

Institute Insider

The Newsletter of the Institute for Ergonomics at The Ohio State University

At the forefront of Human Factors since 1950 Volume 12, No. 2, Spring/Summer, 2009



Billings Presents Prestigious RAF Lecture

Dr. Charles Billings has had a long and distinguished career as a physician, flight surgeon and teacher. In March 2009, he took these experiences to London to present his lecture, *Aviation Medicine Research: An Unending Adventure*, to members of the Royal Aeronautical Society.



Billings

This (40th annual) Stewart Memorial Lecture was founded by friends and the family of Air Vice Marshal William K. Stewart, who was, for many years, the Commandant of the Royal Air Force Institute of Aviation Medicine at Farnborough, UK.

At this lecture, Dr. Billings used examples of studies from his 60-year long career to illustrate the breadth of research needs in the civil aviation community that have motivated his work. He drew on his experience in clinical and aviation medicine practice in both academia and government to discuss some lessons that he believes are important for young people who wish to become involved in this specialty area, as well as the knowledge base and skills needed to be fully effective in an aviation or space medicine career.

Some of the research Dr. Billings discussed was conducted between 1960 and 1973 at Ohio State's Aviation Medicine Research Laboratory, with both Dr. Thomas Rockwell (now Professor Emeritus in OSU's Industrial Engineering program) and personnel in the OSU Departments of Psychology and Aviation.

Details of Dr. Billings' talk can be found at www.raes.org.uk/CONFERENCE/PDFs/stewart09.pdf. More information about the Royal Aeronautical Society can be found on their web site, www.aerosociety.com.



Ergo Research Presented at Honda Appreciation Day

On May 5th 2009, Ohio State's *Center for Automotive Research* hosted an appreciation day for Honda of America Manufacturing, Inc. The purpose of this event was to showcase recent research sponsored through Honda and Ohio State's Industry-University Partnership.

Institute members were quite active in this one-day event. **Dr. Sue Ferguson** discussed, *Assessment of Injury Risk Changes due to Vehicle Rotation during Assembly*, a study conducted at OSU's Center for Occupational Health and Automobile Manufacturing (COHAM). It quantified how physical demands varied as employees performed assembly tasks on a vehicle body rotated at different angles.

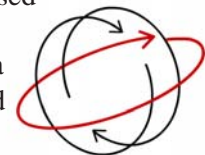


Ferguson

Sue also presented the poster, *Preliminary Assessment of Musculoskeletal Risk using a Super Chair*. A "super chair" is a device that moves employees into and out of a vehicle during assembly. Both of these studies were conducted under the leadership of **Dr. William Marras**, COHAM's Director.

This event also showcased research by **Dr. Carolyn Sommerich** and Dr. Anthony Luscher (Associate Professor, OSU Mechanical Engineering). *DC Torque Tool Assessment* is a study of how these tools can be used and programmed to reduce injury risk.

The Honda Partnership Program, a collaborative effort between OSU and Honda, supports initiatives in education, research, and public service, to positively impact students, faculty, public & private sector practitioners, and the transportation industry. More information can be found at: <http://elearn.eng.ohio-state.edu/honda/index.htm>.



Enriching. Expanding. Excelling.
A Partnership of Honda and The Ohio State University

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Professional Society Info

Board of Certification in Professional Ergonomics

At the Mid-Year BCPE Board of Directors Meeting (held March 22nd-23rd 2009, in Reno NV), a motion was made and passed to add a new certification designation.



The Certified User Experience Professional (CUXP), is equivalent to the CPE and CHFP. It was created in response to growing market acceptance of the user-experience professional title in the human factors/ergonomics profession.

Those interested in changing their CPE or CHFP to CUXP should contact the BCPE office (info@bcpe.org or 888-856-4685, ext. 702). There is a one-time \$25 fee to cover administrative costs.

