

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. 1, Winter, 2009



Marras Elected to The National Academies

William S. Marras, Ohio State professor of Industrial and Systems Engineering, is one of 65 new members elected to the National Academy of Engineering.

The NAE is one of four organizations that comprise the National Academies. The others are: the National Academy of Sciences; the Institute of Medicine; and the National Research Council. The National Academies perform exemplary public service, by bringing together committees of experts in all areas of scientific and technological endeavor. These experts serve *pro bono* to address critical national issues and give advice to the federal government and the public.

Election to the NAE is one of the highest professional distinctions an engineer can receive. Membership to the NAE is an honor for individuals making outstanding contributions to "engineering research, practice, or education, including, where appropriate, significant contributions to the engineering literature," and to the "pioneering of new and developing fields of technology,



making major advancements in traditional fields of engineering, or developing and implementing innovative approaches to engineering education."

Dr. Marras, who is also OSU's Honda Endowed



Chair and Executive Director of the Institute for Ergonomics, was acknowledged specifically for his development of methods and models used to control costs and injuries associated with manual work in industry.

The National Academy of Engineering is a non-profit institution, whose mission is to promote the nation's technological welfare by acquiring the knowledge and insights of eminent members of the engineering profession. Other past or current members of the Academy include: Bill Gates (Chairman of Microsoft); Lillian Gilbreth (a pioneer in the field of industrial engineering); Steven Jobs (CEO, Apple Inc); and Larry Page (co-founder of Google).

A complete description of the NAE and its services can be found on-line, at www.nae.edu.

Congratulations, Bill, on this prestigious honor!

Woods Views Workplace Mistakes as Opportunities

A January, 2009 article in *The New York Times* that focused on making mistakes at work features several insights from Institute member and Ohio State professor **David Woods**.



"In Making the Most of Your Workplace Mistakes," reporter Phyllis Korkki delves in the cognitive dissonance created and responses that occur when employees, who view themselves at competent workers, make errors.

A portion of the article focuses on the actions employees should take when they have made a mistake.

This includes admitting the error and apologizing to those colleagues who have been affected.

The article notes that the response of the manager also is critical to successfully resolving the situation. Dr. Woods said managers need to make clear that "it's more important to share the information than it is to identify the culprit."

Woods suggested that, although many employees may

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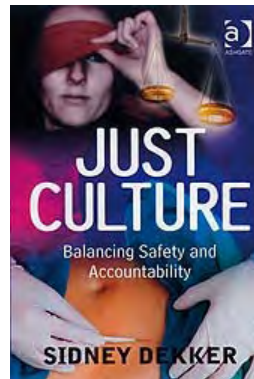
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Hero Pilot Reading Book by Cognitive Engineering Graduate

On January 15th, 2009, an Airbus 320 aircraft being piloted by US Airways Captain Chesley “Sully” Sullenberger hit a large flock of birds shortly after takeoff from New York’s LaGuardia Airport. Following the immediate loss of both engines, Captain Sullenberger successfully landed the aircraft on the Hudson River. Miraculously, all 155 passengers and crew survived.



One item lost during the incident was a book Captain Sullenberger had in the cockpit. The book, *Just Culture: Balancing Safety and Accountability*, was written by Sidney Dekker. Dr. Dekker is an alumni of Ohio State’s cognitive systems engineering program.

Just Culture discusses “honest mistakes” employees may make during work. Dekker suggests that the lack of such a culture in an organization, in a country, or in an industry, hurts both justice and safety. That is, responses to incidents and accidents that are believed to be unjust can impede investigations of the incident, raise fears among those who do safety-critical work, and increase bureaucracy in an organization. Thus, Dekker writes that a just culture is critical for the creation of a safety culture.

Dr. Dekker obtained his PhD from Ohio State in 1996. He is now Director of Research at Lund University School of Aviation in southern Sweden. His research delves into system safety, human error, reactions to failure, and organizational resilience. More information about Dr. Dekker can be found on his web page, www.lusa.lu.se/o.o.i.s/6102.



