

Houston HFES 2018 One Day Symposium

Titles

Panel

Beyond Academia: Landing a job in industry

Evelina Tapia, ChaiOne, Emmanuelle Bolloix, Schlumberger, Maya Greene, KBRwyle at NASA Johnson Space Center, Monica Snideman, End to End User Research

Posters

Investigating Nursing Task Interruptions in Intensive Care Units

Mahnoosh Sadeghi, Texas A&M University, Farzan Sasangohar, Texas A&M University

Towards a Theoretical Model of Aggregate Fatigue in Nursing

Farzan Sasangohar, Texas A&M University, James Flores, Texas A&M University

Functional Information Requirements Analysis of A Smart Nursing Tool Farzan Sasangohar, Texas A&M University, Kunal Khanade, Texas A&M University, Mahnoosh Sadeghi, Texas A&M University

Effects of the source of advice and decision task on decisions to request expert advice Robin M. Richter, University of Houston Clear Lake, Steven C. Sutherland, University of Houston Clear Lake, William F. Althoff, University of Houston Clear Lake

Does restricting an observer's exploration degrade their judgments of others reaching abilities?

Nicholas A Garcia, Texas Tech University, Keith S Jones, Texas Tech University, Benjamin P Widlus, Texas Tech University

Event-related Cerebral Hemodynamics as a Neuroergonomic Measure of Task Demands

Emily L Maw, Texas Tech University, Eric Greenlee, Texas Tech University

Autonomous Robots in Educational Institutions: Roles and Personality

Daniela E Vazquez Klisans, University of Houston-Clear Lake

Fatigue in Offshore Oil and Gas Industry Personnel: A Systematic Review

Pranav Kannan, Mary Kay O'Connor Process Safety Center, Texas A&M University, Taylor Layton, School of Public Health, Texas A&M University, Sisley Yan, School of Public Health, Texas A&M University, M Sam Mannan, Mary Kay O'Connor Process Safety Center, Texas A&M University, Ranjana Mehta, School of Public Health, Texas A&M University

GENERALIZABLE SKILLS AND KNOWLEDGE FOR EXPLORATION MISSIONS

Vicky Byrne, KBRWyle, Jack Stuster, Anacapa Sciences, Inc., Jurine Adolf, KBRWyle, Maya Greene, KBRWyle

Does vigilance get your blood pumping? Transcranial Doppler sonography, vigilance task demands, and compensatory effort

Tiffany Lui, Texas Tech University, Eric Greenlee, Texas Tech University

Vigilance Tasks Are Stressful, But Do They Make You Sick? An Exploration of the Relationship Between Task Induced Stress and Simulator Sickness

William G. Matthews, Texas Tech University, Eric Greenlee, Texas Tech University

The Restorative Potential of Natural Imagery: A Replication of Berto (2005)

William G. Matthews, Texas Tech University, Michaela Knapp, Abigail Boudreaux, Raelyn Curiel, Brittany Neilson, Martina Klein, Texas Tech University

Perceived and Achieved Restoration: Restoration Potential of Different Components of Nature Environments

Theresa Nguyen, Texas Tech University, Brittany Neilson, Texas Tech University, Martina Klein, Texas Tech University

A machine learning approach on frontal lobe activity to assess depression in adults: Implications for rehabilitation outcomes

Yibo Zhu, Texas A&M University, Ranjana K. Mehta, Texas A&M University

A Quantitative Comparison of Methods for Collecting Subjective Usability Ratings

Ian Robertson, Rice University, Phil Kortum, Rice University

Communication patterns on Twitter during Hurricane Harvey: Implications for using Twitter during natural disasters

Ian Robertson, Rice University, Shivam Pandey, Rice University, Xianni Wang, Rice University

Research on the Smartphone Users with Chinese Input Method Based on Big data

Wenchao Zuo, School of Business, Jiangnan University & Department of Industrial Engineering, Lamar University, Yuhong Wang, School of Business, Jiangnan University, Yueqing Li, Department of Industrial Engineering, Lamar University, Guanlong Li, Department of Industrial Engineering, Lamar University

Exploring the Easiest Way to Edit A Chinese Message: A User Experience Study

Guanlong Li, Lamar University, Yueqing Li, Lamar University, Wenchao Zuo, Lamar University

Effects of Cell Phone Conversation on Looming Threshold While Driving

Bradley Weaver, Texas Tech University, Patricia DeLucia, Texas Tech University, Jason Jupe, Rimkus Consulting Group, Inc.

An Exploration of Wayfinding in Complex Hospital Environments

Andrea Crosser, End to End User Research, Spencer Jefferies, End to End User Research, Tyler Duke, University of Houston - Clear Lake, Christy Harper, End to End User Research, Angie Avera, University of Houston - Clear Lake

User-centered Design of a Post-Traumatic Stress Disorder (PTSD) tool: Qualitative Analysis of Interviews with Veterans

Patrick Williams, Texas A&M University, Farzan Sasangohar, Texas A&M University

Representing Work-As-Done (WAD) of Communication and Information Flow in an Incident Management Team

Farzan Sasangohar, Texas A&M University, Changwon Son, Texas A&M University, Jukrin Moon, Texas A&M University, S Camille Peres, Texas A&M University, Tim J Neville, Texas A&M University

A Novel Non-invasive approach to detect hypoglycemia: A Scoping review

Farzan Sasangohar, Texas A&M University, Karim Zahed, Texas A&M University, Ranjana Mehta, Texas A&M University, Madhav Erraguntla, Texas A&M University, Mark Kawkey, Texas A&M University

Modeling Team Cognition for Coordinated Decision-Making in Emergency Response via Naturalistic Observation of Interactions Farzan Sasangohar, Texas A&M University, Jukrin Moon, Texas A&M University, Changwon Son, Texas A&M University, S Camille Peres, Texas A&M University, Tim J Neville, Texas A&M University

A Discount Approach to Remote Mobile UI Usability Testing

Melissa Meingast, Hewlett Packard Enterprise

Study With Fun: A Game-Based & Haptically Enhanced Application For The Visually Impaired To Learn Astronomy

Anirudh Juloori, Lamar University, Yueqing Li, Lamar University

Neck flexion angle while utilizing iPhone X and Samsung S8+

Saishyam Akurke, Lamar University, Yueqing Li, Lamar University

Functional connectivity analysis of fatigue development in older adults using fNIRS

Joo Hyun Rhee, Texas A&M University Health Science Center, Ranjana Mehta, Texas A&M University Health Science Center

SUSapp: A free mobile application that makes the SUS easier to use in research

Jeffrey Xiong, Rice University, Phil Kortum, Rice University, Claudia Ziegler Acemyan, Rice University

Exploring Stress Resilient Feedback Modalities: Investigation of Physiological and Perceptual Load

Whitney P Mantooh, Texas A&M University, Rohith Karthikeyan, Texas A&M University, Seok Chang Ryu, Texas A&M University, Ranjana K Mehta, Texas A&M University

Investigating the Food and Drug Administration (FDA) Biotherapeutics Review and Approval Process: A Scoping Review

Samuel A Bonet, Doctoral Student, Industrial and Systems Engineering Department, Texas A&M University, Farzan Sasangohar, Assistant Professor, Industrial and Systems Engineering Department, Texas A&M University

31 Posters

15 session 1

16 session 2

Presentations

Driver Vigilance in Automated Vehicles: Effects of Task Demand

David C Newton, Texas Tech University, Eric T Greenlee, Texas Tech University, Patricia R DeLucia, Texas Tech University

Procedural Performance: Possible Costs of Time Pressure, Shift Change, and Task Complexity

S Camille Peres, Texas A&M University, Ranjana K Mehta, Texas A&M University, Wimberly S Hoyle, Texas A&M University, Ashley Shortz, Texas A&M University

Home Telemonitoring Platforms for Adults with Diabetes Mellitus: A Narrative Review of Literature

Farzan Sasangohar, Texas A&M University, Julie Hammett, Texas A&M University, Mark Kawkey, Texas A&M University

Virtual Reality Induced Disorientation

Daniela E Vasquez Klisans, UHCL, Michael Merta, UHCL, Spencer Jefferies, UHCL

Are Social Psychological Scales Appropriate for Measuring Robot Anthropomorphism?

Miriam E Armstrong, Texas Tech University, Keith S Jones, Texas Tech University, Alec J Stinnett, Texas Tech University

Analysis of Muscular Fatigue & Foot Discomfort While Wearing Different Types of Men's Formal Shoes

Nirupom Paul, Lamar University, Yueqing Li, Lamar University, Brian Craig, Lamar University

Evaluation of holographic head-up display to enhance driving safety

Karankumar V Modi, Lamar University

Can expertise acquisition for industrial tasks be measured in virtual environments? An exploratory study in SecondLife

Timothy J Neville, Texas A&M University, S. Camille Peres, Texas A&M University, Joe W Hendricks, Texas A&M University, Cara A Armstrong, Texas A&M University

REAL TIME FACE RECOGNITION UNDER VARIOUS UNCONSTRAINED SITUATIONS.

Md Manjurul Ahsan, Lamar University, Yueqing Li, Lamar University, Kishor Datta Gupta, Lamar University

Integrated RSI Prevention Programs: How peer awareness training of employees and practitioners can increase the effectiveness of early workstation discomfort interventions.

Michael R Grimsley, Chevron, Janis Davis-Street, Chevron, Greg Sims, Chevron

Train like a Crew Medical Officer Study: Researchers lessons learned and recommendations from a multi-session training retention study of physicians and non-physicians

Vicky Byrne, KBRWyle, Doug Ebert, KBRWyle, Jerri Stephenson, NASA, Ashot Sargsyan, KBRWyle, Kathleen Garcia, KBRWyle

NEXTGEN ONE PORTAL USABILITY EVALUATION

Ernest V Cross II, Leidos, Jeevan S Perera, NASA, Andrea M Hanson, NASA, Kirk English, JES Tech, L Vu, Geologics

ISS HABITABILITY DATA COLLECTION AND PRELIMINARY FINDINGS

Maya Greene, KBRwyle, Sherry Thaxton, NASA, Alexandra Whitmire, KBRwyle, Susan Schuh, MEI, Ron Archer, Leidos, Katie Vasser, MEI

Virtual Environments: Eliciting Emotions

Yuliana Barajas Barragen, University of Houston-Clear Lake, Spencer P Jefferies, University of Houston-Clear Lake, Raquel S Garcia, University of Houston-Clear Lake

Lessons learned from the development and implementation of a comprehensive Human Performance Strategy in a large oil and gas company.

