advisor: George Kantor (Robotics Institute)
Rangos 2 & 3
Sigma Xi Group 4, 11:45am

Object manipulation and interaction with the environment is a critical application in the field of mobile robotics. In situations where multiple robots cooperate, sensor data can be shared allowing any robot within the colony to find objects located by other robots. Once an object is identified, robots can cooperatively manipulate the object by coordinating movement. While many current robots utilize vision to aid with object detection, this incurs a prohibitive cost for many researchers. By developing the necessary sensory capabilities and coordination algorithms based on inexpensive light sensors, the Colony Project has demonstrated that cooperative manipulation can be feasibly performed within a low-cost robot colony.

Designing Visualization Tools for Adaptive Book Markup Manager

Hoon Sagong (Computer Science Department)
Advisor: Ananda Gunawardena (Computer Science Department)
Rangos Hallway, 2nd Floor
12-2:30

Adaptive Book is an electronic book management system that allows users to markup documents as they read. All markups are saved as XML files that can be independently analyzed for compatibility with other readers. For example, this could tell reader whether he/she marked the same parts as the professor and look for differences and similarities. In this study, I will be designing and developing an online markup repository where users will be able to store, share and analyze various markups. Various text mining techniques such as Latent Semantic Analysis and Tiling will be used to extract context from the documents. I will be using tools such as asp.net, C# and AJAX to build the web-based markup repository. This will be part of a project with CMU's English Department.

Fourier-domain Data Association for Multi-Target Tracking

Jeremy Maitin-Shepard (Computer Science Department)
Advisor: Carlos Guestrin (Computer Science)
McKenna
Oral 7, 2:00pm

Multiple-target tracking (inferring the position of each target over time, where each target has a unique identity) based on measurements that provide only imprecise information about the position or identity of the target that generated the measurement is a difficult problem due to the inherent combinatorial complexity that arises from the ambiguity regarding the association of measurements to targets; tackling this complexity depends on the use of approximation algorithms. Although existing sampling-based methods allow highly general observation and data association models, in general there is no reason to believe the probability mass can reasonably be concentrated on a small number of samples, and consequently accuracy guarantees for such methods depend on maintaining a number of samples that grows exponentially with the number of targets. Recent work by Kondor et al. and Huang et al. demonstrated the applicability of group-theoretic methods, specifically band-limited Fourier-domain representation of distributions over groups of permutations, to multiple-target tracking problems, but their methods depended on a restricted data association model based on the concept of tracks. Unlike sampling-based methods, this Fourier-domain representation can represent diffuse distributions, which are believed to likely occur in these tracking problems. This work extends the approach of Huang et al. to support a more general data association model while also modeling imprecision and uncertainty in the position information from measurements.

Investigating Power Management in a Robot Colony

Kevin Woo (Electrical & Computer Engineering)
Eugene Marinelli (Computer Science Department)
James Kong (Electrical & Computer Engineering)
Aaron Johnson (Electrical & Computer Engineering)
Austin Buchan (Electrical & Computer Engineering)
Brian Coltin (Computer Science)
Justin Scheiner (Electrical & Computer Engineering)
Siyuan Feng (Computer Science)
Christopher Mar (Electrical & Computer Engineering)
Bradford Neuman (Physics)
Advisor: George Kantor (Robotics Institute)
Pake
Oral 7, 2:00pm

Power management is a critical issue in the field of mobile robotics. Managing the supply of power for a team of robots becomes an increasingly difficult problem as the number of active robots increases. As the capabilities and complexity of robots increase, so do power requirements. The Colony project has worked to build a scalable power management platform upon which an increasingly large colony of robots can operate while efficiently completing its tasks. We focused our study on power management algorithms, including charging bay design and location, robot priorities, and battery charging.

Learning To Drive Like a Cabbie

Andrew Maas (Computer Science Department)
Rangos Hallway, 2nd Floor
12-2:30

I will present my work which is part of the Mapprentice project. The goal of this project is to develop a system which learns a model of driver preferences from user GPS data. My work this semester on the project focuses on some of the difficulties in extracting routes (paths in a road network) from raw GPS traces (collections of (latitude, longitude, time) readings).

Object Recognition Tools for Educational Robots

Xinghao Pan (Computer Science Department)
Advisor: Dr. David Touretzky (Computer Science)
McKenna
Oral 10, 3:40pm

SIFT (scale-invariant feature transform) features, developed by David G. Lowe, have been found to be robust to translations, rotations and scaling, and have become the solution of choice for many when dealing with problems of robotic vision and object recognition. The SIFT algorithm extracts significant features from an image, but additional software is needed to match these features against an image library in order to do object recognition. Further software is needed to construct and maintain this library. At present there is no open source tool to conveniently perform all these functions.

This research aims to develop SIFT algorithms into tools that facilitate robotic object recognition for students in undergraduate robotic programming courses. This would involve allowing programmers to use and also to understand the basics of the algorithms behind the tool, and to make adjustments within the object recognition tool to accomplish their goals. As part of the research, the tool will also be evaluated within a real classroom setting when it is released for use in an undergraduate cognitive robotics course.

Online Fingerpointing: Just-in-Time Problem Diagnosis for Distributed Systems

Keith Bare (Computer Science Department)
Advisor: Priya Narasimhan (Electrical & Computer Engineering)
McKenna
Oral 11, 4:00pm

Distributed systems are growing both in size and complexity. In the event of a system failure, this makes it increasingly difficult for systems administrators to determine which component failed. Existing tools and algorithms have been designed to diagnose problems, but they rely on offline analysis. This work explores the possibility of online failure diagnosis that operates as the distributed system under observation is running. A framework for online fingerpointing is presented and evaluated.