Dekker

Upon hearing that Captain Sullenberger lost his copy of *Just Culture* in the accident, New York City Mayor Michael Bloomberg gave “Sully” both a key to the city and a new copy of Dr. Dekker’s book.



IN THE NEWS



With co-authors Pratic Jha and Michael Balint (Lockheed Martin Transportation & Security Solutions) and Ian Crook (ISA Software), **Philip J. Smith** was awarded “Best Paper” at the 2008 Annual Meeting of the Air Traffic Control Association (Washington, DC, November 2008). Their paper was titled, “Regional Air Traffic Flow Management.” Congratulations!



Gary Allread was quoted in the February 2009 issue of *Current Health2*, regarding ergonomics tips for properly using a laptop computer. This magazine is one of a series of educational publications produced by Weekly Reader Corporation. These are geared towards students in grades pre-K to 12, with a circulation of nearly eight million educators, students, and their parents each year.



Equipois zeroG® Arm Arrives at COHAM

Ohio State’s Center for Occupational Health and Automobile Manufacturing (COHAM) is an applied research laboratory that, in part, serves as a test bed for studying and adapting new technology for use in automotive production processes.

Dr. William Marras, COHAM’s Director, has integrated a zeroG mechanical arm into this facility, to

test how it can be used to improve the health and safety of employees doing automotive assembly work.

Produced and distributed by Equipois Inc. (www.equipoisinc.com), the zeroG⁴ mechanical arm is designed to render heavy tools and equipment (8 to 36 lbs) virtually weightless.

This original zeroG arm was made available for sale to the public in March, 2008. It uses a patented spring and cam-based architecture to adjustably float and lift a wide range of tools and parts. The arm is used in situations where employees must lift or manipulate heavy objects, often in awkward postures. Previous tool balancers have not provided both weightlessness *and* freedom of motion.



Equipois also has manufactured another arm, the zeroG², meant for use with smaller and lightweight tools weighing up to 10 lbs.

Equipois highlights three specific benefits it believes this arm offers manufacturers:

- Reduces of employee fatigue and strain, which lowers injury risk and related costs.
- Allows employees to use heavier, more powerful tools with little exertion, which can be a boost to productivity.
- Improves the use of fine motor skills, which can improve work quality.

To see a demonstration of this device at COHAM, contact Dr. Marras, at marras.1@osu.edu.



“Workplace Mistakes,” continued from page 1

take the mistake made personally, it could instead be indicative of a larger problem that exists within the organization.

As an example, Dr. Woods referred to someone who inadvertently hits “Reply to All” in an e-mail message, that results in sending confidential information to a large number of people. Although the employee made this mistake, it could expose a poor design of the e-mail

system; that is, the “Reply” and the “Reply toAll” buttons are placed too closely together.

Woods gave examples of other workplace design flaws, such as a breakdown in communication between departments, a hesitancy for subordinates to question their bosses, and a failure to cross-check work activities.

Dr. Woods commented that all of these events are opportunities for the system to learn and change.

This entire article currently can be found on-line, at: www.nytimes.com.



Upcoming Conferences and Meetings

Indiana Safety & Health Conference

February 23rd - 25th, 2009

Indianapolis, IN - Indianapolis Marriott East

This conference is a great learning venue for: safety managers; industrial hygienists; occupational health practitioners; safety team members; risk managers; maintenance supervisors; and HR managers. In addition, products and services from 75 companies can be seen at the Expo, open on February 24th.

More details about this conference, include an agenda, can be found at www.insafetyconf.com.

Stop by the Institute's booth in the Exhibit Hall!

