

Institute Insider



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The Newsletter of the Institute for Ergonomics at The Ohio State University
At the forefront of Human Factors since 1950

Marras and Mendel Receives Multi-Million Dollar Research Contract to Study “Virtual Surgery”

In the U.S., your chances of having successful back surgery is only about 50%. However, those odds could change significantly as a result of new research beginning in Ohio State’s Biodynamics Laboratory.



Marras

William Marras and **Ehud Mendel** have received a five-year, \$5.8 million contract from a surgical implant firm, to personalize the OSU-developed, biomechanically driven spine model. This would allow surgeons to first perform “virtual surgery” on patients, by determining how a potential surgical procedure would impact a patient’s actual spine before the procedure is performed.

This advance in spinal loading research will assist surgeons in two ways:

First, it would allow alternative procedures to be tested on a computer, using a hybrid, biologically driven spine loading model, to determine which

approach has the best chance for success. For example, the surgeon could select from a number of alternative artificial discs, to chose that which best suits an individual’s specific spine and medical condition.



Mendel

Second, finite element modeling techniques, integrated into a pre-operative analysis, will allow surgeons to determine how a particular device will function over time, as a result of the amount of wear and tear placed upon it by the patient and his or her specific medical condition.

This exciting new advance has the potential to significantly reduce pain amount low back pain patients, improve the odds of successful spinal surgery, and reduce the healthcare costs associated with this all-too-common injury.

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Patterson Takes Faculty Position

Starting January 1st, 2010, **Emily Patterson** will become an Assistant Professor in Ohio State’s College of Medicine, School of Allied Medical Professions, Division of Health Information Management & Systems.



This is a fast-growing area in

healthcare, which develops systems used to collect, store, retrieve and communicate healthcare data. These data are used to plan, deliver, reimburse, protect, and evaluate patient care.

We wish you well, Emily!

Marras Appointed *Human Factors* Editor-in-Chief

William Marras has been appointed by the Executive Council of the Human Factors and Ergonomics Society to become editor-in-chief of its journal, *Human Factors*. Dr. Marras will begin a four-year term on January 1st, 2010. He has already begun transitioning into this position.

The role of an editor-in-chief is to focus on the future direction of *Human Factors* rather than on manuscript review.

“I am honored to have this opportunity to work with such a well-respected journal and the flagship journal in our profession,” Marras said. “My goal for the next few years is to expand the appeal of *Human Factors* and try some new ways to further raise interest in the journal. Ultimately, I would like to get the journal to the next level in terms of professional impact.”

The peer-reviewed *Human Factors* journal presents scientific papers aimed to advance the systematic consideration of people in relation to machines, systems, and environments. Articles published in this journal cover all aspects of the human-system interface, including both basic and applied research, as well as quantitative and qualitative approaches to theory.



Human Factors, the journal of the Human Factors and Ergonomics Society, has been published since 1958.

World Usability Day is about making life easy and user friendly.

2009 World Usability Day to be held November 12th



World Usability Day
Making life easy!

LexisNexis and Elsevier will be hosting the tri-state World Usability Day in Miamisburg Ohio, on **Thursday, November 12th, 2009**.

This year's theme is *Designing for a Sustainable World*. However, as with

past events, “usability” will be defined broadly, including topics on general systems design, human factors, cognitive systems engineering, perception & action, decision making, and physical ergonomics.

As every year, posters, product demonstrations, etc. will be welcome during the event's poster session.

There is no charge to attend this event, but an RSVP is rested (to Douglas Gardner) by Tuesday November 3rd.

More information about this event can be found at www.worldusabilityday.org.

BIODYNAMICS LABORATORIES



Dr. Marras directs this Lab. His unique research

program studies joint loading under dynamic conditions. Dr. Marras' goal is to better understand occupational ergonomics through laboratory quantification of data gathered directly from industry.

From the Archives

Remember these individuals from the Biodynamics Lab, circa 1988? They are (l. to r.): Sue Ferguson, Steve Lavender, Bill Marras, Chris Hamrick, Sudhakar Rajulu, and Jamie Brey.



IN THE NEWS



In August 2009, **David Woods'** recently published article, "Beyond Asimov: The Three Laws of Responsible Robotics" (co-authored with Robin Murphy) was featured on space.com.



This article proposed that Isaac Asimov's Three Laws of Robotics be re-thought, to recognize the current limitations of robots. The article was highlighted on MSNBC's web site as well (www.msnbc.msn.com).