For additional questions on this change, contact Kris Rightmire, BCPE's Executive Administrator, at bcpehq@bcpe.org.



Human Interaction with Complex Systems

The 9th Annual Symposium on HICS will be held August 19th-21st, 2009 at the Greenbelt Marriott, in Greenbelt MD. The focus of this meeting involves current interests on complex systems and asymmetric command and control (C²) decision-



making: people; organization; information technology; and automation. The objective of this conference is to bring together researchers in the fields of Complex Systems, Human Interactions & Modeling, and Sensemaking to exchange ideas on their research and applications. More details can be found at www.eng.ncat.edu/hics09.

Call for Papers: The committee invites those interested in Human Interactions with Complex Systems or Sensemaking/Decision Making to submit papers for presentation at the conference. The symposium will cover the theory and practice of complexity, human interactions with automation, and making sense of complex information networks.

The due date for submitting an abstract is June 15th, 2009. Mail submissions to humansys@ncat.edu.



IN THE NEWS

Kevin Evans (OSU School of Allied Medical Professions) and **Carolyn Sommerich** received a GE Healthcare Excellence in Sonography Award, based on their submission of their proposal, *Utilizing a HCU System to Investigate Ergonomic Injury Among Autoworkers*. The \$2,500 award was presented at the 2008 Society of Diagnostic Medical Sonography (SDMS) Annual Conference in Mashantucket CT (October 16th-19th, 2008). This award is being used to foster continuing education by the team and graduate students for further scientific investigation of imaging ergonomic injury with ultrasound.



Two Institute members lectured at the 2009 Ohio Safety Congress in Columbus OH (March 31st-April 2nd). **Carolyn Sommerich** discussed recent research findings in her *Office Ergonomics* presentation. **Gary Allread** spoke on *Proving the Case: Cost-Justifying an Ergonomics Intervention*.



What We Know About Risk to the Low Back Due to Occupational Exposure and Patient Handling in Particular was the topic of the Keynote Address given by **William Marras** during the Oregon Governor's Occupational Safety & Health Conference in Portland OR (March 9th-12th, 2009). Dr. Marras discussed how various risk factors interact to increase the risk of low back pain and how these risks can be effectively mediated with special focus on patient handling tasks.



In March 2009, **Gary Allread** summarized the applied research capabilities and accomplishments by members of Ohio State's Institute for Ergonomics, at the Applied Ergonomics Conference in Reno NV (March 23rd-26th).



On March 23rd, 2009, **David Woods** gave an invited talk at Idaho National Laboratory, in Idaho Falls ID. Sponsored by the Instrumentation, Control and Intelligent Systems Division, Dr. Woods spoke on *Fundamentals to Engineer Resilient Systems*.



William Marras discussed *The Role of Physical, Psychosocial, and Individual Factors in Determining Spine Loads*, at the 9th Annual Safe Patient Handling & Movement Conference (March 31st-April 2nd, 2009, Lake Buena Vista FL).



Dan Zelik and **David Woods** were invited to participate in a workshop on Sensemaking at the annual Computer-Human Interaction (CHI) conference in Boston MA (April 4th-9th, 2009).



Along with Sharon Schweikhart (OSU College of Public Health) and **Michael Smith** (OSU Cognitive Systems Engineering Lab), Principal Investigator



David Woods received a \$75,000 Google Research Award, to study *Public Health Records and Coordination of Distributed Care in Emergency Medical Systems*. The goal of this project is to discover ways to get added value from Public Health Records so they are more beneficial at point-of-care.



Carolyn Sommerich, **Steve Lavender**, and Amy Darragh (OSU's School Allied Medicine Professions) received a grant from Ohio State's Center for Clinical and Translational Science. This research will study the demands of home health care work, particularly focusing on non-paid caregivers, such as family and friends.



CogFest 2009 Held at Ohio State

On May 1st, the **Center for Cognitive Science** held its 2009 CogFest, on Ohio State University's main campus. CogFest is geared for individuals interested in interactions between the mind and the brain.