Understanding Higher-order Representations and their Adaptation in Hierarchical Belief-Nets

Andrew Maas (Computer Science Department)
Advisor: Tai-Sing Lee
Hoch Commons-2nd Floor, Rangos side
3-5pm

Due to recent advances in training algorithms, hierarchical deep neural networks have increased in popularity in the past few years. Several state of the art results have been obtained using their capabilities for recognition and generation. My experiments apply these models to trying to solve the tasks of digit occlusion and disambiguation. The network is shown an image of a corrupted handwritten digit, and is given a "hint" about the true target class. It uses this information and its generative capacities to "imagine" how the true digit image should appear.

SELF-DEFINED

Adaptive Braille Tutor Software

Daniel Dewey (Self-defined)
Advisor: Mary Bernardine Dias (Robotics Institute)
Hoch Commons-2nd Floor, Rangos side
3-5pm

More than 90% of the world's 161 million blind and visually impaired people live in developing communities. Despite the importance of literacy to employment, social well-being, and health, the literacy rate of this population is estimated at under 3%.

The Adaptive Braille Tutor project aims to develop assistive technological solutions to the problem of Braille illiteracy. As a result of last summer's Undergraduate Research Grant, we developed an adaptive curriculum to help students learn to write Braille on an electronic slate and stylus. Since learning to write with a slate and stylus is difficult both conceptually and physically, we have designed the curriculum to take the student through several stages of Braille literacy, diagnosing problem areas and selecting exercises to fit the needs of the student.

Pathfind: interactive search of large image data sets

Shiva Kaul (Self-defined)
Advisor: Adam Goode (Computer Science Department)
Rangos Hallway, 2nd Floor
12-2:30

Developed in collaboration with UPMC, Pathfind is a system for assisting medical diagnosis. It is an application of the OpenDiamond platform, which enables distributed search of vast amounts of unindexed data. Presented are the application interface, domain-specific image processing algorithms, and a proposed method for exploiting a byproduct of the search interaction using machine learning techniques.

UNDECIDED

Autonomous Quad-Rotor Helicopter Stability Control

Daniel Pehush (Electrical & Computer Engineering)
Ilya Brin (Undecided)
Frank Costello (Computer Science)
Gaurav Verma (Undecided)
Paul Desiderio (Mechanical Engineering)
Scott Ridel (Mechanical Engineering)
Rajit Kumar (Electrical & Computer Engineering)
Advisor: William Messner
Hoch Commons-2nd Floor, Window side
3-5pm

This project will develop a flight controller for an autonomous quad-rotor helicopter, in order to maintain stable flight. This proposal is being presented with two other grants in order to develop a functional autonomous helicopter. A quad-rotor helicopter is a modification of the conventional-single rotor helicopter configuration. The quad-rotor helicopter has four motors arrange in at the corners of a square, each of which turns its own rotor independently. The sum of the thrusts from the four rotors produces the thrust perpendicular to the plane of the rotors. The difference in the thrusts from the left and right rotors produce a pitch moment. The difference in the thrusts from the front and back rotors produce a roll moment. The pitch and roll dynamics of the quad-rotor helicopter are inherently unstable, and thus active control of the rotor speeds is needed to produce stable flight. This will be achieved through the use of a gyroscope for sensing angular velocity and accelerometer for sensing orientation and angular velocity in tandem with a stabilizing control scheme, which will be implemented upon a gumstix© miniature motherboard.

Electro-Mechanical Design for a Quadrotor Helicopter

Zohar Bhagat (Mechanical Engineering)
Daniel Pehush (Electrical & Computer Engineering)
Mikhail Charkin (Computer Science)
Ilya Brin (Undecided)
Matthew LaTorre (Mechanical Engineering)
Gaurav Verma (Undecided)
Chaman Saron (Electrical & Computer Engineering)
Paul Desiderio (Mechanical Engineering)
Scott Ridel (Mechanical Engineering)
Rajit Kumar (Electrical & Computer Engineering)
Harkirat Singh (Electrical & Computer Engineering)
Adam Lederer (Electrical & Computer Engineering)
Advisor: James C. Hoe (Electrical & Computer Engineering)
Pake
Oral 8, 3:00pm
Hoch Commons-2nd Floor, Rangos side
3-5pm

Information of the ECE side of the helicopter

Multiple User Stream Video Interaction using AJAX

Zheng Zhang (Undecided)
Advisor: Justin Weisz (Computer Science Department)
Rangos Hallway, 2nd Floor
12-2:30

A method of presenting synchronized streaming videos and asynchronously recording and transmitting user interactions is described.

Visually Guided Manipulation Primitives for an Educational Robot

Zhengheng Gho (Undecided)
Advisor: Dr. David Touretzky (Computer Science)
McKenna
Oral 13, 4:40pm

Regis is a new prototype educational robot developed in the Tekkotsu lab at Carnegie Mellon. It consists of a 6 degree of freedom Lynx Motion arm which ends with a gripper and a 4 degree of freedom Lynx Motion arm that ends with a camera. The project aims to develop simple manipulation primitives like pushing and grasping for Regis with the aid of visual guidance, hence overcoming problems associated with open loop manipulations.