William Marras was the recipient of the 2009 Paul M. Fitts Education Award. Presented by the Human Factors and Ergonomics Society, this award recognizes individuals who have made exceptional contributions to the education and training of Human Factors/Ergonomics specialists.

Dr. Marras received this honor, in part, due to the methods he uses to encourage his students to think critically and innovatively, using an interdisciplinary approach to advancing this discipline. Congratulations, Bill!



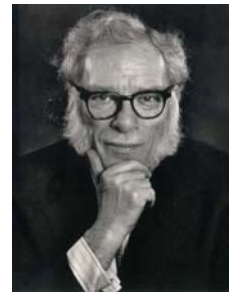
A 2007 article co-authored by **Emily Patterson**, "Impact of Clinical Reminder Redesign on Learnability, Efficiency, Usability, and Workload for Ambulatory Clinic Nurses" has been chosen as one of only nine articles selected by the Agency for Healthcare Research and Quality for its bibliography on Usability Testing in health information technology.



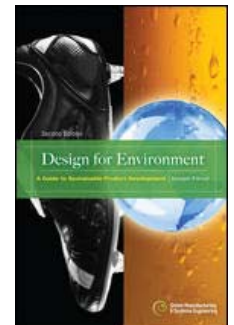
Experts in informatics, usability, and human-computer interaction determined that this article (JJ Saleem, ES Patterson, L Militello, S Anders, M Falciglia, JA Wissman, EM Roth, and SM Asch, *Journal of the American Medical Informatics Association*, 14 (5):632-640) represented best practices on incorporating usability testing into health IT system design, selection, implementation, and usage.

The complete list of recommended articles can be found on the AHRQ web site, <http://healthit.ahrq.gov>.

Joseph Fiksel, Executive Director of OSU's Center for Resilience (www.resilience.osu.edu/CFR-site/index.htm), has recently published, *Design for Environment: A Guide to Sustainable Product Development*, 2nd edition (McGraw-Hill, July 2009). Editorial reviews of this book can be found on amazon.com.

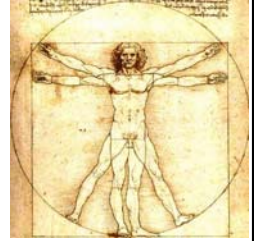


In 1942, Isaac Asimov proposed the Three Laws of Robotics in his science fiction short story, *Runaround*.



Design for Environment: A Guide to Sustainable Product Development can be purchased online, at www.mcgraw-hill.co.uk/html/0071605568.html.

The latest *Professional Society News*



The long-term vision of NEM is to introduce ten million adults to human factors/ergonomics by 2010.

The Human Factors and Ergonomics Society has designated October of every year to be **National Ergonomics Month**.

The purpose of NEM is to promote human factors and ergonomics to corporate executives, students, and the general public, by providing information and services to the community. Information can at <http://hfesnem.org>.

For this yearly event, HFES would like involvement from teachers, reporters, HFES members, students, consumers, and community, industry, and government leaders.

Teachers: Go to the web site's "Teachers" section to request a NEM speaker or NEM presentation materials.

Reporters: Obtain information from the web site and read HFES's NEM press release.

HFES Members: Visit and present at information to schools, community, and other professional groups.

Everyone: Prepare to do a community service project, by recruiting your colleagues to join in NEM activities.

If you took part in this year's NEM, please consider sending a summary report (and photos) of your activities to HFES (info@hfes.org). It will be included in a contest for the best NEM implementation, and you will be included in the NEM album.

The **Applied Ergonomics Conference and Expo** will be held at the Marriott San Antonio Hill Country Resort & Spa in San Antonio TX, March 22nd-25th, 2010.

The AEC is one of the largest ergonomics conferences in North America. Presenters are practitioners who share their real-world experiences and practical solutions to common ergonomics issues in industry.

This conference provides comprehensive and broad-

spectrum education for employees at all levels (managers to professionals to line-workers).

Applications for the prestigious and highly educational **Ergo Cup® Competition** are now being accepted. The application deadline is November 23rd.

Find more information about the 2010 AEC at www.iinet.org/Ergo/Conference/default.aspx.