Christopher W Parker, BP, Sandra Adkins, BP

Visualizations to Support the Design of Fault Management

Carroll Thronesbery, S&K Global Solutions, Pamela Fournier, S&K Global Solutions, Timothy Olson, S&K College (SKC), McMahon Eugene, S&K Global Solutions, Mike Monahan, S&K Global Solutions

16 paper presentations

Abstracts

Panel

Beyond Academia: Landing a job in industry

Evelina Tapia, ChaiOne, Emmanuelle Bolloix, Schlumberger, Maya Greene, KBRwyle at NASA Johnson Space Center, Monica, Snideman, End to End User Research

The changing landscape of academic employment opportunities, as well as the increasing visibility of industry jobs, are attracting interest from research-heavy graduate programs. However, candidates are often uncertain how to best initiate the transition, how to match their skills against job descriptions, and whether it is valuable to pursue industry-specific training and certifications. The panel will present different perspectives from Human Factors and User Experience Researchers who are successfully using their graduate-level skills and experience in the industry. The panel will discuss how candidates with strong academic research backgrounds can translate their skills to specific industry jobs, how to stand out in the job search process, and how to make the overall transition from academia to industry successful. While the panel will discuss specific set topics, audience participation will be highly encouraged.

Posters

Investigating Nursing Task Interruptions in Intensive Care Units

Mahnoosh Sadeghi, Texas A&M University, Farzan Sasangohar, Texas A&M University

More than 250,000 each year in the United States are attributed to preventable medical errors (Hayward & Hofer, 2001). Recent studies show a strong association between the rate of the errors made and interruptions to personnel (Spooner, Corley, Chaboyer, Hammond, & Fraser, 2015). Interruptions are inherent characteristics of the healthcare system due to the importance of communication to convey task-relevant information routinely (Berg et al., 2013, Berg et al., 2016). These interruptions are frequent and may negatively affect patient safety (Yngman-Uhlin, Klingvall, Wilhelmsson & Jangland, 2016). For instance, interruptions affect working memory and result in shifting focus away from the task-at-hand (Berg et al., 2016). Also, interruptions may lead to a significant increase in task completion time (Elganzouri, Standish & Androwich, 2009). Additionally, in many studies, decreased work satisfaction which deteriorates employee's productivity is related to interruptions. However, observational studies indicate that not all interruptions are detrimental, for they may carry crucial patient-related or task-related information that is of importance to patient safety (Sasangohar, Donmez, Easty, Storey, & Trbovich, 2014). Therefore, blocking all interruptions may not be a systematic approach to deal with this phenomenon (Rivera-Rodriguez & Karsh, 2010). Although a variety of interventions have been introduced to the healthcare system, none of them were effectual enough to be used in the hospitals. This can be a result of the gaps and limitations in the studies in this domain. While interruptions to nurses have been studied, comprehensive investigation of interruptions content, context, and characteristics in ICU; which is of the most complex healthcare systems; needs further attention (Rivera, 2014). A scoping review of the literature was conducted to understand current models, gaps, and biases in this area of research. Our findings suggest that there are four main research gaps in existing studies in this area which have to be focused more in future. These gaps are 1) lack of evidence connecting interruptions to high-severity medical errors, 2) lack of using interrupters as the unit of analysis, 3) inconsistent accumulation of knowledge, and 4) study design limitations and biases.

Towards a Theoretical Model of Aggregate Fatigue in Nursing

Farzan Sasangohar, Texas A&M University, James Flores, Texas A&M University

Burnout among shiftwork personnel such as nurses are prevalent and the evidence suggests an increasing trend of nurse drop out in complex healthcare settings. This study treats nursing in a hospital setting as an extreme environment due to the pace, emotional stressors, and shift work which can lead to chronological isolation. Extreme environments tend to magnify psychosocial stressors and limit opportunities for recovery. While nurses' acute and chronic fatigue have been studied, current models of fatigue do not capture the pre-chronic phase we refer to as "aggregate fatigue". Aggregate fatigue is the buildup of fatigue and stress that exceeds the capacity for physiological and cognitive fatigue recovery processes. Understanding aggregate fatigue requires a holistic understanding of a wide range of contributors including recovery, sleep, work, non-work-related stress, cognitive load and other psychosocial factors. In this paper, an integrated model of fatigue in hospital nursing is proposed and a comparison to the common models of fatigue and burnout is presented. Physical factors such as exercise, nutrition, fitness level, fasting and caloric balance are included along with the psychological factors normally associated with stress and fatigue. We use a narrative review of literature to ground this multi-attribute model of aggregate fatigue which may shed light on future methods to identify and mitigate fatigue build-up contributing to burnout. This approach can also be applied to energy industry workers, police, firemen, soldiers, and astronauts by applying the principles to the conditions for each case. Fatigue leading to burnout cost hundreds of billions of dollars annually and more than a third of the US working population is reported to have some level of occupational fatigue buildup.

Functional Information Requirements Analysis of A Smart Nursing Tool Farzan Sasangohar, Texas A&M University, Kunal Khanade, Texas A&M University, Mahnoosh Sadeghi, Texas A&M University

"The nursing work can be characterized as the spearhead for patient care in the healthcare setting. Nurses are the last line of defense to reduce preventable medical errors and often suffer from poor systems design along with human factor issues such as long working hours, dynamic workload, stressful situations, fatigue and moral distress. These factors contribute to reduce the quality of care and might increase the length of stay for patients.

The causes for errors might include systematic design problems, education, and training for healthcare staff and human factors and ergonomics involving different aspects of stress and fatigue. Along with issues with monitoring and measurement techniques to sustain effective programs that track and improve the system, it is important to study critical aspects of the interaction between nurses, nursing work and the nursing environment that might lead to errors.

In recent years, systems engineering approaches have been put forth to improve performance, the framework of Systems Engineering Initiative for Patient Safety (SEIPS) model has been used to analyze complex dependent constructs in nursing.

This poster will provide information regarding the front-end engineering of a "Smart Nursing System" that inculcates principles on human factors and systems engineering to improve communications between the nurses and their managers, provide memory aids, lowers access cost of information of patients for the nurses and based on biometric parameters.

The article will also document the systematic process of deriving information requirements from two focus groups and a group participatory design cum usability study. The usability study was based on the prototype created using the needs from the previous two focus groups. These studies were conducted with nurses working in various Southeastern Texas hospitals. The main information requirements derived from these studies was a need for accessing patient's vital signs as well as laboratory results,

memory aid tools for various critical nursing tasks, and options to call for help as well as options to reduce interruptions for critical tasks. The system would show promise to reduce interruptions, monitor physiological parameters for signs of acute stress or fatigue, provide necessary information linked to patients for the nurses in charge of the patients."

Effects of the source of advice and decision task on decisions to request expert advice Robin M. Richter, University of Houston Clear Lake, Steven C. Sutherland, University of Houston Clear Lake, William F. Althoff, University of Houston Clear Lake

Automation has become a deeply integrated aspect of everyday activities, where members of society must choose when and how much automation to use, alongside input from human cooperatives. There are many attributes associated with both humans and automated systems that we encounter that influence our perspectives and distinguish the amount of trust we assign to them. Without trust in the automation that is implemented, there is an increased probability that the system will be underutilized (Parasuraman & Riley, 1997). In this study, we investigated the decision-making process in a dual advisor context. Our goal was to investigate the relationship between trust in human advice versus automated decision support systems. Participants were asked to play a search and rescue or resource repair video game. The experiment was composed of four different versions of the game; advice from a drone while searching for survivors, advice from a human expert while searching for survivors, advice from a drone while searching and repairing oil wells, and advice from a human expert while searching and repairing oil wells. Participants were randomly assigned to one of the four conditions. In the task, participants were presented with twelve locations in each trial and were asked to choose three locations to search. They could request advice and received either advice from a drone or a human expert (confederate), depending on the condition to which they were assigned. The participants' task was to choose the three best zones in order to save the most lives, or resources, respectively. Participants were asked to play through as many trials as they could in a 30-minute time frame. We predicted that participants would request advice more often from the human expert, in general, and more so when they were trying to save lives rather than resources. We further predicted that participants would request advice more often from the drone when they were tasked with saving resources rather than lives. Overall, the results of this study contradicted our expectations. Participants utilized automation more consistently than the advice of the human expert. There was no significant effect of lives vs. resources being saved on the decision to request advice. Our findings do contradict previous literature that suggests human advice is subjectively weighted more than automated advice (Madhavan & Wiegmann, 2007). This may be a result of societal patterns of increased comfortability and trust in automated systems. As automated systems become increasingly integrated into our daily lives, the gap between reliance on automated versus human advice may decrease (as was observed in this study). When trusted and perceived as reliable, automated systems can be used in locations where it is unsafe for humans to be, which increases the necessity for a higher level of trust in the system that is being utilized.

Does restricting an observer's exploration degrade their judgments of others reaching abilities?
Nicholas A Garcia, Texas Tech University, Keith S Jones, Texas Tech University, Benjamin P Widlus, Texas Tech University

"Studies have shown that an observer can judge an actor's action capabilities. For example, observers can judge the maximum object height upon which an actor can sit, climb in a bipedal manner, or reach (Stoffregen et al., 1999; Mark, 2007).

A small body of literature investigated exactly how observers make such judgments and has led to two

possible explanations. First, observers may perceive actor-environment relations that determine a given action capability. Ramenzoni et al. (2008a) suggests that observers use information available in actors walking kinematics to perceive actors jump-reach heights. Second, observers may perceive observer-environment relations for a given action capability and then use their own capabilities to model the actor's capabilities. This is consistent with Ramenzoni et al. (2008b), which indicates that manipulation of the observer's capability to jump-to-reach an object impacts the observer's perception of an actor's capability to jump-to-reach an object. Therefore, the empirical evidence on how observers make judgments of others capabilities is mixed.

The present research aims to contribute to this debate. To do so, participants in the present study will make judgments about an actor's maximum reach capability by directing a confederate to a position they perceive to be the farthest point from an object that would still afford the confederate the ability to reach the object. The observer's arms will be either freely held by their sides or restricted by having them place their hands behind their back. Widlus and Jones (2017) demonstrated that manipulating arm movements in this way affects an actor's judgments about their own reaching capabilities. This result is consistent with a large body of literature that indicates restricting exploration degrades one's ability to accurately judge one's own action capabilities. For example, Mark et al. (1999) demonstrated that restricting visual exploration reduces the accuracy of one's judgments regarding whether one can cross a gap. Similarly, Yu, Bardy, and Stoffregen (2011) demonstrated that restricting postural movements of the head and torso reduced the accuracy of one's judgments about whether one could pass under a lintel. The observers perceive actor-environment relations explanation will be supported if an observer's arm restriction does not degrade judgments of the actor's reaching ability. However, the observers use themselves as models explanation will be supported if observer arm restriction degrades judgments of the actor's reaching ability. Current data collection is on-going and preliminary results will be reported. The present experiment's results will have practical implications for the design of assistive robots. Such robots will need to judge human actors action capabilities. For example, a robot that serves as an elder's caregiver will need to make accurate judgments of the elders ability to reach objects, in order to best understand when to offer assistance. Developing a better understanding of how human observers judge an actor's action capabilities will inform the design of assistive robots that must judge human actors action capabilities."

Event-related Cerebral Hemodynamics as a Neuroergonomic Measure of Task Demands

Emily L Maw, Texas Tech University, Eric Greenlee, Texas Tech University

"Vigilance and sustained attention have long been studied using physiological measures, such as electroencephalography (EEG) and global cerebral blood flow velocity (CBFV). These neuroergonomic measures, in tandem with the resource theory of sustained attention advocated by Davies, Parasuraman and Warm, can be used to predict performance decline over the duration of a task. Studies by researchers such as Greenlee and Shaw have shown that aside from global CBFV, there is an event-related response in CBFV that behaves similarly to the event-related potential associated with EEG. The proposed study aims to further investigate similarities between these two event-related neuroergonomic measures by testing the sensitivity of event-related CBFV to experimental manipulations that have been established in the event-related potential literature.

