

Institute Insider

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

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In Memoriam

Kevin P. Granata, PhD

A world-class researcher. A man of great intellect. A colleague. A friend. People who knew Kevin Granata described him in many ways. All have mourned his death.

Kevin was one of two engineering professors killed at Virginia Tech on Monday, April 16th, 2007.

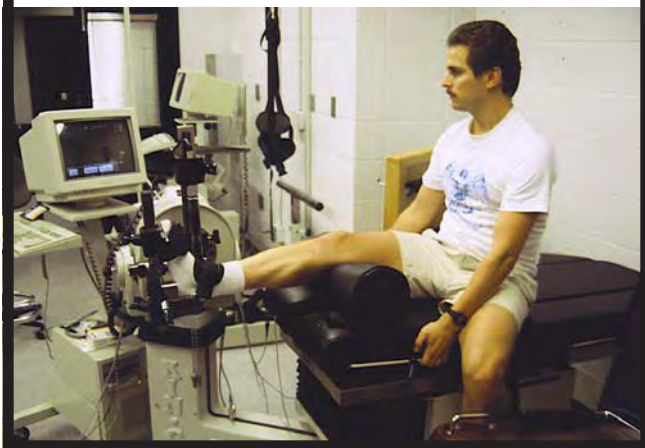
Dr. Granata was a 1993 PhD graduate of Ohio State's Biodynamics Laboratory. With advisor and then colleague Dr. William Marras, Kevin worked in the Lab as a Senior Research Engineer for four years, where he made significant developmental contributions to the Lab's biodynamic spine model.

In 1997, Kevin became an Assistant Professor at the University of Virginia and moved to Virginia Tech in 2003, where he eventually became a full Professor in the Department of Engineering Science and Mechanics.

His research interests included neuromuscular control, muscle and reflex response, and the mechanics of walking and running. He also worked with those afflicted with cerebral palsy, using robotics to better understand human movement.

Marras, who had worked with Kevin for over 15 years, said, "We are losing a good person, a great researcher, who also was extremely caring. It'll be a huge loss."

Kevin is survived by his wife, Linda and children, Alex, Eric, and Ellen.



New Research Center to Reduce Injuries in Automotive Facilities

Worker health care adds \$1,600 or more to the production costs of new vehicles, and these types of expenses increase by up to 12% annually. A new OSU research center affiliated with the Institute aims to address this problem.

May 2nd, 2007 marked the grand opening of the **Center for Occupational Health in Automotive Manufacturing**, or COHAM. Under the direction of Dr. William Marras, this facility will explore ergonomic issues in the automotive manufacturing process that impacts worker safety and skyrocketing health care costs.

COHAM is a unique and interdisciplinary partnership between OSU and several automobile manufacturers and suppliers. The goal of COHAM is to design assembly tasks and processes to minimize occupational health risks while also enhancing efficiency. It also will serve as a location for automobile manufacturing suppliers to demonstrate their new technologies and possible solutions for reducing occupational health problems.

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COHAM is the only university-based, full-scale operation in the world where automobile manufacturers and suppliers can test the effects of manufacturing systems on worker health

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Structuring Flexibility: The Potential Good, Bad, and Ugly in Handoff Standardization

Commentary by Dr. Emily S. Patterson

This article was commissioned by *Quality & Safety in Health Care*, for an upcoming issue. QSHC is an international peer review journal for health professionals in quality improvement and patient safety

The findings from the paper in this issue by Borowitz et al add to the growing empirical evidence that patient handoffs in all healthcare settings are highly variable in content and process. Further, few strategies routinely used during shift change handovers in high-reliability organizations (HROs) are used in healthcare.



Patterson

Similar to other highly-respected healthcare researchers, the authors recommend reducing this variability, in this case by standardizing sign-out protocols.

Similar to other human factors researchers, I am concerned about the potential unintended consequences from this well-intentioned approach.

Given nearly universal agreement that traditional handoff processes can be characterized as "ad hoc" and highly variable, what is the basis for concern? In this commentary, I attempt to predict the potential impacts of standardizing patient handoffs in the hopes of maximizing the "good," preventing the "bad," and steering clear of the "ugly" in the national experiment that is already underway.

These predictions are primarily based on these repeating patterns from human factors research in complex, socio-technical settings:

- All decisions require making trade-offs on competing goals;
- Imposing a simple standard on a complex process does not result in simplicity;
- Local actors must tailor a distant supervisor's plan to the context;
- People adapt procedures over time in response to feedback;
- Communication is not a (macro-cognitive) function, but rather a means to achieve multiple functions in necessarily distributed work; and
- High performing teams communicate less and more proactively (more push than pull) than low performing teams.