Mark Your Calendar! Other Upcoming Events

Ohio Safety Congress & Expo

Columbus Convention Center, Columbus OH, March 30th - April 1st, 2010 (www.ohiobwc.com/employer/programs/safety/SafetyCongress.asp)

CHI 2010 - ACM Conference on Human Factors in Computing Systems

Hyatt Regency, Atlanta GA, April 10th-15th, 2010 (www.chi2010.org)

Engineering to Improve the Operations of Manufacturing Enterprises - A National Symposium

University of Michigan, Ann Arbor MI, May 13th, 2010 (www.engin.umich.edu/eiome/index.html)

AIHce 2010 - American Industrial Hygiene Association Conference & Expo

Denver CO, May 22nd - 27th, 2010 (www.aiha.org/aihce10)

Graduate Student News

New Graduate Students

Mohini Dutt

dutt.15@osu.edu

Advisor: Steven Lavender

Hometown: New Delhi, India

Mohini earned her Bachelor's degree (Biomedical Engineering) and Master's degree (Industrial Engineering and Management) from Case Western Reserve University. She is now working towards a doctoral degree in physical ergonomics.

Mohini has worked on several industrial projects, specifically in product development and Six Sigma.

When not studying, Mohini enjoys swimming, cooking, reading, and singing.



SangHyun Park

park.1099@osu.edu

Advisor: Julia Higle

Hometown: South Korea

SangHyun has a Master's degree in cognitive engineering at the Korea Advanced Institute of Science & Technology. Before arriving at OSU, she spent four years designing user interfaces for mobile phones at LG Electronics. Her goal at Ohio State is to study human factors/ergonomics to enhance her knowledge about user interaction, especially in the context of human physical limitations and aging.

SangHyun's interests include travel, photography, and cooking Korean foods.



Tony Farfan

farfan.5@osu.edu

Advisor: Carolyn M. Sommerich

Hometown: Cincinnati, OH

Tony received his Bachelor's degree (Mechanical Engineering) at The Ohio State University. For his graduate work, however, he chose Industrial Engineering. This occurred after having taken a few ISE classes as technical electives, which drew his interest.

Tony is now pursuing a Master's degree in Occupational Safety and Ergonomics.



Kyle Russ

russ.43@osu.edu

Advisors: Blaine Lilly, Steve Lavender, Carolyn Sommerich

Hometown: Sound Beach, NY

Kyle is a second-year graduate student, pursuing a dual Master's degree in Mechanical Engineering and Industrial Systems Engineering. His focus is in product design and human factors/ ergonomics. Currently, Kyle is studying an ulnar nerve entrapment known as cyclist's palsy, which is due to bearing weight on bicycle handlebars for extended periods of time.



The Graduate Studies Coordinator and point of contact for graduate work within the Department of Integrated Systems Engineering is Ms. Judith Flickinger.

Judith can be reached at flickinger.22@osu.edu or 614-292-6841.

Graduate Student News

Transitions

Recent graduate **Dawn Chandler** (December 2008) is now an engineer in the Human Systems Integration (HSI) Branch of the Naval Surface Warfare Center - Dahlgren Division.



This HSI Branch integrates the human element into a system, working across all seven domains (Human Engineering, Manpower, Personnel, Training, Safety & Health, Habitability, and Personnel Survivability) as the tradespace to optimize human performance.

HSI aims to enhance the capabilities of our war fighters and improve total system performance and affordability over the entire life-cycle of a platform or system.

Dawn can be reached at dchandl@columbus.rr.com.

Olivia Hernandez successfully defended her thesis, "The Potential for Tele-Presence to Assist and Aid with the Supervision of Medication Self-Management." Olivia's faculty advisors were Drs. Carolyn Sommerich and David Woods.



To find out more about this research, contact Olivia at hernandez.127@osu.edu.

Naira Campbell-Kyureghyan (2004) is now an Assistant Professor in the Department of Industrial and Manufacturing Engineering at the University of Wisconsin-Milwaukee. Dr. Campbell-Kyureghyan can be reached at 414-229-6190 or campbeln@uwm.edu.



Opportunities

Beginning Autumn 2009, the OSU **Statistical Consulting Service** is expanding its consulting capacity for graduate students.

Students working on dissertations or master's theses that need statistical help can sign up for 15 hours of assistance from a graduate student consultant in the Statistics Department.




Consultants provide help in designing experiments, planning surveys or observational studies, and analyzing quantitative data.

For more info, contact Jeni Squiric (jas@stat.osu.edu; 292-1529).

The Human Factors group in Cardiac Rhythm Management at Medtronic is seeking new college graduates with a human factors background to fill the position of Human Factors Scientist in Mounds View, MN.

This is a permanent position, with a start date of May 2010 or later.

To express interest, reference requisition number 69551, at www.medtronic.com/employment.



Medtronic

Medtronic is the world leader in medical technology, providing lifelong solutions for people with chronic disease.

Publish or PERISH

Beyond Asimov: The Three Laws of Responsible Robotics

RR Murphy, **DD Woods**, 2009, *IEEE Intelligent Systems*, Jul/Aug, 1-8.