SCIENCE AND HUMANITIES SCHOLARS PROGRAM

A Comparison of Models for Overdispersed Insurance Data

Aaron DePonceau (Statistics)
Jeffrey Dunn (Mathematics)
Steve Karolyi (Business Administration)
Rohan Chatterjee (Scholars Program for Humanites)
Akshaya Jha (Statistics)
Advisor: Tanzy Love (Statistics)
Kirr Commons-1st Floor, Window side
12-2:30

Despite their seemingly simple nature, insurance claim count data remain difficult to model effectively. The two models used in practice, Poisson and negative binomial, fail to capture the overdispersion exhibited in the tails of the empirical distributions. This study evaluated fits of the geometric and relatively unknown Conway-Maxwell Poisson (CMP) distributions against the aforementioned standard models for two separate insurance datasets. Although the CMP failed to capture the deviations more accurately than the negative binomial, the geometric exhibited significant improvement over the Poisson. Due to its appealing statistical properties and interpretability, the results suggest that the geometric distribution may remain a viable alternative.

Effects of Daily Regularity on the Lives of Mothers and their Infants

Adriane Soehner (Scholars Program for Humanites)
Advisor: Erik Thiessen (Psychology)
Rangos 2 & 3
Sigma Xi Group 8, 11:00am

This study explores the role daily lifestyle regularity plays in the adjustment of new mothers to the schedule of their infants. Thus far, there has been very little quantitative research on how changes in daily regularity impacts the lives of new mothers. Cross-sectional data was collected, using a one time take-home survey, to investigate how changes in maternal lifestyle regularity and infant daily regularity affect maternal sleep quality, perceived stress, daytime sleepiness and depressive symptoms. Pearson correlations were used to analyze data from sample of mothers (n = 11, avg age = 30.76 years) with infants 4.5 ¿ 5.5 months old (avg age = 5.04 months). Aspects of maternal and infant lifestyle regularity were found to correlate with maternal sleep quality, daytime sleepiness, and depressive symptoms.

Insight Problems: Unconscious Problem Solving

Lauren Burakowski (Scholars Program for Humanites)
Advisor: Kenneth Kotovsky (Psychology)
Kirr Commons-1st Floor, Window side
3-5pm

Insight problems present a unique challenge in problem solving research because reaching the solution requires a representation change. Current research has not identified many of the mechanisms of the unconscious processes hypothesized to occur when people solve insight problems. Participants worked on an insight problem and received a second task 5 minutes into problem solving. The second task was in one of two conditions, one of which gave a hint to the solution. The relationship between the presentation of a hint, the distance of the hint from the solution, and participants' ability to make an unconscious metaphor were examined.

PBN1 Alanine Scanning Project

Mariela Zeledon (Scholars Program for Humanites)
Advisor: Elizabeth Jones
Rangos 2 & 3
Sigma Xi Group 1, 11:30am
Class of '87
Oral 5 1:20pm

The Jones lab has been working on PBN1, a gene in yeast with a protein function that is only partly understood. Since this gene is essential to the cell, its unknown function is probably of great importance. Previous researchers have already designed suitable mutations in the gene, which we have been introducing into the yeast. This will allow us to learn about the role of Pbn1p (the protein product of the PBN1 gene) and, we hope, to isolate PBN1 alleles that encode mutations that produce a protein with controllable activity(temperature-sensitive mutants).

Removing the Physiological Effects of the Brain

Ryan Sieberg (Mathematics)
John Scarfutti (Scholars Program for Humanites)
Emil Shalmiyev (Statistics)
Martin Nemaric (Mathematics)
Shawn Mankad (Mathematics)
Advisors: William Eddy (Statistics)
Tanzy Love (Statistics)
Kirr Commons-1st Floor, Window side
12-2:30

It is very difficult to simplify the complexity of the brain, and to take reasonable measurements of it. Several tools are available to measure functions of the brain. Our project examines the effectiveness of optical imaging in identifying brain activity. However, as many physiological effects obscure the true response to particular stimuli, these factors must be identified and addressed. We applied statistical methods to recognize the underlying periodicity of various major obfuscating effects, leading us to conclude that optical imaging indeed reveals the brain response to visual stimuli.

BUSINESS ADMINISTRATION

A Comparison of Models for Overdispersed Insurance Data

Aaron DePonceau (Statistics)
Jeffrey Dunn (Mathematics)
Steve Karolyi (Business Administration)
Rohan Chatterjee (Scholars Program for Humanites)
Akshaya Jha (Statistics)
Advisor: Tanzy Love (Statistics)
Kirr Commons-1st Floor, Window side
12-2:30

Despite their seemingly simple nature, insurance claim count data remain difficult to model effectively. The two models used in practice, Poisson and negative binomial, fail to capture the overdispersion exhibited in the tails of the empirical distributions. This study evaluated fits of the geometric and relatively unknown Conway-Maxwell Poisson (CMP) distributions against the aforementioned standard models for two separate insurance datasets. Although the CMP failed to capture the deviations more accurately than the negative binomial, the geometric exhibited significant improvement over the Poisson. Due to its appealing statistical properties and interpretability, the results suggest that the geometric distribution may remain a viable alternative.

Galaxy Classification Using SDSS Spectra

Shawn Yoon (Statistics)
Michael Wang (Business Administration)
Sergey Bystritskiy (Mathematics)
Gerry Llaque (Mathematics)
XiaYi (Sandy) Shen (Electrical & Computer Engineering)
Advisor: James Delaney (Statistics)
Hoch Commons-2nd Floor, Rangos side
12-2:30

The primary problem under investigation is to accurately and automatically classify galaxies into either the star-forming or active galactic nuclei categories. Shawn Yoon, Sergey Bystritskiy, Xiayi(Sandy) Shen, Michael Wang, and Gerry Llaque worked together to create a program in R to automate the processes of classifying galaxies based on wavelength data collected from the Sloan Digital Sky Survey(SDSS). Part of the data is in the form of a continuum which is the underlying distribution of background "noise" in galaxies. There are also various emission lines which come from emitted photons from galaxies. Our code is designed to fit a distribution of the continuum while overlaying a normal distribution to model the emission spike.
Taking the ratios of the area under the distribution, we can then begin to classify the type of galaxy we are viewing.