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IN THE NEWS

On January 23rd, 2007, **David Woods** spoke at the Health Care Transformation Through Systems Approaches--MacArthur Foundation Roundtable in Chicago, IL. This conference was supported by the John D. and Catherine T. MacArthur Foundation.



Woods

David Woods was an invited speaker at the Almaden Institute 2007 conference, *Navigating Complexity: Doing More with Less*. It was held April 11th and 12th, 2007 at IBM's Almaden Research Center in San Jose, California. Dr. Woods spoke on, "Creating Safety by Engineering Resilience." More information can be found at www.almaden.ibm.com/institute.



On May 16th, 2007, **Emily Patterson** gave a webinar on "Human Factors: Unlocking the Mystery," which focused on handoffs in patient safety. It was sponsored by the Ohio Patient Safety Initiative.

Gary Allread discussed ergonomics in warehouses and distribution centers at two recent conferences. On March 21st, 2007, he spoke on injury reduction methods at the Ohio Bureau of Workers' Compensation Safety Congress in Cleveland, OH. On May 10th, 2007, he talked about applying ergonomics in this industry, at Kentucky's 23rd Safety & Health Conference and Exposition (Louisville, KY).



Allread

David Woods gave the keynote address on "Creeping Complexity" Conference for Medical Product Safety Network (MedSun) Representatives (March 26th-27th, 2007, Falls Church, VA). This was sponsored by FDA Center for Devices and Radiological Health.

William Marras presented results of "Recent Injury Risk Assessments of Hotel Housekeeping using the Lumbar Motion Monitor," at the American Industrial Hygiene Conference and Exposition (June 6th, 2007) in Philadelphia, PA.



Marras

Human Factors and Ergonomics Society – 51st Annual Meeting

Baltimore is the host city of the 2007 HFES meeting. It will be held October 1st – 5th, 2007 at the Baltimore Waterfront Marriott Hotel.

Two related conferences also are being held in conjunction with this meeting. These are the Human Performance in Extreme Environments 5th Annual Meeting and the 3rd International Conference on Augmented Cognition. Hope to see you in Baltimore!

A preliminary program is available on the Society's web site, www.hfes.org.

Registration is now open and can be done on-line. Early registration discounts end on August 27th.



Graduate Student News

New Student

Dawn Chandler

(dchandl@columbus.rr.com)

Advisor: Carolyn M. Sommerich

Hometown: Worthington, Ohio

Dawn is currently completing her undergraduate degree in the IWSE Department and working towards a Master's in Occupational Safety and Ergonomics. In her Senior Capstone project, she performed an ergonomics assessment at The Ohio State University Hospital. She is enjoying working with OSU technologists and learning how to develop and evaluate possible improvements. Dawn is excited to be a student in this program and is looking forward to the new challenges she will face as a graduate student.



Justin Grossman earned his Master's degree in March, 2007. His thesis involved, "Supporting The Cognitive Work of Information Analysis and Synthesis: A Study of the Military Intelligence Domain."

Justin recently moved to Baltimore, MD, where he was hired as a Cognitive Systems Engineer at Resilient Cognitive Solutions. Justin can now be reached at jgrossman@resilientcognitivesolutions.com.



ThesisAbstract: Information Analysis and Synthesis (IAS) is a type of cognitive work that plays a key role in many high-performance, complex, and mission-critical domains. These can range from tactical military intelligence to scientific or technological forecasting, business and financial intelligence to national strategic counterterrorism, and include areas as disparate as geopolitical policy analysis to computer network intrusion detection. The specific subject of this study is the military intelligence domain as one instantiation of IAS. Several innovative ethnographic and cognitive task analysis methods were used to observe team-based distributed work done by actual domain practitioners. The main investigative effort took the form of a scaled-world study, leveraging a real world tactical intelligence training exercise as a natural laboratory for investigating the contrasts between weaker and stronger IAS. Specifically, we examined the role of instructors in providing broadening checks to the team analytic process, and mapped the findings to an existing framework.



In March 2007, **Dan Zelik** successfully defended his Masters thesis. With advisor Dr. David Woods, Dan's thesis was, "When is Analysis Sufficient? A Study of How Professional Intelligence Analysts Judge Rigor."

Dan continues his graduate work at Ohio State, by pursuing a PhD in Cognitive Systems Engineering. His research will explore rigor in information analysis, both within intelligence analysis and across other information analysis domains. He also is interested in developing tools to support information analysis briefing interactions, expanding the understanding of how trust is established with autonomous agents in coordinated joint activity, and exploring the potential connections between the fields of cognitive systems engineering and law.