College Students and Computers: Assessment of Usage Patterns and Musculoskeletal Discomfort

KL Noack, **CM Sommerich**, GM Mirka, 2009, *Work*, 32(3):285-298.

Does the Asymmetry Multiplier in the 1991 NIOSH Lifting Equation Adequately Control the Biomechanical Loading of the Spine?

SA Lavender, YC Li, RN Natarajan, GBJ Andersson, 2009, *Ergonomics*, 52(1):71-79.

Evaluation of a Physician Informatics Tool to Improve Patient Handoffs

ME Flanagan, **ES Patterson**, RM Frankel, BN Doebbeling, 2009, *Journal of the American Medical Informatics Association*, 16:509-515.

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

WS Marras, **GG Knapik**, **S Ferguson**, 2009, *Clinical Biomechanics*, 24(2):155-163.

Quantification of a Meaningful Change in Low Back Functional Impairment

SA Ferguson, **WS Marras**, DL Burr, S Woods, **Ehud Mendel**, P Gupta, 2009, *Spine*, 34(19):2060-2065.

Human Factors & Ergonomics Society 53rd Annual Meeting

San Antonio TX, October 19th-23rd, 2009

Workshop

Engineering Resilience to Create Safety
DD Woods

Lectures

Application of a Participatory Methodology for Investigating Personal Fall Arrest System (PFAS) Usage in the Construction Industry
D Liu, **CM Sommerich**, E Sanders, **SA Lavender**

Comparative Study of Computer Usage Patterns and Prevalence of Musculoskeletal Symptoms Among College Students
KN Cooper, NH Campbell, **CM Sommerich**

Dynamic Load Moment Exposure and Spine Function Impairment
WS Marras, **SA Lavender**, **SA Ferguson**, **RE Splittstoesser**, **G Yang**

How Panoramic Visualization Can Support Human Supervision of Intelligent Surveillance
AM Morison, **DD Woods**, **JW Davis**

Human Factors Issues in the Design of Super-Dense Operations Airspace
A Andre, M Evans, J Krozel, **P Smith**, **A Spencer**

Identifying Safe Load Moment Exposures for the Back
SA Lavender, **WS Marras**, **SA Ferguson**, **RE Splittstoesser**, **G Yang**, **P Schabo**

Is There a Lateral Transfer Distance that Minimizes the Twisting and Lateral Bending Motions of the Spine During Box Transfers?
SA Lavender, **M Johnson**

Musculoskeletal Disorder Risk associated with Auto Rotation Angle during an Assembly Task
SA Ferguson, **WS Marras**, **WG Allread**, **GG Knapik**, **KA Vandlen**, **RE Splittstoesser**, **G Yang**

Understanding Coordination Challenges in Urban Firefighting: A Study of Critical Incident Reports
M Branlat, L Fern, **M Voshell**, S Trent

Discussion Panel

Medical Informatics: What Contributions can Human Factors Make?
AL Russ, RL Wears, **ES Patterson**, A Miller, L Militello, S Anders, BT Karsh



These are the latest publications authored by Institute members (indicated in **bold-face font**)

The 2010 Human Factors and Ergonomics Conference will be held September 27th-October 1st, in San Francisco



This issue of the *Insider* summarizes recently conducted research by Institute members.

“The PHT, marked for dissemination to other VA medical centers, has considerable potential for improving safety.”

Research Corner

Does the Asymmetry Multiplier in the 1991 NIOSH Lifting Equation Adequately Control the Biomechanical Loading of the Spine?

SA Lavender, YC Li, RN Natarajan, and GBJ Andersson

Ergonomics, 52(1):71-79

Abstract

The aim of this research was to evaluate whether the asymmetry multiplier incorporated in the 1991 National Institute for Occupational Safety and Health lifting equation adequately controls the biomechanical spine loads during asymmetric lifting.

Sixteen male subjects lifted a box from four initial locations varying in terms of the angular deviation from the mid-sagittal plane (0, 30, 60 and 90°). From each location, boxes that weighed the recommended weight limit (RWL) and three times the RWL were lifted at two qualitatively defined lifting speeds. Ground reaction forces were combined with kinematic data in a linked-segment model to quantify the 3-D moments at the base of the spine (L₅/S₁) and the spine compression forces.

The results show that the twisting and lateral bending moments increased with task asymmetry despite the

lessening of the RWL (p<0.01). The flexion moment and the spine compression decreased with asymmetry, although at a slower rate than the RWL.