LunchMeet

Kevin Kwan (Business Administration)
Eugene Gaysinskiy (IS)
Advisor: Anthony Stanton
Kirr Commons-1st Floor, Window side
3-5pm

It seems that as one goes further into their college career, the harder it is for one to meet someone new¿either spontaneously or through a function. Events such as lunch become more and more routine every day¿same group of people, same type of food. We embarked on a social experiment: we built a website that selects sets of random strangers to eat lunch together every week. We hope to create a new channel through which strangers at Carnegie Mellon from very different backgrounds can meet each other.

Understanding Inconsistencies within the Khmer Rouge Period of Cambodia, 1975-1979

Eileen Morrison (Business Administration)
Pake
Oral 11, 4:00pm

The Khmer Rouge Period in Cambodia (1975-1979) is a under-researched period of history. Although major Cambodian historians such as David Chandler, Ben Kiernan, and Michael Vickery have written books on this period, most have failed to thoroughly understand what happened while Pol Pot was in power. Only Phillip Short's recent book Pol Pot: Anatomy of a Nightmare deals with the complexity of what happened. I would like to explore the question: Why did the strict policies of the Khmer Rouge yield such different outcomes for the Cambodian people?

During the three years and eight months that the Khmer Rouge was in power, an estimated 1-2 million people out of a population of 6 million died as a result of starvation, disease, and political killings. However, the conditions that the Cambodian people lived under during this time were remarkably inconsistent. The differences between the provinces- and even within provinces- are remarkable considering Pol Pot's obsession with control over the country. For example, some provinces in Cambodia had little food but relatively low occurrences of political killings; other provinces had just the opposite. During my interviews, I asked the survivors what their experiences were like and why they thought that their experiences differed so greatly from each other.

ECONOMICS

An Exploration of Social Interaction Through Music

Jesse Chorng (Economics)
Paul Castellana (Economics)
Advisor: Christine Mondor (Architecture)
Wean Commons-1st Floor, Connan side
12-2:30

Boomboxes is an environment designed to promote social interaction through music. It consists of three primary elements - music, architecture, and lighting - each of which is determined to varying degrees by the actions of the users. The greatest degree of freedom is represented in the music played. Users are able to freely share any music they want from their portable music devices. Further manipulation of the space is derived from the modularity of its architecture. Distinct units serve to house speakers and other electronics, as well as to provide seating and multipurpose surfaces. These units can be arranged by the users to best suit the given social situation. Finally, the lighting of the environment changes in response to the actions of the users. The modular units communicate with one another to gauge the overall level of social interaction occurring within the space, and illuminate as a reward to encourage further interaction.

The user-generated interplay between these three elements creates a unique social dynamic that is uncommonly found in a public setting.

Do different students learn at different rates?

Jennie Shoemaker (Statistics)
Rebecca Radkoff (Economics)
Davis Woo (Statistics)

Hyung Jae Kim (Mathematics)
Advisors: Brian Junker (Statistics)
James Delaney (Statistics)
Elizabeth Ayers (Statistics)
Wean Commons-1st Floor,
Connan side
12-2:30

This semester we have been working with the HCI and statistics departments to analyze the effectiveness of the web based standardized testing assistance tool "Assistment". We are looking at data from several hundred eighth graders in Massachusetts who have been using the tutoring program to help improve their scores on the statewide MCAS exam. Our project focuses on examining the learning curves for both individual students and particular skills taught by the program. In order to do this we are running a logistic regression algorithm to determine the probability for success for each student on each problem. Our goal is to show for what skills and demographics "Assisment" is useful, and for what skills and demographics it needs improvement.

Food Price and Market Behavior in the California Gold Rush

Rebecca Radkoff (Economics)
Advisor: Karen Clay (Economics)
Pake
Oral 9, 3:20pm

In the late 1840s, the California Gold Rush was viewed either as a rare opportunity to find wealth in the mines or as a risky investment. Daily life during this time was often chaotic and uncertain. Not only were food prices notoriously high and volatile during this time, but food markets were often highly disorganized and unstable. This paper utilizes historical price data and information from surviving diaries and letters to examine food prices in California during the gold rush. We are interested in three related issues. What were miners eating? Given that very little food was produced in California, where was their food coming from? Why were prices so high and volatile? We find that miners were eating at a basic diet of dried foods, occasionally supplemented by fresh foods or luxury foods. The staple foods included beans, preserved meats like beef jerky or salt pork, coffee, sugar and flour. Beans, flour, and preserved meat were largely imported from South America. Coffee, sugar, and luxury foods were often imported from the East Coast of the United States. The Hawaiian Islands also provided food to the California market, although the food imported from this region was typically of Asian or South American origin. We use a simple supply and demand model and regression analysis to examine the evolution of prices in the California market over time. The dramatic increase in demand initially drove prices higher. In the long run, prices remained higher due to the cost of transporting food to California and higher wage structure. Volatility was driven by a number of factors including seasonal variation in the ease of transporting goods to mining camps, seasonality in the wheat harvest in South America, and slow transfer of information between California and supplying markets. This tended to cause large variations in the supply of certain foods in California.

Project Demonstrations for Rapid Design Through Virtual & Physical Prototyping

Instructor: Susan Finger
Connan
12:30-4 p.m.