Dr. Gary Marcus (Department of Psychology, New York University) gave the Keynote Address, *Language as Kluge*.

Three OSU faculty delivered talks as well. Dr. Susan Nittrouer (Department of Otolaryngology and Department of Speech and Hearing) discussed, *What is Speech? Hints from Speech, Nonspeech and Everything In Between*. Dr. Simon Dennis (Department of Psychology) spoke on, *An Associative*



Model of Sentence Processing. Dr. Richard Samuels (Department of Philosophy) discussed, *How Empiricist are Empiricist Models of Language Acquisition?*

Abstracts of these lectures can be found at www.cog.ohio-state.edu/html/cogfest.php.

Marras Honored at OSU Reception

A gathering to celebrate the election of **Dr. William Marras** into the National Academy of Engineering was held at Ohio State's Faculty Club on April 16th, 2009.

Many friends, family, and colleagues both past and present joined in the celebration. Pictured here are just a few of those who attended to congratulate Bill. (All photos courtesy of Cedric Sze.)



Marras shares a laugh with Dr. Tom Rockwell (ISE Professor Emeritus) and his wife, Elizabeth.



Marras is congratulated by Dr. Greg Washington, Interim Dean of OSU's College of Engineering.



Dr. Malcolm Ritchie catches up with Dr. David Woods (Professor, ISE).



Sharing in the celebration are Dr. Blaine Lilly (Associate Professor, ISE) and Dr. Ramteen Sioshansi (Assistant Professor, ISE)

Graduate Student Updates

In December 2008, **Michael Smith** successfully completed his PhD General Exams. With advisor David Woods, Michael is pursuing several research topics: coordination in health care delivery (e.g., Emergency Medical Systems) and the possible roles that information technology, such as Personal Health Records, play in this system; and intelligence analysis—the challenges in analyzing organizations and forecasting behavior.



Congratulations to **Di Liu**, who graduated with her PhD in Industrial & Systems Engineering in March 2009.



With her adviser, Dr. Carolyn Sommerich, Di studied, *Multi-Phase Empirical Investigation and Path Modeling of Construction Workers' Use of Personal Fall Arrest Systems*. The abstract of this work can be found on page 8.

Dr. Liu can be reached at liu.640@osu.edu.



Kim Vandlen completed her Masters degree in March 2009, under the direction of William Marras. The abstract of her thesis, *A Nonlinear Contact Algorithm Predicting Facet Joint Contribution in the Lumbar Spine*, is located on page 8.



Kim is currently living in Cedar Rapids, IA, where she is beginning her job search. She can be reached at kimberly.vandlen@gmail.com.



In January 2009, **Dan Zelik** successfully completed his General Exams, as part of his PhD requirements. He is currently continuing his doctoral course work and research, under the advisement of Dr. David Woods,.



Best of luck to **Martin Voshell**, who completed the requirements for his PhD and graduated in March 2009. With adviser David Woods, the focus of Martin's work was *Planning Support for Running Large Scale Exercises as Learning Laboratories*. The abstract of this dissertation is on page 7.



Dr. Voshell is now a Senior Cognitive Systems Engineer for Resilient Cognitive Solutions, in Pittsburgh PA. At this facility, he works in a number of mission critical domains, for a variety of customers, to develop decision support systems and decision support environments. Martin can be reached at his new email address: mvoshell@resilientcognitivesolutions.com.



In March 2009, **Alex Morison** successfully completed the General Examination for his PhD requirements in cognitive engineering. His advisor is Dr. David Woods.



