Undergraduate Research Symposium May 19, 2017 Mary Gates Hall

Online Proceedings

SESSION 1T

EMBODIED VOICES: NEW DIALOGUES IN MUSIC AND DANCE

Session Moderator: Juliet McMains, Dance
Meany Studio Theatre
12:30 PM to 2:00 PM

* Note: Titles in order of presentation.

***Breakup Bench:* Finding My Voice by Writing a Musical**
Rheanna Atendido, Senior, Psychology, Individualized Studies
Mentor: Wilson Mendieta, Musical Theater Program

Breakup Bench is an original musical about one girl's routine of breaking up with current lovers at the same park bench before getting too emotionally involved. The pattern is challenged when her bench disappears, along with her confidence, and she is forced to navigate through her first committed relationship in years. Much like the characters in this show, I too am searching for my voice and the bravery to use it. As a composer, lyricist, and book writer, this project pushes me to practice my individual creative process in collaboration with a number of my fellow UW theater artists. Culminating in a staged reading of the script, I am exploring the career path of a writer by learning how to showcase work that reflects a universal message by way of my original story. The characters' struggle to make sense of society's passive dating culture highlights a human phenomena experienced by all: allowing the fear of pain to prevent us from taking important risks. If just a fraction of my show resonates with someone, then my work will accomplish what I believe to be the purpose of art - to make connections. Embracing vulnerability and taking a risk myself, I hope that, in sharing the early workings of my show, I will not only discover my unique voice, but inspire others to recognize the importance of finding their own.

POSTER SESSION 2

Commons East, Easel 54
1:00 PM to 2:30 PM

The Luminous Impact of Artificial Light Sources on Human Health
Paula Gibson, Senior, Electrical Engineering
Mentor: Denise Wilson, Electrical Engineering

The purpose of this study is to effectively measure and estimate the health impact of common sources of artificial lighting that humans are exposed to at night. To compare the impact of many different types and intensities of artificial light, we have developed an approach for analyzing the profiles of these light sources that evaluates them in terms of the full moon and the way in which the melanopsin photoreceptors in the human eye respond to a full moon. Melanopsin photoreceptors play a key role in regulating circadian rhythms and biological timing in all systems of the body. At an evolutionary scale, natural moonlight is what humans are adapted to, and by comparing full moon exposure (FME) to artificial light source exposure in the context of how much is absorbed by melanopsin photoreceptors, we can understand how unnatural different devices and light sources are at night and compare their relative impact on circadian rhythms and sleep health. The results of this study show that many common electronic devices easily exceed 5X a full moon exposure and can reach as high as 100X. Ambient lighting in the home, from light sources ranging from incandescent to LED deliver well over 100 full moons of exposure at recommended ambient lighting conditions. The implication of these results is that most devices and light sources disrupt normal sleep rhythm in some way and could lead to a variety of health concerns if not properly managed. Individuals can use this data to adjust their light exposure at night, to make adjustments to urban lighting in cities, and to inform architects and designers to light residential spaces in a way that minimizes health risk.

POSTER SESSION 2

Commons East, Easel 55
1:00 PM to 2:30 PM

Capturing the Environmental Impacts of Electric Vehicles for K-16 Learners
Eloise Loen, Senior, Materials Science & Engineering
UW Honors Program
Mentor: Denise Wilson, Electrical Engineering

Electric vehicles have gained attention in recent years as an environmentally friendly alternative for conventional,

gasoline-fueled vehicles. While internal combustion engines power gasoline-fueled vehicles, electric vehicles use electric motors or batteries for propulsion. It is true that electric vehicles produce little to no tailpipe emissions and, overall, produce fewer pollutants than comparable gasoline-powered vehicles. However, when comparing the total environmental impact of electric vehicles to their gasoline counterparts, it is important to consider the associated impacts from the electricity grids from which they glean their power. In the United States, modes of electricity production vary by geographic location and include coal, natural gas, petroleum, nuclear, hydroelectric, and renewable sources. The purpose of this research has been to understand and quantify these environmental impacts and communicate them in an accessible manner to K-16 learners. To date, only the greenhouse gas emissions of electric vehicles have been quantified in such a way, providing equivalent miles to the gallon compared to gasoline vehicles by state. Our research efforts have taken this comparison one step further by capturing equivalent emissions of lead (Pb), land usage, and water usage of electric vehicles for every state in the U.S. While useful in and of itself, this information has been embedded in clickable maps, various multimedia, and exhibits for K-16 audiences using principles of exhibit design that allow a participant of any age to understand and absorb key principles surrounding electric vehicle usage in the United States. Effective exhibit interactives emphasize the engagement of all five senses through physical activity and stimulate visitors both intellectually and emotionally. Our exhibits and presentations have been carefully engineered to convey factual and intuitive information to K-16 students in an inviting, exploratory, and accessible manner.