The teams of students in Rapid Prototype Design (39-245) have designed, prototyped and tested activities to engage middle school girls in learning about engineering. Some of the activities created by the students will be used during the Summer Engineering Experience for girls (SEE) sponsored by ICES at CMU. The theme of the summer program is Energy and the Environment.

Dammed Energy

Rachel Cawley (Electrical & Computer Engineering)
Anna Lenhart (Civil Engineering)
Eric Couphos (Mechanical Engineering)
Advisor: Susan Finger (Civil Engineering)
Connan
12:30-4pm

The goal of our project is to engage children in a fun and educational activity: ?Dammed energy.? Through the activity, students will learn that water held behind a dam has potential energy. We will tie this into the purpose and basic construction of dams. We will discuss how dams are usually used for flood control by forming a reservoir behind the dam. A byproduct of this reservoir is the available potential energy gained from the height of the water behind the dam. This is usually harnessed with hydroelectric generators.

The activity will consist of a Rubbermaid model of a reservoir and a hydropower dam. The dam will consist of a foam barrier, holding the water back in the reservoir. The barrier will have multiple holes at different heights, each initially blocked. The girls will decide which hole they want to uncover so the water can flow through it. As this water flows through the hole, it will spin a waterwheel. The waterwheel will be connected to a meter which measures the rotational velocity of the waterwheel. A higher velocity is correlated with more energy. The students will see that by increasing the elevation head, more power is generated in the waterwheel.

Drag Forces

Ioannis Goutakis (Civil Engineering)
Alexander Kalberer (Mechanical Engineering)
Nicholas Burkholder (Mechanical Engineering)
Advisor: Susan Finger (Civil Engineering)
Connan
12:30-4pm

The goal of our experiment is to teach children about how drag forces affect energy loss in vehicles such as airplanes. In order to illustrate this concept our group is going to build a wind tunnel a few feet long out of Plexiglas. We are then going to instruct the students to build two different models of airplanes with distinct differences in plane wing surface area. The one plane will have a large wingspan and total wing area. The second will be smaller and more stream line. Then the students will be instructed to calculate the wing surface area using basic geometry calculations. The concept of conservation of mass between the 2 planes will be reinforced throughout the entire process. The students will be shown that all though the wing surface area differs, the same amount of volume is displaces in the wind tunnel by both planes. Then when the students finish their calculations they will be able to their planes in the wind tunnel and test the flying. They will be able to compare the aerodynamics and will learn about how smaller wing area and more streamline designs, will cause

the smallest loss in energy. We will then teach the students about how a small loss in energy translates into a large overall efficiency. The students will learn all of this by being able to measure the turbulent flow when smoke is added to the wind tunnel.

Faster, Further, for Less - Practical Aerodynamics in Action

Scott Moorby (Mechanical Engineering)
Vitaly Cherednichenko (Electrical & Computer Engineering)
Paul Kim (Mechanical Engineering)
Advisor: Susan Finger (Civil Engineering)
Connan
12:30-4pm

This activity is designed to facilitate hands-on learning about the effects of drag on moving vehicles, through a series of wind tunnel experiments and a practical road test of miniature toy cars, which are designed by the participants.

Children will have the opportunity to mix and match different car components and test them in a small wind tunnel. They can then modify their design to make improvements, re-testing and enhancing their designs until they are satisfied with their vehicles. At that point, their final design may be tested on a track, powered by its own tiny CO2 container, in order to evaluate its practical performance on the test course.

The children will be able to use hands-on experiments to develop an intuitive understanding for the practical ways in which a vehicle's geometry and cross sectional area is related to the amount of drag exerted upon it. Also, the iterative cycle of design, testing, and modification will encourage the students to develop a better understanding of the engineering discipline in general.

Friction Car

Andrew Zagoren (Civil Engineering)
Alex Au (Mechanical Engineering)
Michael Barako (Undecided)
Advisor: Susan Finger (Civil Engineering)
Connan
12:30-4pm

The goal of this activity is to illustrate the relationship between energy loss and friction. Children will roll a car down a track and vary parameters on both the car and the track. The car will have different sets of wheels varying in hardness. The flat portion of the track is interchangeable to allow for different surfaces, altering the coefficient of friction. When doing the iterations for the track, the children will monitor the maximum height of the car on the exit ramp. The children will observe patterns in energy loss by noticing how the height reached varies for different wheel and track combinations. Using the collected data, the children will attempt to construct setups with specific goals such as the setup that loses the most amount of energy (most friction), the setup that loses the least amount of energy (least friction) and some goals in between. From the patterns, the children can see that the frictional forces cause a loss in energy. They will also be able to gain a small understanding of automobile efficiency. Automobiles require a substantial amount of grip on the road surface but cannot lose more energy than necessary so as not to waste energy from the engine.

Homemade Electric Generators

Ryan Yates (Mechanical Engineering)
Christina Daup (Civil Engineering)
Heeyong Kang (Physics)

This activity is designed to demonstrate a method of converting mechanical energy to electrical energy to middle school girls. Each team will assemble a basic electric generator with loops of copper wire, magnets, and a hand crank. Students will use the crank to manually spin the magnets in the center of several loops of wire. This changes the magnetic flux through the loops and

Advisor: Susan Finger (Civil Engineering)
Connan
12:30-4pm

current will flow through the wires. Students will learn that mechanical energy can be converted to electrical energy by using the induced current to operate electronics such as light bulbs.