A 40-minute vigilance task will be administered to test the hypothesis that event-related CBFV is responsive to the same types of experimental manipulation as event-related potential (ERP). If task related differences impact the P300 component of the ERP, given that P300 is an index of attentional

resource, and the apparent pattern of response in event-related CBFV is also an index of attentional resource, CBFV might then be impacted similarly by task manipulation. The primary task manipulation for the experiment at hand is signal probability. All CBFV measures will be recorded continuously via transcranial doppler sonography. Data collection for this project is currently ongoing, and preliminary results will be reported.

If event-related CBFV is responsive to manipulations of signal probability, which is a well-documented manipulation within the realm of ERP literature, this lends credibility to the hypothesis that event-related CBFV is an additional neuroergonomic measure of attentional resources.

This line of research has the potential to be applied in operational settings requiring vigilance-type tasking, including safety-critical environments. Further understanding operator response to attentional demands in real time could better allow for the development of strategies that address and optimize operator performance. "

Autonomous Robots in Educational Institutions: Roles and Personality

Daniela E Vazquez Klisans, University of Houston-Clear Lake

The evolution of robots and artificial intelligence has spiked rapidly in the last decade, and autonomous robots are now being utilized in a diverse array of domains, including education. Previous research about people's perceptions of robots have identified human and robot's personalities (Lee, Peng, Jin, & Yan, 2006) and the robot's role (Tay, Jung, & Park, 2014) as mediators of acceptance. Few studies, however, have been conducted to examine individuals opinions about utilizing autonomous robots in the classroom, and even less have included and inquired into the given personality of these robots. Also, it is noteworthy that studies that did address personality within human-robot interactions enclosed their discussions within the introversion-extroversion dimension (Santamaria & Nathan-Roberts, 2017). Even further, it has been found that culture plays a prominent role in people's perceptions of robots, and most studies have been conducted in Asian and European countries. With these concerns in mind, the survey presented here explores the opinions of parents, educators and students living in the U.S. about autonomous robots in schools, their potential roles, social capabilities and personality traits. This research is ongoing, and preliminary findings are discussed from the responses of 53 graduate students enrolled in research design and statistics courses at University of Houston-Clear Lake.

Fatigue in Offshore Oil and Gas Industry Personnel: A Systematic Review

Prnav Kannan, Mary Kay O'Connor Process Safety Center, Texas A&M University, Taylor Layton, School of Public Health, Texas A&M University, Sisley Yan, School of Public Health, Texas A&M University, M Sam Mannan, Mary Kay O'Connor Process Safety Center, Texas A&M University, Ranjana Mehta, School of Public Health, Texas A&M University

"This systematic review focuses on fatigue research on workers in the offshore oil and gas industry. Fatigue is a construct that can be measured through physical, mental, and/or emotional well-being. As workers in the offshore oil and gas industry work in high-risk environments, fatigue can have grave repercussions. In the oil and gas industry, specifically offshore workers are exposed to complex and dynamic fatiguing tasks due to their environment. Further research is needed in the offshore sector in order to increase the mental and physical well being of these workers. From this review we hope to highlight the gaps that are currently in place when measuring fatigue in offshore workers and prove extensive research is needed on the subject.

The review was conducted on publications from four databases: Medline OVID, Engineering Village Ei Compendex, CINAHL, and PsycINFO. Following the defined inclusion and exclusion criteria, 280 abstracts

were sorted using Rayyan QCRI by one graduate student and two undergraduate students. Conflicts in sorting were resolved in person through discussion and abstract screening. When the abstract screening was completed, the articles were narrowed down to a total of 131 articles that fit our inclusion criteria. The coding process began once the articles were narrowed down. The coding process was completed by using a data entry form where data from the articles was coded into the form for the systematic review. Articles were still being excluded in this step due to foreign language or irrelevant content in regards to the review. Throughout the entire process, some common variables were seen and associated with fatigue from the included articles. Among these variables were shift work, sleep, circadian rhythm, stress, and mental health. "

GENERALIZABLE SKILLS AND KNOWLEDGE FOR EXPLORATION MISSIONS

Vicky Byrne, KBRWyle, Jack Stuster, Anacapa Sciences, Inc., Jurine Adolf, KBRWyle, Maya Greene, KBRWyle

This study addresses the Risk of Inadequate Mission, Process, and Task Design and the Risk of Performance Errors Due to Training Deficiencies by identifying the work that will be performed during an expedition to Mars and the abilities, skills, and knowledge that will be required of crew members. The study began by developing a comprehensive inventory of 1,130 tasks that are likely to be performed during the 12 phases of the first human expedition to Mars, from launch to landing 30 months later. More than 60 subject matter experts (SMEs) rated major categories of expedition tasks in terms of (likely) frequency, difficulty to learn, and importance to mission success; a fourth metric was derived by combining the mean ratings of the three dimensions. SMEs also placed the physical, cognitive, and social abilities necessary for performance of the tasks in order of importance for specialist domains identified by the task analysis. The next research steps are to, 1) Identify the abilities, skills, and knowledge that can be retained and generalized across tasks; 2) Develop optimum training strategies; and, 3) Recommend crew size and composition. Study results also will be useful to the designers of equipment, habitats, and procedures for exploration-class space missions.

Does vigilance get your blood pumping? Transcranial Doppler sonography, vigilance task demands, and compensatory effort

Tiffany Lui, Texas Tech University, Eric Greenlee, Texas Tech University

"Objective: This study uses a novel neuroergonomic approach to determine whether blood flow within the frontal cortex is sensitive to task demands and indicative of compensatory effort regulation that may occur in response to the vigilance decrement.

Background: Vigilance refers to an individual's ability to sustain attention for an extended period of time in order to detect rare, unpredictable stimuli. Vigilance is a requirement in a variety of operational settings (e.g., military surveillance, medical monitoring) and is a human factors concern because performance in vigilance tasks declines over time, a phenomenon known as the vigilance decrement. According to attentional resource theory, the vigilance decrement is caused by depletion of cognitive resources. Support for this theory comes from neuroergonomic work using transcranial Doppler (TCD), a device that measures cerebral blood flow velocity (CBFV), a hemodynamic index of neural activity. Studies using TCD demonstrate a temporal decline in CBFV that parallels the vigilance decrement. To date, CBFV studies have focused on the middle cerebral artery (MCA) because it fuels brain regions associated with vigilance. However, research using functional near infrared spectroscopy (fNIRS) suggests that understanding and predicting vigilance performance may also require examining the role of frontal lobe activity. In one vigilance study, frontal cortical regions were monitored using fNIRS, while

the MCA was monitored using TCD. Results demonstrated that the typical decline in MCA CBFV was paired with an increase in frontal lobe activity. Given the frontal lobe's importance for executive control, the researchers argued that the frontal activity represented increases in effort that may have been required to compensate for the loss of attentional resources indexed by the MCA.

The aim of the current study is to further explore that possibility using TCD. While the MCA has been the exclusive focus of past vigilance research utilizing TCD, the anterior cerebral artery (ACA) supplies blood to the frontal regions that were measured using fNIRS in the abovementioned study. If those frontal regions are indeed involved in effort regulation for vigilance tasks, CBFV within the ACA should increase as a function of time on task, opposite the vigilance decrement. Additionally, CBFV within the ACA should be sensitive to manipulations of task demands.

Methods: Participants completed a visual vigilance task while equipped with TCD which monitored CBFV within the ACA. Demands of the vigilance task were manipulated (between subject) by presenting participants with stimuli that occurred in either a constant, temporally predictable manner or a variable, unpredictable manner.

Expected Results: We expect that there will be a temporal increase in CBFV in the ACA during a vigilance task as performance decreases. We also expect that CBFV will be greater when stimuli appear predictably than when they appear unpredictably. The vigilance decrement should be greater in the vigilance task with temporal uncertainty compared to a vigilance task with no temporal uncertainty.

Application: Potential applications of this research include better assessment of operator vigilance using TCD. This line of research may inform adaptive strategies for optimizing performance in operational settings that require vigilance. "

The Restorative Potential of Natural Imagery: A Replication of Berto (2005)

William G. Matthews, Texas Tech University, Michaela Knapp, Abigail Boudreaux, Raelyn Curiel, Brittany Neilson, Martina Klein, Texas Tech University

Resource limitations are a prevalent issue in operational settings requiring prolonged attention. One potential solution to this problem is provided by Attention Restoration Theory, which suggests that viewing natural imagery restores one's attentional resources better than urban imagery. We sought to replicate a study supporting this theory, namely that of Berto (2005). The reasons for replication are twofold: 1) Berto performed multiple t-tests without correction for familywise Type 1 error inflation, 2) Berto did not include a control condition. Sixty participants (taken from a larger study of 120) were randomly assigned to conditions involving urban, natural, and geometric (control) imagery. The choice of geometric imagery as our control condition stems from a separate study by Berto, which demonstrated that it produced no significant performance differences. During the experiment, participants first completed a ~4-minute Sustained Attention to Response Task (SART) to induce attentional fatigue, then viewed a series of 25 images for ten seconds each, corresponding to their assigned condition. All images were identical to those used by Berto. The images were followed by a second SART to determine post-intervention performance. With regards to the pre- and post- imagery SARTs, we analyzed correct responses, average response time, and sensitivity to detect targets (d) in order to establish an effect of imagery; 2 (pre- vs post- SART) x 3 (nature, urban, control) mixed-design ANOVAs indicated that there was no such effect. With this in mind, there is potential that Berto's original study results were due to Type 1 error. A further possibility for our failure to replicate Berto may be differences in imagery preference between Berto's Italian sample and our American sample. While this study functioned under the hypothesis that restoration is the augmentation of attentional

resources, future investigations may seek further to identify alternative possibilities concerning the mechanism of restoration.

Vigilance Tasks Are Stressful, But Do They Make You Sick? An Exploration of the Relationship Between Task Induced Stress and Simulator Sickness

William G. Matthews, Texas Tech University, Eric Greenlee, Texas Tech University

"Vigilance, or the ability to maintain attention for prolonged periods of time to detect critical events, is a crucial element of tasks in many operational settings. For example, monitoring video surveillance for threats, examining x-rays for anomalies, and monitoring imperfect automation systems for potential failures are all tasks that require vigilance. Such tasks represent a human factors concern for several reasons: the ability to maintain vigilance tends to decline over time on task, the workload associated with vigilance is high, and vigilance tasks are stressful. The current study focuses on the stress induced by vigilance tasks, which is a concern because task-induced stress often cooccurs with or is a harbinger of performance impairment, and it may even lead to operator burnout.