ThesisAbstract: The proliferation of data accessibility has exacerbated the risk of shallowness in information analysis, making it increasingly difficult to tell when analysis is sufficient for making decisions or changing plans, even as it becomes increasingly easy to find seemingly relevant data. In addressing the risk of shallow analysis, the concept of rigor emerges as an approach for coping with this fundamental uncertainty—motivating the need to better define and understand analytical rigor. The concept of rigor is explored through a study that asks how professional analysts decide when there is sufficient rigor in an analytic process.

Nine professional intelligence analysts participated in a scenario walkthrough in which they critiqued the analysis processes of two junior analysts (a high- and a low-rigor analysis process). Participants assumed the role of analyst supervisor, deciding if these analyses were of sufficient rigor to send to a decision maker—a fundamental judgment task characterized as the Supervisor's Dilemma.

This study design validated and refined the Elicitation by Critiquing methodology, also developing the Liquified Natural Gas Scenario, based on security issues that challenge safety analyses, as a cognitive case for exploring themes in information analysis.

This research identified three general findings on rigor in information analysis. (1) It found that process insight influenced judgments of rigor. (2) It found that while similar cues were used in forming assessments of rigor, the way in which those cues were interpreted as indicating rigor tended to be more varied. (3) The results of the study suggest a revised definition of analytical rigor, reframing it as an emergent multi-attribute measure of sufficiency rather than as a measure of process deviation. This expanded understanding of rigor serves as an analytic broadening check to be leveraged against the risk of shallow analysis.



An Adaptive Focus-of-Attention Model for Video Surveillance and Monitoring

James W. Davis, **Alexander M. Morison**, and **David D. Woods**, *Machine Vision and Applications*, 18(1):41-64, 2007.



Alternative Design to Distribute Work Across Multiple Organizations: Control at Different Levels of Abstraction

Philip J. Smith, **Amy Spencer**, and **Charles Billings**, *Proceedings of the 8th International Conference on Naturalistic Decision Making*, Monterey, CA, 2007.



Challenges for Cognition in Intelligence Analysis
Stoney A. Trent, **Emily S. Patterson**, and **David D. Woods**, *Journal of Cognitive Engineering and Decision Making*, 1(1):75-97, 2007.



Changes in Spine Loading Patterns Throughout the Workday as a Function of Experience, Lift Frequency, and Personality

Anne-Marie Chany, **Julia Parakkat**, **Gang Yang**, **Deborah L Burr**, and **William S. Marras**, *The Spine Journal*, 6:296-305, 2006.



Communication Strategies from High-Reliability Organizations: Translation is Hard Work

Emily S. Patterson, *Annals of Surgery*, editorial 245(2):170-172, 2007.



Decision Support for Airport Surface Management & Control

Charles Billings, **Philip J. Smith**, and **Amy Spencer**, *Proceedings of the 14th International Symposium on Aviation Psychology*, Dayton, OH, 2007.



Detecting the Spectrum of Assumptions behind "Facts": The Faction Display Concept

Michael Smith, **Emily S. Patterson**, **Daniel Zelik**, and **David D. Woods**, *Proceedings of the 8th International Conference on Naturalistic Decision Making*, Monterey, CA, 2007.



Discovering the Events Expert Practitioners Extract from Dynamic Data Streams: The Modified Unit Marking Technique

K. Christoffersen, **David D. Woods**, and G. T. Blike, *Cognition, Technology & Work*, 9(2):81-98, 2007.



Engineering Organizational Resilience to Enhance Safety

David D. Woods, *Proceedings of the 8th International Conference on Naturalistic Decision Making*, Monterey, CA, 2007.



Heuristics for Designing Coordination during Patient Handoffs

Emily S. Patterson and **David D. Woods**, *Forum* (Special Issue: Reducing Risk During Handoffs), 25(1):8-9, 2007 (e-publication available at www.rmfm.harvard.edu/files/documents/Forum_V25N1.pdf).



The Influence of Lift Frequency, Lift Duration and Work Experience on Discomfort Reporting
Julia Parakkat, **Gang Yang**, **Anne-Marie Chany**, **Deborah L Burr**, and **William S. Marras**, *Ergonomics*, 50(3):396-409, 2007.



Measuring Pad-Pad Pinch Strength in a Non-Human Primate: *Macaca Fascicularis*

Jake Banks, **Steven A. Lavender**, J. Buford, and **Carolyn M. Sommerich**, *Journal of Electromyography & Kinesiology*, 2006 (e-publication available at www.sciencedirect.com).