Imperfect Recycling

Naomi Eduardo (Drama)
Kay Csuri (Mechanical Engineering)
Michael Whiston (Philosophy)
Advisor: Susan Finger (Civil Engineering)
Connan
12:30-4pm

Our group proposes an exhibit that teaches students about the imperfections of recycling. In particular, we would like students to learn that recycling is an imperfect process because it requires that all of the materials contained in a product be returned to their raw states, and that this is sometimes impossible or detrimental to the raw material. Consequentially, it is sometimes more worthwhile or beneficial to reuse products by incorporating them in new applications. In the exhibit students will create a cast of plaster of Paris as well as another cast made with reused plaster. The activity will test and compare the strengths of the material in its original application and subsequent reuse.

Insulated House - An Exploration of Recycled Materials and their Insulative Properties

Bryan Ward (Drama)
Michael Li (Mechanical Engineering)
John Johnson (Mechanical Engineering)
Advisor: Susan Finger (Civil Engineering)
Connan
12:30-4pm

The goal of this activity is to help children understand how recycled materials can be used to insulate a house effectively by assembling walls from post-consumer materials and measuring their efficiency in preventing heat transfer in a small model/simulation of a house. The children will be presented with a model of a house with one wall missing. They will use a prefabricated mold to make a wall out of a recycled, insulating material of their choosing. Materials that will be available will be granulated or in sheet form. The materials may include rubber, plastic, aluminum, paper, glass, sand, cement, styrofoam, and cotton/fabric. The children will place their wall in the house model. A heat lamp will be used to generate heat and focus it toward the newly created wall. Temperature probes on the inside and outside of the house will record the temperatures needed for calculation of the R-Factor.

The effectiveness of insulating (R-Factor) will be investigated and calculated for each of the removable walls that are built and compared to the R-Factors of existing, commonly used insulation. The children will discover that some materials are better at insulating than others, and through experimentation and calculations, will determine why through the experiment.

Mouse Traps to Drive Engineers to Their Future

YoungJoo Jeong (Computer Science)
Jonathan Goettler (Mechanical Engineering)
David Torres (Mechanical Engineering)
Advisor: Susan Finger (Civil Engineering)

In this activity, the girls will face a common engineering problem: maximize the acceleration and distance traveled of a vehicle with a fixed power source. The power is provided by a string attached to the arm of a mousetrap. Through this interactive activity, they will learn about energy, torque, and the laws of motion. They will be able to adjust the string position on the moment arm connected to the mousetrap. By experimenting with this string position, they will develop their own understanding of how a constant torque can produce different forces in the string depending on its distance from the pivot point. This principle will be reinforced when they change the diameter of the wheels. Challenging the girls to produce the fastest acceleration possible and the longest distance

Connan
12:30-4pm

traveled will encourage them to explore the different component combinations and learn engineering fundamentals along the way.

Power Your Car

Kristie Bennett (Electrical & Computer Engineering)
Insoo Jung (Civil Engineering)
Meehyun Jang (Mechanical Engineering)
Advisor: Susan Finger (Civil Engineering)
Connan
12:30-4pm

The goal of this activity is for the girls to experiment and learn about the energy supplied from difference power sources. By comparing the amount of energy produced by various power supplies, the girls can draw conclusions about which are the most effective. We plan to demonstrate this concept by allowing the girls to use different power sources to race cars on a straight track. They will design "engines" for their cars using given materials. We will also teach them about cost efficiency by giving them game money they may use to buy the needed materials. We will have markers on the track to test how far each power supply moves the car. Each trial will be recorded on a white board so the girls can compare their results. Game money will be awarded if a team?s car reaches a certain marker. The power supplies will include balloons, springs, rubber bands, and a sling shot mechanism.

Rubber Band Racers

Michael Ricci (Mechanical Engineering)
Po-Yu Chou (Mechanical Engineering)
Marcus Ruggiero (Mechanical Engineering)
Alex Timmons (Mechanical Engineering)
Advisor: Susan Finger (Civil Engineering)
Connan
12:30-4pm

This activity introduces children to the fundamentals of springs/rubber bands and how they store potential energy. The children will measure the spring constants of different rubber bands by hanging weights and noting the static displacements. They will then use these rubber bands to power small toy cars. They will measure the distance traveled by the cars and correlate the distances.

Sailboats

Edward Yuen (Civil Engineering)
Samson Debela (Civil Engineering)
Chris Stubbs (Mechanical Engineering)
Advisor: Susan Finger (Civil Engineering)
Connan
12:30-4pm

The sailboat activity engages children in learning about wind power ¿ specifically how people can turn wind energy into kinetic energy. The activity also teaches children how force can be split into different components, which move the sail in a desired direction. In the beginning of the activity the children will listen to a short lesson about the effects of the size of the sail and the centerboard of the boat. After working with a scale model of a sailboat, the children will design and build their own boat using recycled materials. The children will be able to change the size of the sail and its angle to the wind so they can see how these parameters affect the speed and direction of the boat. The children will try to create a sailboat that is faster than the target time.

Van de Graaff Generator

Ian Norman (Mechanical Engineering)
Lucy Terrell (Civil Engineering)
Advisor: Susan Finger (Civil Engineering)
Connan
12:30-4pm

We would the students to learn that electrons can build up on materials and objects. By the end of the activity, they should understand that this happens by transferring elections from one type of material to another. Not only this, but already built-up electrions can disperse, effectively discharging the object, taking the object back to neutral.

In this activity, they will first experience well-known phenomena, like static-laden clothing and hair sticking to combs. This concept will be extended to other phenomena such as the electric shocks that people feel when walking in dry rooms on carpets and lightening. They will see the build up of electrons on a large Van de Graff generator. Finally, the students will assemble smaller do-it-yourself Van de Graff generator kit which they can take home.