Numerous previous studies have shown that stress increases during vigilance tasks, an effect that has been attributed to the boring, fatiguing, and distressing nature of vigilance tasks. Recent evidence from a study by Greenlee and colleagues (2015), suggests the possibility that the stress induced by vigilance tasks may contaminate other, non-stress-related measures. Specifically, these researchers found that a vigilance task that induced high levels of stress also induced symptoms associated with simulator sickness (e.g., Oculomotor Disturbances, Disorientation, Nausea). To explain this novel finding, they raised the possibility that the elevated reports of simulator sickness may be due to the stress caused by vigilance tasks, meaning that the stress of vigilance tasks may have a negative impact on the validity of non-stress-related psychometric instruments used by human factors researchers and practitioners, such as simulator sickness questionnaires.

The current study was designed to further explore this possibility. If stress is indeed the cause of elevated simulator sickness reports in vigilance, then task induced stress levels should be correlated with simulator sickness levels for individuals performing a vigilance task. Though correlation is necessary but not sufficient evidence to determine causality, correlational analyses would indicate whether it is possible for a causal relationship to exist. To determine whether this may be the case, the present study employed a visual vigilance task and assessed subjective task-induced stress and simulator sickness. The correlational relationship between these measures will be determined by way of bivariate correlational analysis, and implications for research and practice will be discussed."

Perceived and Achieved Restoration: Restoration Potential of Different Components of Nature Environments

Theresa Nguyen, Texas Tech University, Brittany Neilson, Texas Tech University, Martina Klein, Texas Tech University

Nature environments are thought to have cognitively replenishing capabilities, and if we are able to implement this idea into areas where people typically get cognitively fatigued (e.g., occupational settings), it may be possible to assist people working in these areas. In addition, it would be further beneficial to know what components of nature environments to implement and if a particular aspect of nature leads to more cognitive restoration than others. Previous research has found that aquatic components of a nature environment (e.g., lakes, oceans) are perceived to be more restorative than greenery components (e.g., grass, trees), and this finding has been coined as the "dose effect of water" (White et al., 2010). The researchers theorized that from an evolutionary perspective, people's

preference for water is adaptive, as water is a crucial element for survival. However, controversy surrounding the effect arose when subsequent researchers were only able to partially replicate this effect (Neilson, Klein, Briones, & Craig, 2016; Neilson, Nguyen, Bukowski, & Klein, 2017). The researchers wondered if their findings were the result of confounds with the photos White and colleagues used, such as having vastly differing photo quality across photos and using a very small and uneven number of photos across conditions. Since the dose effect of water has only been observed in White and colleague's study using his specific photos, we were interested in observing if this effect would generalize to a set of unique images that accounted for the various confounds thought to be present in previous research. Our objective of Study 1 was to determine whether the perceived dose effect of water would generalize to new, unique images. In Study 1, we planned on measuring the perceived restorativeness of differing nature conditions; however, in Study 2, we were interested in measuring the actual, cognitive restoration of these same images. Since the dose effect of water had not been found with measures other than perceived restoration measures, we wondered if this would translate to cognitive restoration. Because of the potential benefits and ease of application into occupational domains, our objective of Study 2 was to determine if the dose effect of water would generalize to cognitive restoration. Our results indicated that the restorative effect cannot be explained simply by proportion of water and more research should be conducted to clarify what aspects of nature make it more restorative.

A machine learning approach on frontal lobe activity to assess depression in adults: Implications for rehabilitation outcomes

Yibo Zhu, Texas A&M University, Ranjana K. Mehta, Texas A&M University

"Major depressive disorder (MDD), also known as depression, is a severe and common psychiatric disorder and often associated with increased disability, cognitive impairments, and suicidality and mortality (Gotlib et al., 2008; Ilić et al., 2017). Depressive symptoms can significantly impact physical capabilities, particularly when workers perform critical or complex occupational tasks involving intensified workload and precision demands. Clinical symptoms of MDD patients and their brain-image data implicate differential activation in both prefrontal and motor cortices (Dolan et al., 1994). Whether prefrontal activation changes alone are indicative of depression symptoms is not well understood. Machine learning techniques may be able to address these potential opportunities.

The purpose of this study was to explore whether depression can be assessed using prefrontal activation using novel machine learning algorithms. Twenty participants (10 diagnosed with MDD) were instructed to perform submaximal isometric handgrip force control tasks for 5 minutes. Functional near infrared spectroscopy (fNIRS) optodes recorded continuous bilateral PFC activity during the trials. 10 features were extracted from the neural hemodynamic activation (e.g., mean value of the HbO signal (HM), Variance of the HbO signal (HV), left and right slope of the activity curve (CSL and CSR)). Extracted features were submitted to several machine learning classification algorithms to examine the features and channels that showed best classification performance.

For the "maximum HbO" feature, when data was pooled across all optodes, support vector machine and logistic regression algorithms delivered predictive models with the highest accuracies (75% and 70%). The predictive model accuracy increased to 85% (OneR algorithm; sensitivity: 90%; specificity: 80%) when the 10 features obtained from the first HbO peak of right lateral PFC were pooled. Overall, the preliminary analyses demonstrate that machine learning algorithms applied to multiple features of PFC optodes can help to identify biomarkers in classifying adults with MDD.

Follow up investigations are planned, which include larger samples and optimizing the motor control

tasks to address rehabilitation outcomes in stroke and SCI patients. Early identification of patients at high risk of depression would enable the early implementation of effective management and prevention strategies for depression that can subsequently improve rehabilitation outcomes."

A Quantitative Comparison of Methods for Collecting Subjective Usability Ratings

Ian Robertson, Rice University, Phil Kortum, Rice University

"Subjective usability evaluation is a common tool in human factors research, both applied and academic. Multiple methods for collecting subjective usability exist but there is little understanding of how they compare. The four methods are as follows. Use-Then-Measure refers to the most common method of using a product and then assessing its usability immediately, usually in a lab. Retrospective refers to collecting subjective ratings based on recall. Retrospective ratings generally come from real users of a product and base ratings off collective past use. Prospective refers to subjectively rating a product before using it. We speculate that users may prospectively rate the usability of products before using them based off descriptions or visual inspection before purchase. Watching-Others refers to rating the usability of a product from seeing others use the products, perhaps in person or based on video footage (e.g. online reviews, training videos).

It is unclear whether usability results from these 4 methods yield comparable results, which is the subject of an ongoing research study in our lab. Using the Subjective Usability Scale (SUS), participants use and rate three products. The products tested are a can opener, a digital outlet timer and a library website. The order of the products is randomly assigned for each participant. In the Use-Then-Measure, participants use each product for a specified task. Subjective usability is assessed after the completion of each task. In the Retrospective group, participants use all three products in the same way as those in the first condition. Rather than being assessed immediately, participants rate the products after a two-week delay. The Prospective group of participants are given the description of the task to be completed for each product. Participants can visually inspect each product before rating it. In the Watching-Others group, participants assess usability of each product based off a corresponding video. In the videos, a confederate uses each product to complete the same task being performed by participants in the other conditions. Before watching each video, the participant is given a description of the task the confederate is completing with the product. Participants in the fourth condition may watch each video any number of times before assessing the product.

The mean SUS scores of each condition will be compared using Dunnett's test. In total, three Dunnett's test will be conducted, one for each product. Because Use-Then-Measure represents the most common method of collecting subjective usability data, it will serve as the control to which the other three groups will be compared. The goal of this study is to determine if any differences exist between four methods of capturing subjective usability. Using this data will improve our understanding of the equivalency of these different methods and help determine if currently underutilized methods can have broader practical applications."

Communication patterns on Twitter during Hurricane Harvey: Implications for using Twitter during natural disasters

Ian Robertson, Rice University, Shivam Pandey, Rice University, Xianni Wang, Rice University

Hurricane Harvey struck Texas on August 25, 2017 causing more than \$198 billion in damage. Leading up to and after Harvey's landfall Texans were discussing the storm via Twitter. Twitter has been recognized as a potential tool to keep citizens informed during a disaster and for identifying areas that were highly impacted by weather events. Research can inform governments and NGOs on how to utilize Twitter as a

tool in engaging victims. This study analyzed 398,324 tweets using sentiment analysis. The questions of interest were whether certain sentiments related to higher twitter engagement as measured by likes, comments, and retweets. Tweets were also analyzed qualitatively to identify what Twitter users were discussing in relation to Harvey and what the general attitude of Twitter users was towards Hurricane Harvey. A regression analysis using sentiment as a predictor for social engagement indicated that sentiment does not appear to relate meaningfully to social engagement. Unsurprisingly, Twitter users were overall very negative when discussing the storm. What was not expected was that politics appeared to be the most widely discussed subject related to Hurricane Harvey. Sentiment analysis does not appear to be useful for informing how governments and NGO's may be able to leverage Twitter to disseminate information to actual or potential storm victims. It is speculated that sentiment analysis may be useful in identifying highly impacted areas by analyzing Tweets, but geolocation information is required to test this hypothesis. Those impacted by Harvey proved to be active in their use of Twitter leading to and during Harvey. Twitter may prove to be useful as a tool for engaging (potential) storm victims in future weather events.

Research on the Smartphone Users with Chinese Input Method Based on Big data

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The purpose of this paper is to find what feature of the smartphone users when they use the Chinese input method tool. Nowadays, there are the largest group of smartphone owners in China, every day hundreds of millions of people get used to shopping, texting and searching information and so on. If they want to accomplish their work, they should input Chinese words through their Chinese input method tool. It's meaningful to find which kind of user suit for what Chinese input method. Furthermore, based on the massive user's behavior data analysis through Baidu Index, it can be identified the target-users attribute for the Chinese input method, and advance a more user-friendly Chinese input method of smartphones considering the social-cultural factors affecting users. Firstly, the most popular Chinese input method tools are introduced. Secondly, the research on the Chinese input method is analyzed to find the current research limitation. Thirdly, Considering the limitation of the research on the Chinese input method, a big data analysis platform, Baidu Index is selected in order to research on the people's attributes and geographical distribution of using smartphone's Chinese input method. The conclusion and discussion show at the end of the paper.

Exploring the Easiest Way to Edit A Chinese Message: A User Experience Study

Guanlong Li, Lamar University, Yueqing Li, Lamar University, Wenchao Zuo, Lamar University

"Background: Today, China has the largest number of smartphone users, around 663.37 million in 2017 (Statista Report, 2017). The widespread use of smartphone breaks time and space limits and dramatically facilitates interpersonal communication. Among numerous dazzling Apps planted on the touchscreen, instant messaging is playing a critical role in supporting mass communication. Though various novel functions such as hold-to-talk voice messages, group chat, video conferencing and free voice call greatly enrich the way people communicate, texting is still the core and most widely used function of instant messaging.

When it comes to edit a Chinese message on a smartphone, Chinese input method is indispensable. Basically there are two types: Pronunciation based input method (Pinyin method); Structure based input method (hand-writing method). Besides, the emerging voice method is also gaining increasing

popularity.

Research Question: These three Chinese input methods advantage themselves over each other in different contexts. For example, Pinyin method greatly saves input time, and sometimes avoids the embarrassment that user doesn't know how to write the Chinese character; Handwriting is helpful in enhancing user's memory of character structure, this is especially important for entry-level Chinese learner such as children and foreigners who need sufficient practice of Chinese character handwriting; For voice method, the obvious convenience is that user can free their fingers and no design effort of virtual keyboard is required. However, no research has ever examined, with same task and under same scenario, which method has an overall higher efficiency and provides a better user experience.

