Institute for Ergonomics

Year in Review: Research
2009 - 2010
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Institute for Ergonomics
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A Message from the Institute's Executive Directors

The Institute for Ergonomics is now well into its second decade of operation, and its members continue to make remarkable advances across many areas within human factors/ergonomics.

To attain an optimal level of human performance, one needs to understand the complex interactions that occur between the mind and the body. To do this, we here at the Institute use a systems approach to integrate principles of both cognitive and physical ergonomics to our research endeavors. This perspective helps us to generate significant advances that are impacting people in their everyday lives. Many of these are highlighted in this Review, which include:

- Improving design & management of the air traffic control system;
- Creating methods for surgeons to accurately conduct “virtual surgery” in patients with low back pain;
- Developing practical techniques for caregivers to safely and easily assist with the healthcare needs of their loved ones;
- Increasing our understanding of teamwork and its cognitive demands;
- Balancing new sensor and robot technologies with advanced decision-making concepts to support Army missions; and
- Assessing methods to more safely integrate new technology into the design of automotive assembly tasks.

From these efforts, our ergonomics research continues to be published across a wide range of well-respected scientific journals and conferences. Recently, several have received accolades, including “Best Paper” at both the 2008 Air Traffic Control Association meeting and the 2008 International Conference on Information Systems for Crisis Response & Management, as well as the “GE Healthcare Excellence” award at the 2008 Society of Diagnostic Medical Sonography conference.

Institute members have been recognized recently for their achievements both within the University and nationally. Local awards include the 2008 Lumley Research Award, given by Ohio State’s College of Engineering. Nationally, Institute members have been given a 2009 Medallion Award from the Air Traffic Control Association and been elected to the prestigious National Academy of Engineering (one of the four National Academies organizations). Finally, the Institute is represented through elected leadership positions in the Human Factors and Ergonomics Society.

As summarized in this Review, our interdisciplinary research approach has enabled the Institute to obtain a substantial amount of funding that makes these contributions to human factors/ergonomics possible. For the 2009/2010 fiscal years, active Institute contracts totaled more than $22 million.

Our proudest achievement, however, is the opportunities these projects have given our students. They have been involved in numerous highly respected research efforts, allowing them to broaden their perspectives beyond the traditional studies in physical or in cognitive ergonomics alone. Our multi-disciplinary educational program has resulted in graduates obtaining faculty positions at some of the finest universities in the U.S., as well as research and development careers in many respected companies.

The Institute continues to grow, and we are excited about future opportunities and research avenues. We believe that research by Institute members will continue to contribute to our knowledge of ergonomics and lead the country by developing new insights. This is an exciting time to work in human factors/ergonomics, and we here at the Institute for Ergonomics welcome this opportunity to share our accomplishments with you and to encourage future collaborations.

Philip J. Smith
Professor, Integrated Systems
Executive Director
Institute for Ergonomics
Co-Director
Cognitive Systems Engineering Laboratory

W. S. Marras
Honda Professor, Integrated Systems
Executive Director
Institute for Ergonomics
Director, Biodynamics Laboratory
Director, Center for Occupational Health in Automotive Mfg (COHAM)

A Message from the Institute’s Program Director

As our latest Review shows, members of our Institute continue to be very active in ergonomics-related research, even during these difficult economic times. In addition to research, our outreach efforts have extended to ergonomics training courses (both at the University and on-site) and to technical consulting assistance to companies and organizations nationwide.

A primary goal of Institute members has always been information transfer. This was no exception in the 2009 fiscal year, as we provided comprehensive ergonomics training to approximately 60 business professionals from around the country, as well as ergonomics awareness training to more than 2,000 production employees.

Our consulting projects have been quite diverse as well. Over the past year, we provided technical assistance to the airline industry and automotive parts suppliers, in addition to other manufacturers and food processing companies. We also have given guidance with office ergonomics issues to numerous organizations. For each of these projects, our objectives have remained the same — to reduce employee injuries at work and the costs associated with them.

As the nation deals with a global economic crisis, many companies have seen that ergonomics improvements can help to increase employee safety, company productivity and competitiveness, and their bottom line.

W. Gary Allread
Program Director, Institute for Ergonomics

Institute for Ergonomics, The Ohio State University
Year in Review: Research: 2009 - 2010
Introduction

2009 - 2010 Year in Review: Research

The Institute for Ergonomics, located on main campus of The Ohio State University, is dedicated to ensuring the design of safe, effective work environments and consumer products. This requires knowledge about the physical and cognitive capabilities of people, as well as experience on how human performance is affected by the use of different support technologies, tools and work practices.