Wah-BOOM

Alexander Hanna (Mechanical Engineering)
James Langhauser (Mechanical Engineering)
Advisor: Susan Finger (Civil Engineering)
Connan
12:30-4pm

This activity will engage students in active learning about momentum and stopping distance. In this activity, students will roll cars from various heights, dropping them down and having them hit a stationary wall. The object inside the car (a Pringles potato chip representing the passenger) might break when the car hits the wall depending on whether the "bumper" works or not. Then, the children will add different materials to the wall to cushion the car as it hits. These materials will include a zip-lock bag filled with air, a sponge, a sock, and foam.

After testing and noting the effects of height, the children will experiment with different bumpers to see which ones work and which ones do not. They will then analyze the differences in the material and learn about how different materials change the stopping distance and thereby change the effect on their Pringle potato chip passenger.

'Thought' Undergraduate Research Journal Staff:

Laura Willey (MA in Professional Writing)
Darin Clark (Materials Science & Engineering)
Elizabeth G. Herring (Psychology & English)
Ramya Ramesh (Mechanical Engineering & Biomedical Engineering)
Jessica L. Smith (Humanities & Arts)
Megan Nisargand (Social and Decision Sciences/Philisophy)
Ha Jin Choi (Design)
Jessica Kaercher (Design)
Rachel Inman (Design)
Ian Pytlarz (Business Administration)
Graham Pugh (H&SS Interdisciplinary)
Guang Gao (Materials Science & Engineering)

Advisors:

Stephanie Wallach (URO)
Jen Weidenhof (URO)
12-2:30 p.m.

'Thought', the Carnegie Mellon Undergraduate Research Journal, presents its third 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 focus on seeking out and publishing compelling undergraduate research.

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SPECIAL COMPETITIONS JUDGES & SPONSORS

The 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 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.

Grace A. Lewis, MSE 2001 (Chairperson)
R. Craig Coulter, B.S. 1990, M.S. 1992 (MechE), M.S. 1994, Ph.D. 1996 (Robotics)
Kayvon Fatahalian, B.S. 2003
James Ivers, MSE 1996
Raúl Medina-Mora, M.S. 1979, Ph.D. 1982
David I. Murray, B.S. 2006, B.F.A. 2006
Erik W. Selberg, B.S. 1993
Boris Sofman, B.S. 2005 (ECE and CS)
David M. Steier, M.S.1986, Ph.D.1989
Andrew P. Widdowson, B.S. 2005

Award for Artistic Excellence

The Award for Artistic Excellence is sponsored by engineers in support of the arts. Awards will be given to outstanding visual and performing arts presentations.

Cara Costello, Language Development Specialist, ICC
Tim Haggerty, Director, Humanities Scholars Program
Joe Mannino, Professor of Art
Ayanah Moor, Assistant Professor of Art
Terese Tardio, Lecturer, Spanish
Maureen McGranaghan, Pittsburgh High School for the Creative and Performing Arts (CAPA)

The Seventh Annual Bose Competition

Bose is proud to sponsor a special competition open to all students presenting research projects that relate to audio - technology, signal processing or education. Prizes will be awarded for the top two presentations.

Rick Kunin – Manager of Embedded Software Development, Home Entertainment Division
Jennifer McKaughan – Technical Recruiter
Bojan Rip – Electrical Engineer, Advanced Development, Home Entertainment Division

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:
Shelly Anna, Mechanical Engineering
Chris Hendrickson, Civil and Environmental Engineering
James Hoe, Electrical and Computer Engineering
Mohammad Islam, Material Science and Engineering
John Kitchin, Chemical Engineering
Bruce Krogh, Electrical and Computer Engineering
Radu Marculescu, Electrical and Computer Engineering
Irving Oppenheim, Civil and Environmental Engineering
Tom Sullivan, Electrical and Computer Engineering
Newell Washburn, Biomedical Engineering
John Wesner, Institute for Complex Engineered Systems/ME
Alumni:
Ms. Jayshree Ranka

Elizabeth Jones Award in Humanities and the Arts

The Elizabeth Jones Award, made possible by a generous contribution from Biological Sciences Department Head and Professor Elizabeth Jones, is for outstanding work in the Humanities and Fine Arts.

Cara Costello, Language Development Specialist, ICC
Tim Haggerty, Director, Humanities Scholars Program
Joe Mannino, Professor of Art
Ayanah Moor, Assistant Professor of Art
Terese Tardio, Lecturer, Spanish
Maureen McGranaghan, Pittsburgh High School for the Creative and Performing Arts (CAPA)

Ford Motor Company Undergraduate Research Awards

Ford Motor Company is proud to encourage environmental and automotive research through their sponsorship of the First Annual Ford Undergraduate Research Awards. Prizes will be awarded to the top three presentations.

Nancy Adler, Diesel R&A Performance & Emissions Engineer
Peter J. Castelli (Mechanical Engineering '04), Vehicle Development Engineer, Vehicle Dynamics CAE

IBM Undergraduate "Innovation That Matters" Award

IBM, in association with the CMU ACM Student Chapter, is proud to sponsor the Undergraduate "Innovation That Matters" Award. One of IBM's bedrock principles is to create "Innovation that Matters." This award is rooted in the belief that the very nature of innovation has changed in the early days of the 21st century. It is increasingly open, collaborative, multi-disciplinary and global. This shift means that the truly revolutionary innovations of our time -- the ones that will create new markets, redefine old ones, and maybe even change the world for the better – require the participation and knowledge across multiple disciplines with a diversity of approaches/thought patterns. This award is designed to challenges some of the brightest minds on the planet -- CMU Undergraduates -- no matter what their field of study – to collaboratively advance the state of society through interdisciplinary research.