2009 INDIANA SAFETY & HEALTH CONFERENCE
THE BUSINESS OF SAFETY - VALUE THAT MATTERS

Applied Ergonomics Conference and Expo

March 23rd - 26th, 2009

Reno, NV - Grand Sierra Resort



The annual Applied Ergonomics Conference is a forum for ergonomics practitioners who work in health, government, military, and safety to focus on how ergonomics works to improve business operations.

Held at Reno's Grand Sierra Resort, attending the conferences will allow you to:

- Increase your ergonomics knowledge;
- Hear how ergonomics has been used to create workplace solutions; and
- Network with hundreds of practitioners in the field.

This conference also sponsors the ErgoCup competition, where teams from many global companies demonstrate practical solutions for real-world ergonomics issues.

The conference schedule and registration information is located at www.iinet2.org/Ergo/Conference.

OSC | 09
Ohio Safety Congress & Expo

Ohio Safety Conference and Expo

March 31st - April 2nd, 2009

Columbus, OH - Greater Columbus Convention Center

This conference is Ohio's largest and most established occupational safety and health event, drawing approximately 5,000 safety-minded individuals.

This free event sponsors nearly 150 educational sessions, conducts live demonstrations, and provides access to 200 exhibitors showcasing their safety & health products and services.

Descriptions of the numerous educational session, a list of this year's exhibitors, and on-line registration, can be found at www.bwc.state.oh.us/employer/programs/safety/safetycongress.asp.

Stop by the Institute's booth in the Exhibit Hall!

2009 Human Factors and Ergonomics Society Meeting

October 19th - 23rd, 2009

San Antonio, TX - Grand Hyatt Hotel

Mark your calendar, as this is your opportunity to both Remember the Meeting *and* "Remember the Alamo."

More information about the 53rd Annual Meeting of the HFES will be posted at: www.hfes.org/web/HFESMeetings/09annualmeeting.html.

NOTE: HFES has issued a **Call for Proposals** on any human factors/ergonomics topic, in any format (e.g., lecture, poster, panel). The submission and review site can be located on-line at <http://submissions.miracd.com/hfes2009/login.asp>. All proposals are due by **February 23rd, 2009**.



Graduate Student News

New Students

Radin Zaid Radin Umar

(radinzaid@gmail.com)

Advisor: Carolyn M. Sommerich
Hometown: Kajang, Malaysia.



Radin has begun pursuing his Masters degree in Occupational Safety and Ergonomics. He previously received a Mechanical Engineering degree from the University of Wisconsin at Madison.

Radin's interests in ergonomics are quite broad, but his wish is to focus on occupational ergonomics in manufacturing environments, such as manual materials handling, job design, safety, and workplace biomechanics.

Radin is married to a fellow Industrial Engineering graduate student, Nadiah Ahmad. They have two children.



Jay Mehta

(jaymehta@gmail.com)

Advisor: Carolyn M. Sommerich
Hometown: India



Jay's undergraduate degree (obtained in India) and his Masters degree (from Marquette University) are both in Biomedical Engineering.

Through his studies, Jay became more interested in the design field, prompting him to pursue further study in a field where he could help society in direct or indirect ways. This led to his decision to study ergonomics and occupational health & safety.

Jay has recently published his research, "A Novel Technique for Examining Human Brain Activity Associated with Pedaling using fMRI, which will appear in the the *Journal of Neuroscience Methods*.

Dawn Chandler successfully defended her Masters project and graduated in December, 2008. With her advisor, Dr. Carolyn Sommerich, Dawn studied, "Ergonomics in the Medical Intensive Care Unit of The Ohio State University Medical Center" (see the abstract on page 7).



Dawn is currently seeking full-time employment that utilizes her knowledge of industrial and systems engineering, occupational safety, and ergonomics. She can be contacted at dchandl@columbus.rr.com or 614-203-3115.