Experiment: Baidu Input Method Editor (IME) will be used to offer three types of Chinese input methods: Pinyin, handwriting and voice. Volunteers will complete the texting of a paragraph of Chinese characters without punctuation. User's performance will be measured quantitatively in terms of completion time, error numbers and workload index. In addition, participant's subjective feedback will be collected by means of questionnaire.

Anticipated results: It is expected key usability problems of three input methods will be detected and suggestions addressing them will be proposed for future IME development. Besides, since different input designs enable different kind of human computer interaction and thus trigger different user behavior, it is interesting and meaningful to explore what are the common user behaviors associated with the use of varied Chinese input methods based on smartphone. A better understanding of user behavior will in return benefit the improvement of Chinese input method design."

Effects of Cell Phone Conversation on Looming Threshold While Driving

Bradley Weaver, Texas Tech University, Patricia DeLucia, Texas Tech University, Jason Jupe, Rimkus Consulting Group, Inc.

"An abundance of research has been conducted on the effects of cell phone conversations on driving, and the predominant finding is that there is a moderate performance cost in terms of brake response time to critical events, accuracy and response time of stimulus detection, and rate of collisions (Caird, Simmons, Wiley, Johnston, & Horrey, 2018). Despite ample research on this topic, there is no existing literature on the effect of cell phone conversations on driving when a lead vehicle is located at a far distance. Moreover, prior measures of detection during driving used signs or secondary probes as stimuli rather than immediate hazards (Caird et al., 2018). Detection threshold in the absence of cell phone conversation is between .003 rad/s and 0.006 rad/s (Hoffman et al., 2017; Muttart, Messerschmidt, & Gillen, 2005). However, effects of cell phone conversations on a driver's detection threshold of an immediate hazard that requires action have not been measured, which is the aim of the current pilot study.

Using a driving simulator, a comparison will be made between a group of drivers engaged in a cognitive task emulating cell phone conversation (last letter task) and a group of drivers not engaged in any cell phone conversation task. The time taken to initiate an evasive maneuver in response to a stopped lead vehicle located far in the distance will be measured and has important practical implications because collisions with a stopped vehicle represent more than 70% of all rear-end collisions (Muttart et al., 2005). It is expected that the cell phone conversation group will initiate an evasive maneuver later than the no cell phone conversation group. Results will indicate whether the detection threshold of an immediate hazard is affected by cell phone conversations, and will inform analyses of accidents by indicating when a driver can be expected to react to a stopped lead vehicle and thus when a warning might be effective. Results will be discussed."

An Exploration of Wayfinding in Complex Hospital Environments

Andrea Crosser, End to End User Research, Spencer Jefferies, End to End User Research, Tyler Duke, University of Houston - Clear Lake, Christy Harper, End to End User Research, Angie Avera, University of Houston - Clear Lake

This research began with an examination of the usability and effectiveness of three multi-building hospitals interactive touchscreen, wayfinding interfaces. Participants were recruited onsite from each of three major hospitals and completed various tasks using the wayfinding display in their respective hospital. Errors and issues consistently observed were organized and developed into insights and recommendations to aid in future design. We found basic heuristics, such as classifying information according to user expectations, including a universal search, minimizing unnecessary on-screen information, adhering to platform standards, presenting visual aids effectively, and orienting navigation information effectively were often violated. However, the biggest takeaway was the mismatch between the system and the environment created the most difficult obstacle to wayfinding success in these complex environments. Recently, we examined another wayfinding touchscreen interface and found very similar issues. We then conducted heuristic analyses on hospital wayfinding apps. Our next step is to conduct usability evaluations of the apps within the hospitals. Results from these studies will be used to develop integrated design guidelines for wayfinding systems within the complex environment of large multi-building hospitals.

User-centered Design of a Post-Traumatic Stress Disorder (PTSD) tool: Qualitative Analysis of Interviews with Veterans

Patrick Williams, Texas A&M University, Farzan Sasangohar, Texas A&M University

Many veterans from recent wars are suffering from Post-Traumatic Stress Disorder (PTSD). Ideas for novel PTSD supportive technologies were explored through iterative semi-structured interviews with veterans diagnosed with PTSD. A qualitative analysis of transcribed interview data suggests emerging topics pertaining to veteran behaviors or attitudes, overall improvement opportunities in the current PTSD care, and functional and information requirements for PTSD-supportive technologies. Findings suggest hyperarousal triggers inhibit the quality of life by encouraging avoidance, high perceived value of well-timed alerts, and a need for closing a disconnect between clinicians and their patients. Findings will inform the design of supportive solutions to connect patients to peers, report crucial information to clinicians between sessions, and leverage breathing or meditation exercises to encourage healthy refocus. Findings are expected to inform the process of designing novel PTSD treatment-supportive technologies and enable them to be better integrated with the current care system.

Representing Work-As-Done (WAD) of Communication and Information Flow in an Incident Management Team

Farzan Sasangohar, Texas A&M University, Changwon Son, Texas A&M University, Jukrin Moon, Texas A&M University, S Camille Peres, Texas A&M University, Tim J Neville, Texas A&M University

Resilience is considered an essential capability of an incident management team (IMT) to cope with increasing complexity of disasters and catastrophes, as it represents the IMT's ability to adapt its performance to emerging challenges as the incident evolves. Among many aspects of the performance of the IMT, communication and information management are crucial components that facilitate incident action planning and operational activities. To investigate such components and to understand the patterns of resilient performance that manifests itself in operation, a naturalistic observational study was conducted in a high-fidelity emergency management training environment. The study aimed at

identifying the communication and information flow following injects of scenario information into the training environment. An episode analysis was conducted to trace communication, information flow and resilient performance following the inject of scenario-based information. The analysis also facilitated the identification of complex and dynamic interactions among human and technological agents to satisfy work demands, representing work-as-done (WAD) vs. work-as-planned (WAP) in large-scale emergency response operations. The representation of WADs provided stories of how emergency operators adapted their behaviors to different challenges on information management as the incident evolved. Overall, this analysis method has shown promise and is expected to provide a measure of resilience in other safety-critical, complex team environments.

A Novel Non-invasive approach to detect hypoglycemia: A Scoping review

Farzan Sasangohar, Texas A&M University, Karim Zahed, Texas A&M University, Ranjana Mehta, Texas A&M University, Madhav Erraguntla, Texas A&M University, Mark Kawkey, Texas A&M University

"For the 400 million patients living with diabetes around the world, a serious condition called Hypoglycemia happens when their blood sugar drops below the mild and severe threshold. To help patients monitor their condition, Continuous Glucose Monitors (CGMs) have been developed over the last several years making them the most pervasive tool used to track blood glucose levels. However, these tools are invasive, require frequent maintenance and are costly, making not every diabetic willing to utilize them.

Hypoglycemic control is a bare minimum necessity in managing diabetes and so several non-invasive approaches have been tested. From among these current approaches, we find that they have not really leveraged tremors; which have been shown to be a primary symptom of hypoglycemia. In this article we review these non-invasive technologies and attempt to understand the relationship between hypoglycemia and its associated tremors.

The findings suggest that hypoglycemic tremors can be categorized as a medium frequency tremor, more resistant to hypoglycemic impairment than other symptoms, and have not been fully explored yet. This paper also documents the work in progress to utilize a novel wearable device that predicts the onsets of hypoglycemia using hand tremor sensing and incorporates several human factors principles to account not only for usability and wearability, but for user engagement as well."

Modeling Team Cognition for Coordinated Decision-Making in Emergency Response via Naturalistic Observation of Interactions Farzan Sasangohar, Texas A&M University, Jukrin Moon, Texas A&M University, Changwon Son, Texas A&M University, S Camille Peres, Texas A&M University, Tim J Neville, Texas A&M University

"To protect and assist threatened populations and infrastructures in response to natural and man-made disasters, emergency responders from diverse backgrounds collectively work as ad hoc teams. We are particularly interested in cognition of an incident management team (IMT), an ad hoc strategic decision-making team of command-level responders co-located at the incident command post of major incidents such as Hurricane Harvey. To develop and provide an incident action plan to subordinate branch directors in the field, an IMT continuously manages information based on incoming cues from outside, following a cyclical planning process. Interestingly, an IMT is a team of functional sub-teams, and each sub-team is also a team of functional units.

For a successful response, it is essential to understand the role of team cognition in coordinated decision making of an IMT as a team-of-teams (or a cognitive system-of-systems) embedded in complex sociotechnical systems. However, an IMT's coordinated decision-making has not been adequately

addressed in terms of team cognition as interaction, especially due to lack of theorizing efforts. Thus, the purpose of this study is to develop a theoretical interactionist model of team cognition in emergency response, to inform future interventional attempts to improve coordinated team decision-making. To address this gap, we utilized an observation-based theory building approach. We conducted a naturalistic observational study in a high-fidelity simulator replicating a generic IMT facility, the emergency operations training center (EOTC), College Station, TX. This is an initial attempt to build a theoretical model of team cognition in emergency response by understanding interactions of an emergency response planning team for cognitive tasks of perceiving (P), diagnosing (D), and adapting (A) to the changes in the status of critical elements.

For an illustrative purpose, a P·D·A (Perceive·Diagnose·Adapt) model is proposed as a proof-of-concept that depicts nonlinear, interdependent, and dynamic interactions observed within and among three functional sub-teams of a Plans team at a simulated incident command post. The proposed P·D·A model illustrates the benefits of a network representation of team interactions in investigating team cognition for context-specific cognitive tasks in emergency response. As a future work, the P·D·A model will be further developed with a network and content analysis and validated through interviews with SMEs involved in the Hurricane Harvey."

A Discount Approach to Remote Mobile UI Usability Testing

Melissa Meingast, Hewlett Packard Enterprise

Responsive, and often mobile-first, design of websites and UIs has become standard, and global populations are key focus at HPE. This paper presents a recent HPE case study in which we implemented a discount approach to remote mobile usability testing, and our lessons learned. Subscriptions to tools such as UserZoom, Validately, UserTesting, etc. are common mechanisms for remote testing of interfaces in a mobile context. Ease of use, and limiting of the burden placed on the participant are key advantages with such an approach, as well as the wide scope of testing types available, however, the costs can often be prohibitive. Lower cost options such as the use of web cams exist, however, this places a technological burden on the participant, and often results in impaired visibility of user actions and diminished rapport due to the need for repeat device placement reminders. We needed an approach that was low cost, allowed a clear view of the users' screen, allowed the user to switch back and forth between mobile and desktop in a single session, allowed multiple observers, and provided all data in a single video file. We utilized a mirroring application to meet this need. The lessons learned from conducting mobile research remotely utilizing such an approach include the need to be OS agnostic, to provide users' a range of choices, the importance of a scheduled pretest, and the increased need for a skilled recruiter in speeding the process and ensuring successful outcomes. Limitations include the inability to view hand movements, and bandwidth requirements.