Kevin Faughnan, Director, IBM Academic Initiative
Joann Winson, Executive, IBM Academic Initiative
Jim Whitmore, Sr. Certified IT Architect, Office of the Tivoli Security CTO
Herm Anand, SW Engineer, Business Partner Technical Strategy and Enablement
Vikram Desai, SW Architect, WebSphere Competency Center
Frank Stein, IBM Ambassador to CMU, and Program Director, Federal SOA Institute

Intel IFYRE Competition

This competition, sponsored by Intel, seeks to recognize significant and creative work supported by the IFYRE (Intel First Year Research Experience) program and to encourage students to develop and practice visual and oral presentation skills suitable for academic conferences and industrial research venues. A first-place ($500) and two runner-up ($250 each) cash prizes will be awarded.

Dina Papagiannaki, Research Scientist
Steve Schlosser, Research Scientist

The Eighth 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 Sixth 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.

Ben Cannon, Senior ECE, Eta Kappa Nu (HKN) Officer
David Casasent, Professor, ECE
Fred Dentel, Sr. Staff Computer Systems Architect, Lockheed Martin

The Allen Newell Award for Excellence in Undergraduate Research

The Allen Newell Award for Excellence in Undergraduate Research, established in 1993, recognizes outstanding undergraduate research in Allen's scientific style, i.e., a good idea is not enough. Allen Newell had a long and rich 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. Because of the breadth of scope and extraordinary quality of Allen's contributions, this award recognizes 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.

In this simplicity lies the source of profound science.

Phi Kappa Phi Competition

The Carnegie Mellon chapter of the Phi Kappa Phi honor society will award prizes to student member(s) in recognition of outstanding research. Judges include faculty and staff members of the society, including executive committee members:

Eric Grotzinger, Associate Dean, Mellon College Science
Nancy Klancher, Director, Graduate Programs Office
James Roberts, Teaching Professor, Computer Science

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.

Brooke Feeney, Associate Professor, Psychology
Vicki Helgeson, Professor, Psychology
Charles Kemp, Assistant Professor, Psychology
Ken Kotovsky, Professor, Psychology
David Rakison, Associate Professor, Psychology
Erik Thiessen, Assistant Professor, Psychology

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
Joseph Ayoob, Special Faculty, Biological Sciences
Bahareh Behkam, Post-Doctoral Research Scholar, NanoRobotics Laboratory
Michael Bockstaller, Assistant Professor, MCS
Christopher Borysenko, Interdisciplinary Lab Director, MCS
Amy Burkert, HPP Director, Biological Sciences
Subha Ranjan Das, Assistant Professor, Chemistry
Mark Fichman, Associate Professor, Tepper
Corey Flynn, Graduate Research Assistant, Biological Sciences
Elvira Garcia Osuna, Special Lecturer, Biological Sciences
Kunal Ghosh, Assistant Head for Undergraduate Affairs, Physics
Robert Heard, Associate Teaching Professor, MSE
Veronica Hinman, Assistant Professor, Biological Sciences
Jelena Janjic, Research Biologist, Biological Sciences
George Kantor, Systems Scientist, Robotics Institute
Chris Langmead, Assistant Professor, Biological Sciences
Greg Lowry, Assistant Professor, Chemical Engineering
Danith Ly, Associate Professor, Chemistry
Mike McHenry, Professor, MSE
Nicholas Minnici, CMU alum, Management Consultant
Radu Moldovan, Research Associate, Physics
Timothy Mullins, EDP Electronics
Burak Ozdoganlar, Assistant Professor, Mechanical Engineering
Frank Pfenning, Director of Graduate Programs, Computer Science
Lisa Porter, Professor, MSE
Paul Prichard, Kennametal
Nan Song, Graduate Student Assistant, Biological Sciences
Zunjing Yang, Physics

Statistics Competition

The purpose of this competition is to encourage undergraduate projects and research in statistics and its applications, to inform faculty and students about these projects, and to encourage cross-departmental interaction. The competition is open to any student or team of students who have completed a project under supervision of faculty in the Statistics Department.

Matthew Harrison, Visiting Assistant Professor, Statistics
Cosma Shalizi, Visiting Assistant Professor, Statistics

STUDIO for Creative Inquiry Award

This competition awards up to $350 for a creative project that exemplifies or explores the zone between art and science and impacts the local or global community. The recipient(s) will be selected by research fellows and staff of the STUDIO for Creative Inquiry.

'Thought' Prize for Excellence in Research Presentation

'Thought', Carnegie Mellon's Undergraduate Research Journal, is proud to sponsor its second 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. The Undergraduate Research Office is co-sponsoring this competition.

Laura Wiley (Professional Writing)
Ramya Ramesh (Mechanical Engineering and Biomedical Engineering)

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.

David Gerard, Executive Director of the Center for Study and Improvement of Regulation
Michael Griffin, Executive Director of the Green Design Institute
Cliff Davidson, Director of the Center for Sustainable Engineering

Yahoo! Undergraduate Research Awards

Yahoo! will be looking for interesting and creative projects that lie in the intersection areas between computer and information sciences and the business or social science domains.

Don McGillen, Ph.D., Senior Manager, Campus Relations
David Knights
Dan Parham
Sahdra Robles
Nina Shih

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- **Patricia Bellan-Gillan**, Professor & Associate Head, School of Art
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- **Thomas M. Keating**, Associate Teaching Professor, CSD Education
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INDEX OF PARTICIPANTS

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Obtain general information about Carnegie Mellon University by calling 412-268-2000.

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