Tactical Airport Departure Flow Management

Amy Spencer, T. Carniol, J. Pepper, M. Fledman, and M. Huynh, *Proceedings of the 14th International Symposium on Aviation Psychology*, Dayton, OH, 2007.



Towards Development of a Non-Human Primate Model of Carpal Tunnel Syndrome: Performance of a Voluntary, Repetitive Pinching Task Induces Median Mononeuropathy in *Macaca Fascicularis*

Carolyn M. Sommerich, **Steven A. Lavender**, J. Buford, **Jake Banks**, **Sahika V. Korkmaz**, and **William S. Pease**, *Journal of Orthopaedic Research*, 2007 (e-publication available at www3.interscience.wiley.com).



Understanding Rigor in Information Analysis
Daniel Zelik, **Emily S. Patterson**, and **David D. Woods**, *Proceedings of the 8th International Conference on Naturalistic Decision Making*, Monterey, CA, 2007.



The Use of Airspace Flow Programs to Manage Large-Scale Weather Events

Philip J. Smith, and **Amy Spencer**, *Proceedings of the 14th International Symposium on Aviation Psychology*, Dayton, OH, 2007.



Honda-OSU Partnership Named One of the Best in the U.S.

Corporations are increasingly directing more funds toward university research, in the areas of biotechnology, nano-technology, engineering, and alternative energy. After years of corporate downsizing and inconsistent government funding for educational research, industry and academia have realized the benefits of a formal collaboration.

Of these national programs, *Business Facilities Magazine*, a leading publication for corporate executives, ranked the Honda-Ohio State Partnership Program among the top five industry-university partnerships in the U.S.

Others named were Stanford, MIT, the University of California, and Penn State.

The Honda Partnership Program is a collaboration between Ohio State and Honda of America Manufacturing, Inc. Directed by Dr. Steve Yurkovich, it supports initiatives in education, research, and public service. This will positively impact diverse global audiences of students, faculty, public and private sector practitioners as well as the transportation industry.

Members of the Institute for Ergonomics have been active in this partnership for several years, most recently with the opening of COHAM, the Center for Occupational Health in Automotive Manufacturing (see related story on page 1).

Across Ohio State's engineering departments there are more than 40 laboratories and research centers.

"The value of research projects done in cooperation with the Ohio State College of Engineering lies not only in the expected finding of solutions to current and future problems," said Jim Wolever, Associate Chief Engineer for Honda of America Mfg. "There is also a significant intangible benefit in keeping our engineers current with the latest technology trends and analysis methods. This joint research has improved Honda's ability to influence product design for manufacturability."



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



Yurkovich

COHAM, continued from page 1

"The creation of COHAM breaks new ground in the manufacturing research arena," said Dr. Marras. "By partnering with auto and manufacturing companies to learn how injuries occur, we can solve problems that will impact worker safety and health care costs, as well as productivity and quality." This approach will provide quantitative cost-benefit information to manufacturers so they can make production decisions based on scientific evidence.

Ohio State invested \$1 million in COHAM, funded partially through an endowment from Honda of America Mfg, Inc. Several equipment suppliers donated an additional \$1 million worth of lab equipment.

Equipped with a "real world" manufacturing environment, new production technologies and cutting edge analysis methods, COHAM is focused on developing health risk assessment techniques for the high-tech manufacturing critical to Ohio's economy.

The COHAM facility features several new production technologies. These include an overhead car carrier and an adjustable-height skillet system, both developed to orient vehicles relative to workers and reduce stress on their bodies. These systems use numerous support functions including state-of-the-art tooling, rail systems, balancers, and carts.

Speakers at the May 2nd event included: Dr. Bud Baeslack, Dean of the OSU College of Engineering; Ohio State University President Dr. Karen Holbrook; Dr. Steve Yurkovich, Director of the OSU/Honda Partnership; Assistant Secretary of Labor for OSHA, Edwin Foulke; Dr. Delon Hull, Director of the NIOSH Office of Research and Technology Transfer; and Marsha Ryan, CEO of the Ohio Bureau of Workers' Compensation. Numerous safety and health representatives from auto manufacturers Honda, BMW, Toyota, and Mitsubishi also attended the grand opening celebration.



Dr. William Marras (right) cuts the ribbon at OSU's new Center for Occupational Health in Automotive Manufacturing

Structuring Flexibility, *continued from page 2*

The Good

Communication is required in order to safely transfer responsibility and authority for patient care during a handoff. Standardization reduces the cost of communication because: 1) The "rules" for interaction do not need to be negotiated (including the function, process, content, timing, and who is directly or indirectly included in the conversation); 2) No information on a topic (usually) implies that there is nothing worthy of mention on that topic; and 3) Information can be conveyed more efficiently and with higher reliability.