When the dynamics were removed from the linked segment spine model to approximate the assumption of slow and smooth lifting, the estimated compression remained approximately 3400 N across all asymmetry conditions.

Thus, the reduction in the RWL due to asymmetry multiplier appears appropriate and should not be changed, as been suggested by recent psychophysical studies.



Evaluation of a Physician Informatics Tool to Improve Patient Handoffs

ME Flanagan, ES Patterson, RM Frankel, and BN Doebbeling

Journal of the American Medical Informatics Association, 16:509-515

Abstract

Objective: To facilitate patient handoffs between physicians, the computerized Patient Handoff Tool (PHT) extracts information from the electronic health record to populate a form that is printed and given to the cross-cover physician.

The objectives were to:

1. Evaluate the rate at which data elements of interest were extracted from the electronic health record into the PHT;

2. Assess the frequency for needing information beyond that contained in the PHT and where obtained;
3. Assess a physician's perceptions of the PHT; and
4. Identify opportunities for improvement.

Design: Observational study.

Measurements: This multi-method study included content coding of PHT forms, end of shift surveys of cross-cover resident physicians, and semi-structured interviews, to identify opportunities for improvement.

Thirty-five of 42 internal medicine resident physicians participated. Measures included: 1264 PHT forms coded for type of information, 63 end-of-shift surveys of cross-cover residents (residents could participate 2 times), and 18 semi-structured interviews.

Results for each Objective:

1. Patient identifiers and medications were reliably extracted (>98%). Other types of information - allergies and code status - were more variable (<50%).
2. Nearly a quarter of respondents required info from physician notes not available in the PHT.
3. Respondents found that the PHT supported handoffs but indicated that it often excluded the assessment and plan.
4. Residents suggested including treatment plans.

Conclusion: The PHT reliably extracts information from the electronic health record. Respondents found the PHT to be suitable, although opportunities for improvement were identified.

Research Corner

Quantification of a Meaningful Change in Low Back Functional Impairment

SA Ferguson, WS Marras,
DL Burr, S Woods, **Ehud Mendel,** and P Gupta
Spine, 34(19):2060-2065

Abstract

Study Design: Repeated measures study design.

Objective: Determine a meaningful change in low back functional impairment as measured with the lumbar motion monitor.

Background Data: A quantitative functional performance probability (P(n)) measure has been developed and is scored from 0.00 to 1.00. Previous research has shown that a 0.5 cut-off provides excellent sensitivity and specificity for identifying impaired and healthy low back function. However, a meaningful change in the P(n) measure has not been defined.

Methods: The lumbar motion monitor was used to

repeatedly measure P(n) in three groups of subjects including:

1. Asymptomatic;
2. Recovering low back pain (LBP); and
3. Non-recovering LBP.

The asymptomatic group had 20 subjects. The recovering and non-recovering LBP had 18 and 8 subjects, respectively. The asymptomatic group was tested five times at 1-week intervals. The two LBP groups were tested every two weeks for three months (6 evaluations).

Results: The P(n) in the asymptomatic group did not



significantly change over the observed period. On the basis of the variability in the asymptomatic group it was hypothesized that a meaningful change in P(n) was 0.14.

The defined meaningful change was evaluated in two patients with LBP populations. The P(n) in the recovered LBP group significantly improved during the three month observation period, and there was a corresponding reduction of symptoms. In the recovering LBP group the within subject standard deviation was 0.14 and all patients had at least one visit to visit change greater than 0.14. Furthermore, 11 of the 18 recovering patients with LBP had a meaningful change between the first two visits. In contrast, none of the non-recovering LBP group had a meaningful change between the first two visits.

Conclusion: A meaningful change in P(n) was defined as 0.14.

“Measuring the functional performance probability over time would provide a direct objective measurement of functional impairment throughout the recovery process. It would also quantify the degree of degradation from a relapse or exacerbation.”

Exploring Relationships Among Macro-cognitive Processes with a Card Sort Study

Jason Blake

Undergraduate Honors Thesis Abstract

This study examines how study participants with no prior knowledge of a set of macro-cognitive processes grouped the concepts,

defined their categories, and distinguished among groups.

The findings from this study both support and extend prior findings about the existence of a set of macro-cognitive processes and their interrelationships. Future work is planned to explore more systematically how these data relate to two conceptual frameworks published in the macro-

cognition literature.

Note: Undergraduate student Bryan Rogers is continuing this research, through funding he received from OSU’s College of Engineering.

For more details on this work, contact either Bryan (brogstrong@gmail.com) or Jason (blake.172@osu.edu).

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