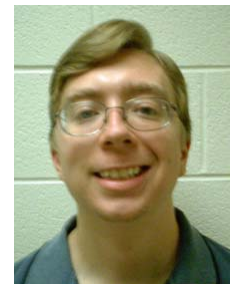
New Student

Joseph Rose

(jdrose.eng@gmail.com)

Advisors: Alan Litsky, William Marras

Hometowns: San Angelo TX and Big Springs NE



Joe began working on his Masters Degree in March 2009. He previously earned a B.S. in Pre-Biological Systems Engineering at the University of Nebraska at Lincoln. Joe is a biomedical engineering major, who hopes to do some modeling work, particularly computer modeling of human systems.

In his spare time, Joe writes fiction and runs a "Choose Your Own Adventure"-style website.



PUBLISH

or perish



Recent publications by Institute members (indicated in **boldface** font) include:

Airport Departure Flow Management (DFM): Findings from Field Trial Testing

Amy Spencer, T Carniol, J Pepper, and **Philip J Smith**, 2009, *Proceedings of the 2009 Aviation Psychology Symposium*, April 27th-30th, Dayton OH.

Barriers and Facilitators to Increasing Access to Care with an Electronic Intensive Care Unit (e-ICU)

Emily S Patterson, S Anders, S Schweikhart, P Ebright, and **David D Woods**, 2009, *Proceedings of the 2009 American Medical Informatics Association (AMIA) Spring Congress*, May 28th-30th, Orlando FL.

Cooperative Advocacy: A Strategy for Integrating Diverse Perspectives in Anomaly Response

J Watts-Perotti and **David D Woods**, 2009, *Computer Supported Cooperative Work: The Journal of Collaborative Computing*, 18(2):175-198.



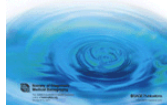
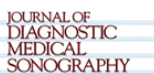
Emergence of the Communities of Practice
RR Hoffman, L Militello, and **David D Woods**, 2009, in RR Hoffman & L Militello (aus), *Perspectives on Cognitive Task Analysis: Historical Origins and Modern Communities of Practice*, NY: Psychology Press, 69-90.

Escaping Failures of Foresight

David D Woods, 2009, *Safety Science*, 47(4):498-501.

The Feasibility of using an HCU System for Investigating Ergonomic Injury among Autoworkers

KD Evans and **Carolyn M Sommerich**, 2009, *Journal of Diagnostic Medical Sonography*, 25:80-87.



Human-Cyber-Physical Systems for Emergency Response. Robotics and Cyber-Physical Systems. Special Session

A Ames, **Matthieu Branlat**, R Murphy, **David D Woods**, J Valasek, and T Zourntos, *IEEE/RSJ 2008 International Conference on Intelligent Robots and Systems (IROS08)*, September 24th, Nice France (available on-line (free) at www.ece.cmu.edu/~webk/IROS_CPS/papers/murphy.pdf).

Lumbar Spine Forces during Manoeuvring of Ceiling-based and Floor-based Patient Transfer Devices

William S Marras, **Gregory G Knapik**, and **Sue A Ferguson**, 2009, *Ergonomics*, 52(3):384-397.



Methodological Challenges for Cognitive Task Analysis

RR Hoffman, L Militello, and **David D Woods**, 2009, in RR Hoffman & L Militello (aus), *Perspectives on Cognitive Task Analysis: Historical Origins and Modern Communities of Practice*, NY: Psychology Press, 379-398.

Minding the Gaps: Creating Resilience in Health Care

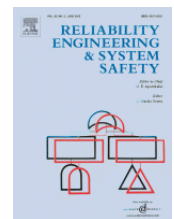
C Nemeth, RL Wears, **David D Woods**, E Hollnagel, and RI Cook, 2008, in K Henriksen, et al (eds), *Advances in Patient Safety: New Directions and Alternative Approaches, Vol. 3. Performance and Tools*, Rockville, MD: Agency for Healthcare Research and Quality, AHRQ Publication No. 08-0034-3 (available on-line (free) at www.ahrq.gov/downloads/pub/advances2/vol3/Advances-Nemeth_116.pdf).