Study With Fun: A Game-Based & Haptically Enhanced Application For The Visually Impaired To Learn Astronomy

Anirudh Juloori, Lamar University, Yueqing Li, Lamar University

"Serious Games (educational games) are rapidly gaining acceptance and will probably become a relevant educational tool for enthusiastic teachers in the next few years. But research states that current level of accessibility in commercial and educational games is still relatively low compared to other kinds of technologies and contents that can be contributed in this field. Although many researchers have focused on various learning topics like mathematics, navigation, biology and many other STEM subjects, none has been conducted on astronomy for the visually impaired in their games and research. Therefore, to

contribute and evaluate the effect of game-based science learning on task performance a low-fidelity prototype of the game was developed to compare with traditional teaching methods.

As mentioned, the effect of game-based science learning methods over traditional learning methods is unclear. The main objective of this study is to design a conventional game and approach for the visually impaired students to learn science (astronomy).

Target subjects are visually impaired high school students. The experiment will be conducted under safe and reliable conditions. Two groups, Experimental group (EG) and Control group (CG) will be made with eight members each. EG will play the low-fidelity prototype of the game and CG will take a regular class session. A pre-test and a post-test will be taken to measure the performance in learning the subject. A t-test will be taken to measure the main effect of the approach"

Neck flexion angle while utilizing iPhone X and Samsung S8+

Saishyam Akurke, Lamar University, Yueqing Li, Lamar University

"There is progress in all the fields of innovation in past decade. Different contemporary specs of innovation and capability can be found in the market of electronic devices where makers are competing in accomplishing the best place in buyer's mind by launching all most recent and conceivable highlights in a solitary box. Different electronic devices for correspondence can be seen as well, however, the mystical box among every one of those boxes is a Smartphone which is an extremely cheerful, coordinated and versatile gadget these days. The Statistics Portal detailed that there were 1,859.3 million Smartphone clients worldwide in 2015 and the number will hop to 2,659.4 million clients in 2019. Additionally, the expansion in Smartphone use by undergrads or adolescents is substantial compared to other age people. In 2015, Pew Research Center reported that 85% of Americans utilizing Smartphone on daily basis area aged 18-29, this urges us to examine impacts of Smartphone use among college going students.

There has been a considerable measure of research and explanation on Smartphone screen size and user experience of various Smartphones. This investigation considers the contrast between neck flexion angle and its impacts on human ergonomics while utilizing two Smartphones with various screen sizes and show highlights (iPhone X and Samsung S8+). This examination additionally gathers user experience data through a poll to create the most ergonomic model among the Apple Inc's. iPhone X and Samsung S8+. 8 members were considered for this examination. A computerized goniometer was utilized to find participant's neck flexion angle while utilizing both the Smartphones (iPhone X and Samsung S8+). A paired t-test of means was performed. Neck flexion angle was exceptionally flexed for the users while utilizing iPhone X compared to the neck flexion angle while utilizing Samsung S8+. Users felt more agreeable while utilizing both the Smartphone. But, 'True-tone' innovation in iPhone X facilitated the feeling of anxiety of eyes as per the users. This investigation proposes a large screen smartphone with 'True-tone' or comparative innovation, which can be an iPhone X yet with a bigger screen size."

Functional connectivity analysis of fatigue development in older adults using fNIRS

Joohyun Rhee, Texas A&M University Health Science Center, Ranjana Mehta, Texas A&M University Health Science Center

Functional connectivity is the temporal correlation of neurophysiological events between the different spatial locations in the neural area. More specifically, when several neural regions activated simultaneously under certain conditions, those areas are considered to be functionally connected. The most common neuroimaging modality to measure the functional connectivity is fMRI but the device is limited to measure of cognitive tasks or motor tasks using small muscles in the distal part of the body.

On the other hand, fNIRS (functional Near Infrared Spectroscopy) provides good spatial and temporal resolution as well as the flexibility to measure the brain activation during the motor tasks utilizing large proximal muscles. The present study measured fatigue development of older adults while they were performing intermittent submaximal handgrip contractions and concurrent brain activation in the prefrontal, motor and sensory areas using fNIRS. Brain activations of each region during baseline resting period and intermittent motor tasks were extracted. The extracted motor task related brain activations were then concatenated to create the signal having enough duration to compare with signals of other regions. The motor task related signals were extracted from early (not fatigued) and late (fatigued) phases of motor tasks. Correlation across all channels in each resting, early, and late phases were computed. Next, the network analysis will be performed to examine how the functional connectivity changes with fatigue development. The co-activating brain regions will change based on its phase, resting, early, and late. Possible gender related different functional connectivity would exist. While fatigability increases and brain volume declines with aging, examining functional connectivity changes with fatigue development in older adults is important to understand how these age related changes affect the functionality of older adults brain.

SUSapp: A free mobile application that makes the SUS easier to use in research

Jeffrey Xiong, Rice University, Phil Kortum, Rice University, Claudia Ziegler Acemyan, Rice University
The System Usability Scale (SUS), created by Brooke (1996), is a widely used measure to assess subjective usability. However, few if any digital tools have been created to help collect the required data and compute SUS scores, which rely upon a formula that is not necessarily intuitive. The aim of our project was to develop an open-source and cross-platform app to help experimenters easily collect and automatically compute SUS scores, view relevant statistics such as the mean, maximum, or minimum scores of a product or study, and export study data conveniently. To ensure the free SUS app is itself usable for both experimenters and subjects, human factors iterative design and development methods were used, and the final version of the app was assessed on an iPhone using ISO 9241-11's suggested measurements: efficiency, effectiveness, and satisfaction. Based on the results of this assessment, we can conclude that the app is usable - supporting the viability of using the SUS app as an alternative to traditional methods of collecting SUS data, such as via paper survey or through a paid platform like Survey Monkey, and then having to perform manual data entry or compute a SUS score for each participant and product assessed.

Exploring Stress Resilient Feedback Modalities: Investigation of Physiological and Perceptual Load
Whitney P Mantooh, Texas A&M University, Rohith Karthikeyan, Texas A&M University, Seok Chang Ryu, Texas A&M University, Ranjana K Mehta, Texas A&M University

Feedback in human-machine systems can aid in improving or maintaining operator performance and enhance user experience; however, little is known whether existing feedback modalities are resilient against user stress states. Moreover, there is a lack of understanding of physiological responses that accompany different modes of feedback and associated performances, particularly over time. Ten novice participants performed a 3D gripping task in a virtual tracking environment across four experimental conditions that manipulated error correcting feedback modality (visual vs visual + haptic) and added cognitive stress (no mental arithmetic vs mental arithmetic); the protocol was repeated twice to test the effects of time. Performance on the task, participants heart rate (HR) and heart rate variability (HRV) responses, and perceived overall workload using NASA TLX was obtained for each condition. Key findings of the present study are 1) comparable performances were observed between

visual and visual + haptic feedback conditions; 2) HR and HRV responses indicated lower physiological load in the visual + haptic condition when compared to visual feedback alone, particularly under stress; and 3) no learning or habituation was found on any study measures over time. These findings highlight the resilience of haptic feedback modality augmented with visual feedback in application domains that are associated with high stress.

Investigating the Food and Drug Administration (FDA) Biotherapeutics Review and Approval Process: A Scoping Review

Samuel A Bonet, Doctoral Student, Industrial and Systems Engineering Department, Texas A&M University, Farzan Sasangohar, Assistant Professor, Industrial and Systems Engineering Department, Texas A&M University

The development, review and approval process of a therapeutic biological product present two primary challenges: time and cost. The process of taking a biotherapeutic from concept to market may take an average of twelve years with costs exceeding one billion dollars. Even after significant time and resources have been invested in a therapy, it may still fail the FDA approval process. Advocacy groups and experts in the area are demanding a more rapid approval and release of bio-products. The FDA has implemented practices to expedite the approval of new therapies. Despite all these efforts, seeking FDA approval remains a long, costly and risky process. This paper documents our findings from a scoping review that aims at understanding the problem scope. Findings suggest an opportunity to employ a Model-Based Systems Engineering (MBSE) approach to model the FDA review and approval process. This holistic approach will serve several investigative purposes, such as identifying influential sources of variability that cause major delays including individual, team, and organizational decision-making, identifying the human-system bottlenecks, identifying areas of opportunity for design-driven improvements, study the effect of induced changes in the system, and assess the robustness of the structure of the FDA approval process in terms of enforcement and information symmetry.

Presentations

Driver Vigilance in Automated Vehicles: Effects of Task Demand

David C Newton, Texas Tech University, Eric T Greenlee, Texas Tech University, Patricia R DeLucia, Texas Tech University

While automated driving systems are relatively novel, the nature of the interaction between the driver and the automation has the hallmarks of a traditional vigilance task. In vigilance tasks, operators must maintain attention for prolonged periods of time in order to detect and respond to unpredictable, infrequent events. Similarly, when driving an automated vehicle, drivers must monitor the conditions of the roadway and the state of the automation and be prepared to intervene in instances where there are roadway hazards that the automation is ill-equipped to detect. In the present study, we were interested in determining if drivers' ability to detect such hazards declines over time and if that decline is affected by how demanding the monitoring task is. Participants "drove" a simulated automated vehicle for 40 minutes, during which time they were tasked with monitoring the roadway for hazards. As expected, drivers' ability to detect those hazards declined across the 40-minute period. Drivers ability to detect those hazards was worse when roadway events appeared at a faster rate and when their location was unpredictable. These findings demonstrate that drivers of automated vehicles may decline in their ability to detect potential collisions and that their performance may also be dependent upon the complexity of the driving environment. Thus, driver vigilance should be a concern to developers of automated driving systems.

Procedural Performance: Possible Costs of Time Pressure, Shift Change, and Task Complexity

S Camille Peres, Texas A&M University, Ranjana K Mehta, Texas A&M University, Wimberly S Hoyle, Texas A&M University, Ashley Shortz, Texas A&M University

Procedural tasks, which typically involve performing a sequence of steps in a regular and consistent manner, are an inherent part of almost all high-risk industrial settings. Further, it is not uncommon for a need It is conceivable that workers maybe able to sustain task performance for a period of time with a combination of these three variables with increased effort and focus. However, this task performance likely comes at a cost. For instance, Metha and her colleagues found that when stressed, participants were able to maintain a certain performance but it required a higher This presentation will share the results of participants who completed 24 different procedural tasks (procedures) representing the 3 variables mentioned above. They completed 12 during a day shift and 12 during a night shift. For each of the 12 day/night shift, half required the participant to complete the procedure under time pressure and the other half were self-paced, and the procedures varied in their levels of complexity. Participants performance on the procedures at a step level (2-perfect, 1-some problems, 0-fail) were scored and their physiological responses (Heart Rate, Heart Rate Variability) were recorded. physiological load, which, if sustained can lead to fatigue. to arrive when these tasks need to be performed at an accelerated rate to meet a deadline or accommodate a mechanical state in the facility. Additionally, because these industries operate on 24-hour cycles, the workers performing these procedural tasks work shift work - often working 12-hour shifts and varying between day and night shifts. Extensive research has shown that changing between day and night (or vice versa) work shifts causes fatigue and can result in decrease performance. Finally, given the nature of these complex socio-technical systems, some of the procedural tasks are more complex than others. These three variables time pressure, shift change, and task complexity could of course individually have impacts on workers performance with

procedures as well as have combined impacts on performance. However, there is little objective research investigating workers performance on procedural tasks in this domain.