POSTER SESSION 2

Commons East, Easel 56

1:00 PM to 2:30 PM

Monitoring the Proper Use of Safety Glasses in the Workplace

Logan Mitchell (Logan) Stimson, Senior, Chemical Engineering
Mentor: Denise Wilson, Electrical Engineering

Safety precautions are only effective when implemented properly. This is a major obstacle when using wearable devices to promote workplace health and safety. User compliance is a serious concern: Is the user using the device and is it worn as intended? Monitoring user compliance using electronic sensing systems faces limitations. The systems must be cost effective, small, and fit the form of the wearable device all while maintaining enough power to be beneficial. This research monitors compliance in the proper wear of safety eyeglasses within these limitations and constraints. Specifically, information on safety eyeglass orientation and location on the head is gathered continuously using a hall effect sensor mounted on the glasses themselves and a magnet mounted on the user's ear. Tests on six different users (including both male and female adults) show that four different positions (on the bridge of the nose, on the tip of the nose, on the forehead, on the top of the head) of the glasses can be detected for each user and four different motions, all beginning in the proper 'on' position on the bridge of the nose, can also be detected. The overall error rate for data sets collected among six different users is less than 10% and error rates within any one user did not exceed 25%. Collecting both transient motion and steady-state position data minimizes error rates for understanding user compliance. These preliminary tests demonstrate the viability of using these safety glass monitoring systems for not only understanding where the glasses are at any point in time but also how they got there. This information is useful to not only capture non-compliance but also to understand behavior well enough to support effective measures to increase compliance (of wearing safety glasses when they are needed).

POSTER SESSION 4

MGH 206, Easel 175

4:00 PM to 6:00 PM

An Ontogenetic Investigation of a Cretaceous North American Mammal, *Didelphodon vorax* (Metatheria: Marsupialiformes), through Quantitative and Descriptive Analysis of the Dentary

Amanda Peng, Senior, Earth & Space Sciences (Biology), Biology (Ecology, Evolution & Conservation)
Natalie Toews, Junior, Anthropology: Human Evolutionary Biology
Mentor: Gregory Wilson, Biology

Didelphodon vorax is a large-bodied, North American metatherian, closely related to today's marsupials. *D. vorax* is posited to have been durophagous (i.e. feeding on hard-shelled organisms or bone), and is considered one of the largest mammalian forms of the Late Cretaceous, living among the dinosaurs. Fossil finds for this taxon are rare and geographically constrained to the North American Western Interior, which often times impedes comparative intraspecific studies. Through quantitative and qualitative measures, including both linear measurements and comparative description, we compiled an extensive review of multiple specimens. We analyzed each specimen, comprised of various mandibular elements, in the context of ontogeny (i.e. the development of an organism from early stage to maturation) utilizing a principal components analysis. We seek to investigate the morphological modifications which characterize and differentiate juvenile and adult forms of *D. vorax*. Our results shed light on the relationship between ontogeny and morphology in this taxon.

POSTER SESSION 4

MGH 206, Easel 171

4:00 PM to 6:00 PM

Theropod Dinosaur Diversity Leading Up to the Cretaceous-Paleogene Mass Extinction, Based on Teeth from Uppermost Cretaceous Hell Creek Formation, Montana

Athena Tse, Recent Graduate,
Mentor: David DeMar, Biology
Mentor: Gregory Wilson, Biology

The Cretaceous-Paleogene (K-Pg) mass extinction is the most recent of the 'big five' mass extinctions and led to the extinction of all dinosaurs except birds. Theropod dinosaurs, which were mostly carnivorous, were important members of latest Cretaceous terrestrial ecosystems. A popular hypothesis for the K-Pg mass extinction is that a meteor impact caused rapid extinction of many taxa 66 million years ago (Ma). The fossil record of dinosaur skeletons is not sufficient to assess the timing and pattern of the K-Pg mass extinction and its potential cause(s). Here, I documented theropod diversity using a sample of 783 fossil teeth from eight localities that span most of the depositional duration of the Hell Creek Formation (HCF; ca. 1.9 million years). To test the hypothesis that the bolide-impact was the sole cause of the mass extinction, I wanted to determine if significant changes in theropod diversity occurred before the impact at the K-Pg boundary. New and updated taxonomic identifications were based on the current literature. Raw, range-thru, and rarefied taxonomic richnesses as well as relative abundances and heterogeneity indices (evenness, Simpson's) were calculated for each of the fossil localities. In total, eight theropod taxa were identified from the HCF. Richness shows a slight decrease from eight taxa in the lowermost HCF locality to five to seven taxa higher in section. Rarefied richness was lowest in the uppermost HCF. Although the changes observed in richness are minor, relative abundance and heterogeneity values differed significantly from the middle to upper HCF localities implying that major changes in theropod faunas occurred locally within the last few hundred thousand years of the Cretaceous prior to the bolide impact. Similar patterns have been observed in the amphibian and mammalian faunas suggesting other environmental factors (e.g., volcanism, climate change) contributed to the causes of the mass extinction.