Preparing for the Future of Collaborative Air Traffic Management (CATM)

Philip J Smith, 2009, *Proceedings of the 2009 Aviation Psychology Symposium*, April 27th-30th, Dayton OH.

Resilience and Brittleness in the Offshore Helicopter Transportation System: Identification of Constraints and Sacrifice Decisions in Pilots' Work

JO Gomes, **David D Woods**, PV Rodrigues de Carvalho, G Huber, and M Borges, 2009, *Reliability Engineering & System Safety*, 94:311-319.



See is Believing? The Effects of Real-Time Imaging on Decision-Making in a Simulated Incident Command Task

John M McGuirl, NB Sarter, and **David D Woods**, 2009, *International Journal of Information Systems for Crisis Response and Management*, 1(1):54-69.

Spine loading at Different Lumbar Levels during Pushing and Pulling

Gregory G Knapik and **William S Marras**, 2009, *Ergonomics*, 52(1):60-70.



Research Corner (page 1)



This issue of the *Insider* summarizes recently conducted research

Planning Support for Running Large Scale Exercises as Learning Laboratories

Martin Voshell

Dissertation Abstract

In many mission critical work domains effective scenario based training and observation are crucial to the success of complex socio-technical systems. Organizations employ many different approaches toward conducting these kinds of training sessions, but as recent high surprise disasters such as the Columbia loss and the 9/11 terrorist attacks indicate, there will always be new surprises that put that learning efficacy to the test. Anomalies will occur, new failure conditions will challenge existing systems and organizations, and these challenges of adapting to surprise and to resilience are nowhere more evident than in these mission critical domains. However, a significant amount of the training conducted in these types of organizations is not about training to be surprised, rather, its about showing individual competency and that current training is effective. These large-scale socio-technical organizations could be more resilient if they effectively exploit the opportunities from these exercises to capture learning and facilitate a deeper understanding behind the cognitive work in the domain.

This thesis proposes the learning laboratory as a support framework for such exercise design. The learning lab framework serves as a general abstraction of CSE staged world study design and envisioning techniques and extends these approaches to cope with new scalability challenges to resilience. CSE has a long history of conducting research in complex domains utilizing effective staged and scaled world design techniques to support and illustrate the critical cognitive challenges of practitioners at work. The learning lab incorporates a variety of these techniques into a common framework that can be applied to a variety of different types of exercises already being conducted in order to maximize organizational understanding and learning from scenario based observation exercises.

The initial learning laboratory framework synthesizes historical Cognitive Systems Engineering staged and scaled world design practices with findings from personal

observations in three exercises: a tactical military intelligence scenario, an urban fire-fighting terrorist bombing, and a large-scale flu pandemic and terrorist attack. This synthesis exposed a number of challenges to successful learning from exercise design. These challenges were explored further in a series of critical incident interviews with a variety of researchers and practitioners in multiple domains.

The insight gained from these interviews highlighted a number of decision-difficult design challenges as well as a number of support strategies for coping with specific challenges that must be planned for to conduct effective staged/scaled world studies as learning laboratories. These challenges were translated into support requirements for the design of an exercise planning tool prototype guided by the learning lab framework.

Through a better understanding of the vulnerabilities that can stall learning opportunities and make conducting an exercise difficult, researchers, stakeholders, and practitioners responsible for future exercise design should consider the potential impact of taking such exercise design approaches to maximize learning yield and develop a deeper understanding of cognition at work.



Barriers and Facilitators to Increasing Access to Care with an Electronic Intensive Care Unit (e-ICU)

Emily S Patterson, S Anders, S Schweikhart, P Ebright, and **David D Woods**

Proceedings of the 2009 American Medical Informatics Association (AMIA) Spring Congress

Abstract

The electronic Intensive Care Unit (e-ICU) is an emerging telehealth application that has the potential to improve access to care for rural populations. An e-ICU is a facility staffed by specialized physicians (intensivists) and nurses with critical care expertise. These personnel remotely care for patients in multiple physical locations by monitoring vital sign data, video data from the patients' rooms, lab results, x-ray images, orders, and electronic medical record (EMR) documentation. We asked the question: What are barriers and facilitators to using an e-ICU to increase access to care for rural populations?