Home Telemonitoring Platforms for Adults with Diabetes Mellitus: A Narrative Review of Literature
Farzan Sasangohar, Texas A&M University, Julie Hammett, Texas A&M University, Mark Kawkey, Texas A&M University

Diabetes mellitus in adults is a global health burden affecting 382 million people and costing over \$612 billion worldwide. The multidisciplinary design and development of new remote patient monitoring (RPM) and telemonitoring technologies stems from the recent push in the healthcare community to embrace a solution that reduces the burden on care providers while still providing accessible, affordable, quality care to its patients. RPM is often considered to be a technological solution to the challenges in healthcare delivery, yet literature reviews have shown that many studies found mixed results or no effect on patient outcomes. A narrative review of literature was conducted to contribute to the field of technology-driven home healthcare delivery by analyzing the systems in context with the monitoring and intervention technologies. This review analyzed papers with home telemonitoring and intervention systems for adults with type 1 or type 2 diabetes. Technologies used were differentiated into four categories: telephones, mobile devices, computers, and other Internet-connected devices. Our findings suggest no clear association between the type of technology used and the outcomes of the participants. Frequency of monitoring and intervention were also distinguishable by diabetic outcome metrics.

Virtual Reality Induced Disorientation

Daniela E Vasquez Klisans, UHCL, Michael Merta, UHCL, Spencer Jefferies, UHCL

While Virtual Reality technology has markedly improved within recent years, there are still concerns regarding the immediate aftereffects of being immersed in a virtual environment. A major issue is the disorientation experienced shortly after leaving VR. This ongoing study will recruit approximately 30 participants to play a VR minigolf game for 10, 15, and 20 minutes. After the participants have played the game for the specified amount of time an alarm will ring, which will indicate to the participant that they should remove the Oculus Rift HMD and identify target computer. There will be two possible computers for the participant to choose from, with the target computer being the one that is not covered by a plastic sign. The distance traveled by each participant to the target computer will be assessed via wall mounted cameras and a 10x10 grid on the floor. After arriving at the target computer, participants will complete trials of the Stroop task, an operation span task, and a symmetry task. This will allow the researchers to assess whether or not there are any performance decrements on cognitive tasks as a result of being immersed within a VR environment. The first prediction of this study is that participants will take longer to identify and navigate towards the target computer as the time spent immersed within the virtual environment increases. The second prediction of this study is that the participant's performance on the cognitive tasks will decrease as the time they spend within the virtual environment increases. As more organizations seek to use VR as a method of training and simulating real world environments, the need to assess the aftereffects of VR immersion will become more apparent. In emergency situations in which a VR system user must leave the virtual environment and quickly orient themselves within their actual environment, any disorientation or cognitive impairment may increase the likelihood of an error being made.

Are Social Psychological Scales Appropriate for Measuring Robot Anthropomorphism?

Miriam E Armstrong, Texas Tech University, Keith S Jones, Texas Tech University, Alec J Stinnett, Texas

Tech University

Social robots are already present in healthcare, service, and entertainment environments and expected to become much more prevalent in the coming years. One of the challenges facing the design of human-robot-interaction (HRI) for social robots is understanding how to measure a robot's level of anthropomorphism. Anthropomorphism, defined as the attribution of human characteristics, is presumed to be the inverse of dehumanization, the denial of human characteristics. Thus, measures used in HRI are based on or directly taken from social psychological literature on dehumanization. The present study directly tested whether these social psychological measures work as predicted on robots and are thus appropriate for use in HRI. The present study focused on measures based on Haslam's Dual Model of Dehumanization which predicts that humans and robots would be seen as equally human along the Uniquely Human dimension of humanness and that robots would be considered less than human along the Human Nature dimension of humanness. Fifty-six undergraduate students played a simple online game with two other players. Participants were told that one player was a fellow university student and that the other player was either a second student or a robot. In actuality, participants were playing with a computer program. After playing the game, participants completed humanness ratings of both other players. As predicted, there was no significant difference in ratings of students and robots along the Uniquely Human dimension but that robots were rated as being significantly less human than students along the Human Nature dimension. These findings support the hypothesis that anthropomorphism is the inverse process of dehumanization and thus that social psychology research on dehumanization may provide evidence as to the factors that influence and the effect of anthropomorphism.

Analysis of Muscular Fatigue & Foot Discomfort While Wearing Different Types of Men's Formal Shoes
Nirupom Paul, Lamar University, Yueqing Li, Lamar University, Brian Craig, Lamar University

"The basic intention of this study was to find the discomfort of wearing formal shoes of regular working professionals like engineers who must look formal always. The independent variables were heel height and shoe weight. The dependent variables were EMG signal of lower limb muscle actives and user discomfort questionnaire.

This study considered 07 male participants of age group 20 - 30 in Lamar University campus and its neighborhood. Primarily, this study focused on the two lower limb muscles (Tibialis anterior and medial head of the gastrocnemius) activities to find the muscle stress of the participants. The participants walked on a trade mill with four different types of men's formal shoes. Each participant walked 10 minutes at the speed of 2 mph and the data was collected in each two-minute interval. The AcqKnowledge software was used to collect the lower limb two muscles data. SPSS software was used to find the statistical result.

For both lower limb muscles, the two-way ANOVA analysis revealed a significant main effect of shoe weight. However, there was no significant main effect of shoe height on both muscle activities. The user discomfort survey concluded that low heel low weight shoe caused less fatigue and provided more comfort than the other types of shoes. "

Evaluation of holographic head-up display to enhance driving safety

Karankumar V Modi, Lamar University

"This study evaluated a Holographic Head-up display performance compare to Dash board display for automotive drivers. Holographic Head-Up Display (HHUD) is latest technology that gives three-dimensional view of navigation. I investigate how holographic head-up display technology can be used

for in vehicle navigation applications. Holography head-up display system can be used for speedometer information as well as useful in collecting information. With all the research has been done on automotive informative display technologies, a main concentrate that some informative display technologies distracting drivers. Less research is being done on comparing navigation system between distinguish informative display types. Simulated vehicle with virtual reality can lead to faster task completion, improved work quality and expertise especially for automotive area. Research has also indicated that group decisions tend to be always superior to individual decisions in various aspects. The primary focus of study was to conduct the experiment that holographic head-up display improves driver's performance to see forward scene events when drivers are accessing holographic head-up displayed information. A secondary focus of this study was to conduct the experiment that holographic Head-up display reduce brake response time compare to dashboard display.

The objective of this study was to investigate the user performance using a holographic head-up display on car hood with severe three different task compare to dashboard display.

I explored the effectualness of two navigation system:

- Using a head-down display or dash-board display
- Using a holographic head-up display"

Can expertise acquisition for industrial tasks be measured in virtual environments? An exploratory study in SecondLife

Timothy J Neville, Texas A&M University, S. Camille Peres, Texas A&M University, Joe W Hendricks, Texas A&M University, Cara A Armstrong, Texas A&M University

Expertise plays an important role in how workers use procedures and conduct tasks in high risk industries. In particular, as workers gain expertise and conduct tasks more frequently, their use and adherence to written procedures changes. The RIHM Lab (Research on the Interaction between Humans and Machines) conducted an exploratory study in a virtual manufacturing warehouse developed in the SecondLife environment to examine how a novice develops expertise over time, how their use of procedures changes as a function of their expertise development, and how their mental model of the task/procedure system develops over the same period. Seven undergraduate students completed 8 separate sessions in the warehouse over the course of two weeks. The number of products produced as well as a participant's behavior as a function of task frequency, procedure use and procedure adherence were measured within each session. Results indicated that participants demonstrated improvement in their productivity over the course of 8 sessions up to a performance asymptote. Furthermore, participants developed their own pattern and routines of conducting the tasks and following procedures. The results suggest that expertise acquisition can be demonstrated within a virtual, lab environment, making it a viable setting in which to study procedure use as expertise develops. Indeed, as expertise develops the reliance on procedural tools to complete a task decreases, especially for frequent tasks. The decrease, however, also results in a reduced adherence to specific steps in the procedure. The findings from the study have implications on procedure design and use for workers as they acquire expertise in the field.

REAL TIME FACE RECOGNITION UNDER VARIOUS UNCONSTRAINED SITUATIONS.

Md Manjurul Ahsan, Lamar University, Yueqing Li, Lamar University, Kishor Datta Gupta, Lamar University

"Face detect and recognition from image/video are becoming popular in many research filed such as biometrics filed, industrial sector etc. due to its wide spread application in security and control. Almost

every place like school, college, office, city road and other government/private facilities are usually having surveillance cameras for security purpose which have the significant value for safety issues. But it is still challenging task due to the variations resulting from different facial expression, pose, makeup, rotations etc. The performance of any recognition depends on several factors such as: storage capacity, computational complexity, recognition rate, image/video quality etc. While the existing methods shows promising results in the clean environment on the other hand performances are limited in an unconstrained environment.

The primary purpose of this research is to develop a facial recognition application which will recognize a face in an unconstrained environment such as foggy, cloudy, rainy weather or low light condition with different facial expression. Primarily, in our experiment for facial detection we are using Haar cascade classifier and for recognition we are using local binary pattern histogram(LBPH), since it shows promising result in different lighting condition. A small data set of two people with 50 sample images are using for pilot test. A complete solution for image/video based face detection and recognition with high accuracy will be provided based on investigation on several methods such as ANN, CNN, Deep Dream, Face Net, machine learning technique etc. Our research includes two experimental study.

In study one, we are comparing the existing facial recognition algorithm under various conditions like bad weather (foggy, rainy, cloudy etc.), pose variations, distance etc. and will point out the most optimistic facial recognition algorithms. Experimental results will include time complexity, accuracy and F-value. And the second study includes developing a human-robot interaction systems based on image processing techniques where the implemented prototype must recognize and identify the face. The test will be performed by the implementation of the study one, analyzing different external factors such as pose, distance, illumination etc. and how this affects the accuracy rate of recognition."

Integrated RSI Prevention Programs: How peer awareness training of employees and practitioners can increase the effectiveness of early workstation discomfort interventions.

Michael R Grimsley, Chevron, Janis Davis-Street, Chevron, Greg Sims, Chevron

"Integrated RSI Prevention Programs: How peer awareness training of employees and practitioners can increase the effectiveness of early workstation discomfort interventions.

Pain experts now embrace a biopsychosocial model of pain, acknowledging the complex interaction between biological, cognitive, emotional, behavioral and social factors in the perception of and response to pain. Stigma is a major barrier within this complexity that prevents people from seeking help, whether it be for available health services, medical treatment, physical assistance, emotional needs, safety or behavioral health. This stigma can be compounded in times of industry downturn where the perception of job insecurity is prevalent. To assist in reducing the impact of both factors, Chevron is implementing an integrated approach to RSI prevention by partnering an existing successful RSI prevention program with EAP services and a short behavioral peer health awareness training video. The purpose of this approach is to use the RSI program as a cultural lever to improve not only the specific physical health, but also the wellbeing and potential safety by increasing the acceptance of needs reporting within the culture and enhancing the triage & referral skills of the screeners. Data points to be evaluated include discomfort reporting and RSI avoidance, program participant referrals to other health services (EAP, Fitness, Sleep & Health Coaching) and the respective success and recidivism rates of those programs, along with potential implications for increased utilization of safety & incident reporting overall."