Perhaps more importantly, the process of standardization provides a window of opportunity to restructure how work is normatively conducted. Technically, a new anchor for normative behavior is set using the "anchor and adjust" strategy. The "adjust" term emphasizes the need for flexibility within the structure in order to tailor the plan to a specific context, support exception handling for non-routine cases, and enable adaptation to feedback about priorities when making trade-offs.

As many have observed, healthcare is a rapidly moving target given anticipated shifts in demographics, costs, technology, international competition, and the role of patients in managing their own care. Room for change to new anchors needs to be built into standards. Based on experiences in other domains, improvements in interdisciplinary coordination might be a key leverage point in radically improving healthcare delivery. Redesigning handoff processes could be a first step in a wedge of activity to improve coordination. Several organizations are already experimenting with new coordination models, including enabling shared decision making with non-physicians, instituting collaborative cross-checking to increase system resilience, including across authority gradients, using information technology to make work more observable to team members, and increasing access to specialized off-site expertise via telemedicine (e.g., the electronic Intensive Care Unit).

The Bad

A primary focus for patient handoff standardization has been ordering the content of the verbal update. Unfortunately, with the possible exception of nuclear submarine handovers, no HRO has yet been found to use a structured verbal update during a handover transition. In addition, data elements are notably absent during handover updates. Most likely, this is explained by the use of "most important first" as an ordering heuristic for topics in the verbal update. In addition, space shuttle mission controllers are reportedly trained to "efficiently communicate a bottom line and details when asked." Under data overload conditions where a massive amount of data is theoretically available but pragmatically impossible to review, the verbal update is used to help the incoming practitioner quickly get a "story" of the situation (the technical terms for the macrocognitive functions supported by a handover update are problem recognition, analysis, sensemaking, and planning), which is not easily conveyed in a structured (checklist) format. Finally, ordering by "most important first" reduces the likelihood that interruptions will occur prior to finishing the verbal update. If content ordering becomes the primary focus during standardization efforts, it is possible that exchanging

paperwork will begin to substitute for verbal updates since that will ensure that information is reliably ordered in the desired way and/or "covert" verbal updates will occur that highlight the most important, informative aspects in a checklist.

Another recommendation for patient handoffs has been the inclusion of readbacks. Although readbacks are used prevalently for specific purposes such as verifying the correct receipt of a planned altitude change, they have never been observed during HRO handovers. One explanation is that, even with readbacks, verbal communications are more prone to erroneous information exchanges than written communication. Likely to meet the same intent as readbacks, written logs or report sheets are recommended for handovers in process operations, and we observed them to be routinely used prior to and/or following handover updates in most HROs. In some settings, including space shuttle mission control, logs contained a short summary that was written explicitly to support the handover process. Since it is hard to know what the equivalent of a "log" is in most healthcare settings, the prediction is that new paperwork will be created that will capture information into a written format using a readback that will then be exchanged during handoffs without an additional readback.

The Ugly

The percentage of adverse events attributed to "communication" is suspiciously similar to "human error." Just as the label "human error" has been remarkably unproductive in improving patient safety, the label "communication" is not likely to provide much traction. If history is repeated, then the primary benefit of standardizing handoffs will be a new way to blame "sharp end" providers for failing to communicate critical information during the course of care. In the ugliest situation, idealized standards will be written that exclusively emphasize "safety" as an isolated goal. After-the-fact investigations will point to deviation from the standard as the main contributor to an undesired outcome, ignoring that trade-off decisions were made without the benefit of hindsight knowledge, that local actors always need to tailor plans of distant supervisors to a local situation, and that people adapt over time to feedback on how to trade off competing goals such as safety, productivity, profitability, satisfaction, and quality of work life.

As we strive to steer clear of the ugly, one more lesson for designing structured, yet flexible, standards might be gleaned from space shuttle mission control. During the busy, anomalous STS-76 mission, several space shuttle mission controllers were observed to work overtime to update a policy regarding landing after detection of an Auxiliary Power Unit (APU) leak. The original policy was to land as soon as possible since the loss of another APU would make it difficult to land safely. A decision was made to keep to the original schedule because: 1) No additional risk was believed to be incurred since APUs were not used while in space; and 2) Even a leaking APU might have some capability in an emergency landing. By officially updating the policy during the mission, the controllers were helping to verify that the decision makers felt sufficiently comfortable with the trade-offs that were being made to repeatedly make the same decision in future missions.