Spring Quarter 2009 Course Announcements

Technology, Efficiency, and Happiness

Course Number: Psych 597.04 (5 credit hours)

Time: Tuesdays & Thursdays, 10:30 - 12:18

Instructor: Richard Jagacinski

This course will examine various ways of evaluating new technologies (e.g., cell phones, SUVs, the Internet, sports equipment). Many new consumer products seem like they might improve our lives through increased efficiency and convenience in performing specific tasks. However, technology often has hidden costs such as unexpected effects on social behavior and cultural values, unexpected health consequences, increases in behavioral complexity, surprising patterns of errors in task performance, greater financial expense, and negative environmental impact. It is therefore difficult to predict whether new technology will make us happy, increase creativity, or generally improve our quality of life.

This course will consider how one can measure and/or predict the consequences of new technology, so that both designers and consumers can make better choices.

Students from all departments are welcome. For further information, contact Dr. Jagacinski at 614-292-1870 or jagacinski.1@osu.edu.



Advanced Topics in Injury Biomechanics

Course Number: Anatomy 820 (3 credit hours)

Time: Fridays, 9:00 - 12:00

Instructor: John Bolte

This is an advanced elective course for graduate students. It is a discussion-based seminar, exploring new methods and research in injury biomechanics. Discussion topics may include: instrumentation; crash databases; trauma to the head, thorax, abdomen, spine and extremities; pediatric trauma; and rehabilitation.

Students will be asked to lead research discussions on topics of their choosing. Grades for the class will be based on: leadership of selected research topics; participation in the discussion of the topics presented; and a paper focusing on the research topics selected.

Please contact Dr. Bolte (bolte.6@osu.edu) for more information.



PUBLISH or perish

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



Loading along the Lumbar Spine as Influenced by Speed, Control, Load Magnitude, and Handle Height during Pushing

William S. Marras, Greg G. Knapik, and Sue A. Ferguson, 2009, *Clinical Biomechanics*, 24(2): 155-163. (The abstract of this research is printed to the right.)



National Occupational Research Agenda (NORA) Future Directions in Occupational Musculoskeletal Disorder Health Research

William S. Marras, R.G. Cutlip, S.E. Burt, and T.R. Waters, 2009, *Applied Ergonomics*, 40(1):15-22.



Point of View

William S. Marras, 2009, *Spine*, 34(4):322.



Regional Air Traffic Flow Management

P. Jha, M. Balint, **Philip J. Smith**, and I. Crook, 2008, *Proceedings of the 2008 Annual Meeting of the Air Traffic Control Association*, Washington, DC.



Rhythmic Force Patterns in the Golf Swing

Richard J. Jagacinski, T. Kim, and **Steven A. Lavender**, 2008, in D. Crews and R. Lutz (eds.), *Proceedings of the World Scientific Congress of Golf*, Chapter 11:82-88. Tempe, Arizona: Ironwood Lithographers. (The abstract of this research is printed on page 7.)



Remember When?

Phil Smith (l.) and Bill Marras (r.) enjoy Coke and conversation at an early 1990s party, held at the Marras residence.



Research Corner

This issue of the *Insider* summarizes recently conducted research

Loading Along the Lumbar Spine as Influence by Speed, Control, Load Magnitude, and Handle Height during Pushing

William S. Marras, Gregory G Knapik, and Sue Ferguson

Clinical Biomechanics, 24(2):155-163, 2009

Abstract

Background: Low back loading and risk associated with pushing activities have been poorly understood. Previous studies have demonstrated that increases in anterior/posterior shear forces are primarily initiated by antagonistic coactivity within the torso. Yet, few studies have considered the range of activities that might contribute to the antagonistic coactivation and subsequent spine loading.



Methods: Twenty subjects were tested to examine how various physical factors might influence spine loads during pushing tasks that workers might experience in industrial settings. Load magnitude, speed of push, required control, and handle height were varied while pushing both carts and overhead suspended loads. A biologically-assisted biomechanical model was used to assess compression, anterior/posterior shear, and lateral shear over the various levels of the lumbar spine.