Train like a Crew Medical Officer Study: Researchers lessons learned and recommendations from a multi-session training retention study of physicians and non-physicians

Vicky Byrne, KBRWyle, Doug Ebert, KBRWyle, Jerri Stephenson, NASA, Ashot Sargsyan, KBRWyle, Kathleen Garcia, KBRWyle

"The Clinical Outcome Metrics for Optimization of Robust Training (COMfORT) study involved comparing retention of physicians and non-physicians for five medical skills after three, six or nine months from initial training. Both successes and overcoming expected and unexpected challenges led to the completion of this enormous undertaking of a long-term retention research. The team compiled a list of lessons learned throughout the study to use as guidelines for planning and execution of future studies.

The purpose of this discussion is to share some our research team's lessons learned from conducting the COMfORT study that might be of value to others looking to conduct this type of research.

The retention study involved a total of 67 research test subjects and 23 patient volunteer subjects which resulted in over 200 individual sessions with physician and non-physicians over a period of ten months.

The research questions of the study were: Can non-physicians perform as well as physicians? What are the mission impacts? When does training "expire"? and How can we optimize just-in-time training and diagnostic support tools? Key measures collected for each of the five medical skill modules included (but not limited to) procedure success, time on just-in-time software review, time on task, procedural compliance, and human factors feedback on tools, software and the study. There were both live patients and simulated patients in each session. Live patients volunteered for retinal imaging and kidney/bladder ultrasound imaging. Human patient simulators were used for intubation and ultrasound-guided IV insertion. The diagnostic patient and diagnostic tool were embedded side-by-side on a tablet computer. Given the complexity of this research study, our team learned a lot of valuable lessons over the course of the study.

We will describe examples of study successes (e.g. advertising placement and title, using Continuing Medical Education course credits to help recruit physicians) and challenges faced (e.g. live patient recruitment, software updates, repetitive use of simulators) along with the lessons that we plan to carry forward for future multi-session studies. We would welcome discussion."

NEXTGEN ONE PORTAL USABILITY EVALUATION

Ernest V Cross II, Leidos, Jeevan S Perera, NASA, Andrea M Hanson, NASA, Kirk English, JES Tech, L Vu, Geologics

"Each exercise device on the International Space Station (ISS) has a unique, customized software system interface with unique layouts / hierarchy, and operational principles that require significant crew training. Furthermore, the software programs are not adaptable and do not provide real-time feedback or motivation to enhance the exercise experience and/or prevent injuries. Additionally, the graphical user interfaces (GUI) of these systems present information through multiple layers resulting in difficulty navigating to the desired screens and functions. These limitations of current exercise device GUIs lead to increased crew time spent on initiating, loading, performing exercises, logging data and exiting the system. To address these limitations a Next Generation One Portal (NextGen One Portal) Crew Countermeasure System (CMS) was developed, which utilizes the latest industry guidelines in GUI designs to provide an intuitive ease of use approach (i.e., 80% of the functionality gained within 5-10 minutes of initial use without/limited formal training required). This is accomplished by providing a consistent interface using common software to reduce crew training, increase efficiency & user satisfaction while also reducing development & maintenance costs.

Results from the usability evaluations showed the NextGen One Portal GUI having greater efficiency,

learnability, memorability, usability and overall user experience than the current Advanced Resistive Exercise Device (ARED) GUI used by astronauts on ISS. Specifically, the design of the One-Portal GUI, as an app interface similar to those found on the Apple and Google's App Store, assisted many of the participants in grasping the concepts of the interface with minimum training. Although the NextGen One-Portal GUI was shown to be an overall better interface, specific exercise tasks had higher completion times than expected. Further analysis and observation data from the test facilitators noted that specific tasks related to the manual creation of exercises were more challenging than tasks associated with following a predefined exercise routine, when using the NextGen One Portal GUI. Although, manual exercises reduced efficiency and usability, the newly developed NextGen software still showed an overall improvement when compared to the current ARED GUI used by crewmembers on the ISS."

ISS HABITABILITY DATA COLLECTION AND PRELIMINARY FINDINGS

Maya Greene, KBRwyle, Sherry Thaxton, NASA, Alexandra Whitmire, KBRwyle, Susan Schuh, MEI, Ron Archer, Leidos, Katie Vasser, MEI

"BACKGROUND The design of space vehicles and crew habitats can greatly affect habitability in terms of physical and psychological needs and comfort. Sources of discomfort may include inadequate volume in which to live and work, auditory interference with privacy and tasks, olfactory distress, frustration over confusing hardware and software interfaces, and other stressors. These sources of discomfort become even more important given the level of isolation crewmembers of long-duration spaceflight missions will have to endure. Researchers have found that isolation tends to affect several areas of human function such as sleep cycles, immune functions, and psychological adaptation to the environment. Any of these areas have the potential to contribute to reductions in crew safety, introduction of inefficiencies, and reduced satisfaction. Therefore, it is important to document and quantify details about crew task performance and well-being in a long-duration microgravity environment in order to provide valuable data for use in research, operations and the design of future vehicles.

OBJECTIVE The primary aims of the ISS Habitability study are:

- Aim 1: Document/quantify details about crew performance of tasks in a long-duration microgravity environment
- Aim 2: Document/quantify details about how crewmembers currently utilize the space on the International Space Station (ISS)

Through accomplishing these aims, the objective is to use characterizations of habitability in the ISS environment to aid in the design of future vehicles/spacecraft.

METHODS Data collection for this study took place aboard the ISS, using crewmembers of 6-month and 12-month duration missions as subjects. A total of 6 subjects participated in the study, which began data collection in March 2015 and continued through August 2017. Subjects used an iPad to collect the majority of the data, taking advantage of the NASA-developed Space Habitability Observation Reporting Tool (iSHORT) to capture near real-time feedback about their living and working environments through text, audio recordings, and video. In addition to iSHORT, participants used Question and Answer (iQ&A) to answer habitability and human factors questionnaires.

Participants were asked to capture observations about their environment about once every two weeks; to capture a walk-through video of an area of ISS about once per month; to narrate a task about once per month; to complete a human factors and habitability questionnaire three times per mission; and to participate in a Principle Investigator (PI) Conference with the investigator team following each questionnaire.

RESULTS Data collection is complete and analysis is in progress. Preliminary findings are based on data analyzed to date. Content analysis is used to categorize the data and draw general conclusions about the state of habitability aboard the ISS and recommendations for future designs. High level results presented here represent examples of data collected and preliminary findings of common themes (e.g., hygiene activities location, stowage, trash management) reported across subjects. "

Virtual Environments: Eliciting Emotions

Yuliana Barajas Barragen, University of Houston-Clear Lake, Spencer P Jefferies, University of Houston-Clear Lake, Raquel S Garcia, University of Houston-Clear Lake

Virtual reality (VR) systems can provide a more immersive video gaming experience than traditional gaming systems. This potential increase in immersion leads to an augmented sense of presence within the virtual world, which may enhance the system's potential for affecting the user's emotional state. This ongoing study is examining how an increase in immersion influences the self-reported negative affect of subjects. Nineteen participants played a survival horror game using two different monitoring systems: a PC monitor and the Oculus Rift. While playing the game, the participant's heart rate variability and galvanic skin response was measured. After each condition, the participants completed the Positive and Negative Affect Schedule (PANAS) and the iGroup Presence Questionnaire. It is predicted that: (a) self-reported negative affect will be higher in the VR condition, (b) self-reported presence will be higher within the VR condition, (c) HRV will be reduced in the VR condition, and (d) GSR data will indicate higher emotional arousal within the VR condition.

Lessons learned from the development and implementation of a comprehensive Human Performance Strategy in a large oil and gas company.

Christopher W Parker, BP, Sandra Adkins, BP

"Across the offshore drilling industry, there is an expectation that the individual operators and personnel are fully reliable, knowledgeable, and available at all times. This is more critical when people are the primary barrier to overcome hazards and events. Experience in the offshore drilling industry shows that a deeper understanding of the role of human performance in risk management is required. The consideration of Human Performance (HP), or the level to which operators and supervisors, etc. are required to perform, is critical to achieving overall system performance goals. One way to actively address challenges to HP is to integrate Human Factors considerations and methods into processes and practices.

BP Global Wells Organization (GWO) set out the following objectives in order to address the challenges posed in the above which are documented in a Human Performance Strategy. These objectives comprise a long-term vision for a sustainable Human Performance initiative in GWO that is described in an incremental approach:

1. HP Capability: Develop Human Performance (HP) capability across the BP GWO organization.
2. HP Integration: Improve the integration of HP in BP GWO risk management activities.
3. Contractor Management: Enable drilling contractors to integrate HP initiatives into their operations.

The proposed presentation will describe the development and implementation of the Human Performance Strategy currently being rolled out to the BP Global Wells Organization. Details of the primary considerations, successes, and challenges that comes with a monumental shift in a large organization will also be provided."

Visualizations to Support the Design of Fault Management

Carroll Thronesbery, S&K Global Solutions, Pamela Fournier, S&K Global Solutions, Timothy Olson, S&K

College (SKC), McMahon Eugene, S&K Global Solutions, Mike Monahan, S&K Global Solutions

"The Fault Management Viewer (FMV) is a tool with multiple visualization models (viewers) to assist with planning fault management (FM) development by providing new ways of visualizing FM concepts and data. Current tools to assist FM development include fault trees, success trees, and tools using SysML. Our team designed FMV to align with NASA's FM Handbook, a design reference mission, and our team's experiences with past FM development support projects. The benefits of developing this approach and tool include improved FM quality, efficiency in developing FM measures, and a more cost-effective expenditure of FM resources on failures that are most important to control.

We have begun an agile approach to developing FMV with an SBIR project. In Phase I, we designed FMV, developed a concept of operations, and created a feasibility prototype. Future plans include a full-function FMV prototype and evaluation followed by a proof-of-principle prototype that includes SME inputs for improvements and expansions. We have extended the initial investigation of visualization types to include diagrams for Failure Modes and Effects Analysis (FMEA) and Hazard Reports, which are not typically shown in diagram format, but often used in safety and engineering evaluations.

Innovations include the viewing options aligned to fit important FM development decisions and the use of a single data model of FM concepts that will drive multiple views of these concepts, each of which highlights different perspectives and supports different analyses. Key decisions include:

- What are the primary system goals for each mission phase?
- How well are my system capabilities protected?
- Which of my mitigation approaches are most effective?
- Where can I spend my FM development resources most effectively?
- How much resource would be required to bolster the protection of this system function?
- How much would it improve my risk profile to add a candidate FM measure?
- How much would my system function improve in dependability if we add this FM measure?

The presentation will include extensive screenshots showing how model-based fault management system engineering data can support these development resource decisions."