Research Corner (page 2)



This issue of the *Insider* summarizes recently conducted research

Multi-Phase Empirical Investigation and Path Modeling of Construction Workers' Use of Personal Fall Arrest Systems

Di Liu

Dissertation Abstract

Personal Fall Arrest Systems (PFAS) are required use by the Occupational Safety and Health Administration for construction employees who work at heights above six feet. However, the literature indicates that current levels of usage of PFAS are not adequate to reduce the number of fall-related injuries. To date, there are no published models describing PFAS usage and factors affecting that usage.

Therefore, the objective of this research was to propose and develop a model that presents the main factors affecting PFAS use, including their interactions, in order to improve the understanding of factors that affect PFAS use. In the long term, such knowledge may help to increase PFAS use among construction workers.

Survey, interviews and participatory workshops were applied in the first three phases of this study to supplement the published literature in assisting us to analyze current usage of PFAS among construction workers and views of PFAS from construction workers and other stakeholders in the construction industry. Analysis of data from all these sources led to the development of a preliminary model of PFAS, and selection of the effect of training on PFAS use, in a longitudinal study to test the model.

The Technology Acceptance Model, with modifications from models of health and safety behavior, formed the bases for the preliminary model of PFAS use. In order to investigate the effectiveness of fall protection training in affecting one's usage intention and actual behavior of PFAS use, a survey was conducted among PFAS users who attended fall protection training courses.

More importantly, two research questions were answered in this phase of the study: what are the significant drivers of PFAS use; and what are the correlations between the factors.

This study provided a theoretical and empirical foundation for understanding the factors contributing to construction workers' PFAS use. A path model of PFAS use was developed and validated for the first time. The developed model explained 40% of the variance accounting for usage intentions. Perceived Value, Perceived Ease of Use, Subjective Norm and Supervisory Enforcement

were determined to be positive drivers of usage intentions. Additionally, the results from this study also showed that fall protection training is effective in improving influence from Perceived value, Perceived Ease of Use and Subjective Norm to one's usage intention of PFAS.

The anticipated benefit of this study is an improved understanding of PFAS use, which, in turn, may lead to intervention research that targets the factors that have been identified as affecting PFAS use.



A Nonlinear Contact Algorithm Predicting Facet Joint Contribution in the Lumbar Spine

Kim Vandlen

Thesis Abstract

It is hypothesized that the facet joints may play an important role in the causality behind back pain. Previous biomechanical models lack detailed facet geometry and contact modeling, the inclusion of cartilage, and the modeling of the full lumbar spine.

The objective of this study was to more realistically assess facet loading in an existing low back biomechanical model. The second objective of this study was to demonstrate how the model including facets reports load distribution in pushing and pulling tasks.

Several new components were added to an existing biomechanical model: realistic geometry (based on CT & MRI); more accurate facet radii of curvature; articular cartilage thickness; and contact algorithms, which defined the contact between each lumbar spine facet.

Trials were run once with facets turned on, and repeated with facets turned off. Resultant disc loads were lower in the model with facets. The model clearly showed facet to lamina contact for many of the trials studied. Facets at L₄/L₅ and L₅/S₁ bore about 40% of the total load through those segments.

The nonlinear model performed well. The facets bear a large portion of the load though the lumbar spine. Load transmission percentage results with the facet model are comparable to previous studies. The facets bore a greater amount of load in pushing tasks than in pulling tasks. The direction of the offloading of the intervertebral discs is not as straightforward as previously hypothesized.

Including realistic facets in the model does not necessarily result in decreased anterior-posterior shear loads within the disc under these loading conditions.