Findings: Anterior/posterior shear loads were greatest at the upper levels of the lumbar spine and of a magnitude that would be of concern. Anterior/posterior shear was influenced by all experimental factors to varying degrees except for the nature of the load (cart vs. suspended).

Interpretation: This study confirms the notion that pushing and pulling is not as simple a task as once believed since it entails a complex biomechanical activity. Spine shear forces result from a complex coactivation of trunk muscle activities and spine orientations that are influenced by several occupational factors. This study may help explain why low back pain rates in some work environments associated with lifting may not be reduced even when lifting interventions (that change the task from lifting to pushing) are employed.



Additional research abstracts continue on page 7



Research Corner



This issue of the *Insider* summarizes recently conducted research

Rhythmic Force Patterns in the Golf Swing

**Richard J. Jagacinski, T. Kim,
and Steven A. Lavender**

*Proceedings of the World Scientific Congress
of Golf, Chapter 11:82-88, 2008*

Abstract

Golfers often use the term “rhythm” to describe their performance. In analogy with music, rhythm typically refers to the relative timing of events during the swing. Golfers generally agree that their rhythm should remain invariant across different shots. However, precisely which timing events any golfer is referring to is often vague.

In order to define rhythm more precisely, one research strategy is to search for aspects of timing that remain invariant. The present study measured the timing of peaks in the force applied perpendicular to the face of the clubhead and in the weight shift. Of interest was whether the timing of these events was invariant when golfers were required to hit short chip shots requiring different amounts of force.

Two patterns of invariance were found. Seven of nine moderately skilled golfers exhibited timing invariance in both the clubhead force pattern and the weight shift. Only the magnitude of the clubhead force pattern and the magnitude of the weight shift varied substantially across shots requiring different amounts of force. Two golfers of somewhat higher skill level exhibited timing invariance in their clubhead pattern, but not in their weight shift. A quicker weight shift was used to generate greater force, while the clubhead timing pattern remained approximately invariant.



These results suggest that the definition of golfing rhythm in terms of invariant timing may change as a function of skill level as certain degrees of freedom that were frozen at earlier levels of skill development are exploited at more advanced levels of performance. The results also suggest that peaks in the force patterns of golfers may be useful events for describing golfing rhythm.



Ergonomics in the Medical Intensive Care Unit of The Ohio State University Medical Center

Dawn Chandler
Masters Project

Abstract

As the percentage of overweight and obese people in the country has increased, a resultant burden on health care workers associated with caring for bariatric patients has been observed. From a productivity standpoint, tasks performed in caring for these patients take longer to perform. From an injury risk standpoint, the weight of the patients, which can reach 1,000 pounds, increases the physical risks associated with patient handling by nurses and other hospital staff.



The objective of this study was to complete an ergonomic assessment in a Medical Intensive Care Unit (MICU) to identify high-risk tasks to the nurses and Patient Care Associates (PCAs). This objective was addressed using an approach that combined traditional industrial engineering methods, modified task analysis and observation to identify the various tasks and subtasks, and participatory ergonomics methods (focus groups) to maximize worker involvement in the decision making process. The specific aim was to compare results of the ergonomic assessment observations with the results of focus groups comprised of nurses and PCAs working in the MICU where the observations occurred.

The results showed that the tasks with higher injury risk, which were identified through observations as tasks with high frequency and duration, were also identified in focus groups as the primary risks to be mitigated. The participation of the nurses and PCAs also raised issues about the various solutions that may not be foreseeable by an outsider (such as how to get the drawsheets back from the laundry, or how beds and operating room tables are not wide enough for bariatric patients with a shorter stature and greater girth).

By completing the ergonomic assessment before conducting the focus groups, the nurses and PCAs were able to confirm their concerns were understood and they could move as a group from problem identification into solution prioritization for the short and longer term. Utilizing this mixed approach of participatory ergonomics and ergonomic assessment helped ensure the final solution matched the actual problem as identified by both the ergonomist and the employees.