Ohio State has a long tradition of conducting high-quality human factors and ergonomics research, which emphasizes a systems approach to design. To achieve this, the Institute draws upon the multidisciplinary expertise of members—faculty, staff, and students—from a variety of backgrounds. These include industrial & systems engineering, computer science, cognitive engineering, industrial design, psychology, statistics, education, physiology, biomedical engineering, public health, and medicine. This interdisciplinary approach is applied to the Institute’s wide range of activities, which includes education, research, and technical consultation.

This publication summarizes the recent activities of Institute members for the fiscal year 2009 - 2010. Here, you can read descriptions of 30 active research projects that were funded in this time period. You also can learn about the range of technical assistance projects and ergonomics training programs taking place as well.

There has been a substantial amount of funding generated for The Ohio State University by Institute members. These 30 active research projects total more than $22 million over their funding periods. The distribution of this funding income, across nine human factors/ergonomics research categories, is shown here.

Institute personnel also provided ergonomics-related technical assistance services to businesses, organizations, and individuals outside the University. This generated nearly $175,000 in income earned through various industrial projects and training programs.

Please contact the Institute for more information about this Review or to obtain an electronic reprint. Our web site also contains useful resources, including issues of our newsletter, consulting services, graduate education opportunities, upcoming events, and more.

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Primary Members

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William S. Marras

Dr. William S. Marras is a professor in The Ohio State University's Department of Integrated Systems Engineering. He is Director of both the Biodynamics Laboratory (http://biodynamics.osu.edu/) and COHAM, the Center for Occupational Health in Automotive Manufacturing or COHAM (http://coham.osu.edu/). Dr. Marras also serves as an Executive Director of the Institute for Ergonomics and holds the Honda Endowed Chair in Ergonomics. Professor Marras holds adjunct appointments in the OSU Departments of Orthopaedic Surgery, Physical Medicine, and Biomedical Engineering. His research applies quantitative engineering techniques to occupational surveillance, laboratory studies, and mathematical modeling, to explore the occupational causality of low back pain and techniques to enhance the clinical assessment and treatment of low back pain. Dr. Marras' findings have been published in over 185 peer reviewed journal articles and numerous book chapters. He serves as Editor-in-Chief for Human Factors and is Deputy Editor for the Spine. Dr. Marras is also the current chair of the National Academy of Science's (National Research Council) committee on Human-Systems Integration.

Dr. Marras has been elected to the National Academy of Engineering and has received numerous honors including an honorary Doctor of Science from the University of Waterloo for his work on the biomechanics of low back disorders. He is a fellow of the American Institute of Medical and Biological Engineers, the Human Factors & Ergonomics Society, the International Ergonomics Association, and the Ergonomics Society. His recently published a book, The Working Back: A Systems View, has received widespread recognition. Contact Information. Phone: 614-292-6670; Email: marras.1@osu.edu; Website: http://ise.osu.edu/biosketch_WMarras.cfm.

Philip J. Smith

Dr. Philip Smith is a Professor in the Integrated Systems Engineering and Biomedical Engineering Departments at OSU. He also is an Executive Director of the Institute for Ergonomics and Co-Director of the Cognitive Systems Engineering Lab. Phil teaches courses in the areas of cognitive systems engineering, artificial intelligence, human-computer interaction & the design of cooperative problem-solving systems, intelligent information retrieval systems, and intelligent tutoring systems. He has completed extensive research focusing on distributed work in the air traffic management system, focusing on traffic flow management, flight operations control and airport surface management. He is a member of the NextGen Airspace Navigation Systems Working Group, as well as a member of the Flow Evaluation and Airport Surface Management Teams for the FAA's Collaborative Decision Making Program.

Dr. Smith is a Fellow of the Human Factors and Ergonomics Society and a member of the National Research Council Committee on Human-Systems Integration. He also was a recipient of the 2009 Medallion Award from the Air Traffic Control Association. Contact Information. Phone: 614-292-4120; Email: smith.131@osu.edu; Website: www.iwse.osu.edu/ISEFaculty/smith/index.htm.

(continued on page 5)
Primary Members

W. Gary Allread
As Program Director for the Institute for Ergonomics at The Ohio State University, Dr. Allread manages and conducts ergonomics research and educational programs. He also provides training and ergonomic technical assistance to clients, which focuses on the prevention of injuries and musculoskeletal disorders across a wide variety of occupational work settings.

Gary has authored peer-reviewed research articles on various ergonomics topics and also has implemented ergonomics programs in several companies. He received his PhD in Industrial & Systems Engineering, with an emphasis on industrial ergonomics and biomechanics and is also a Certified Professional Ergonomist.

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Charles E. Billings
Dr. Charles Billings is a Research Scientist with OSU’s Cognitive Systems Engineering Laboratory. He has a Doctor of Medicine degree as well as graduate training in aviation and occupational medicine. He has had a long and distinguished career as a physician, flight surgeon and teacher. Before his retirement, Charles was Chief Scientist at the NASA Ames Research Center.


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Sue A. Ferguson
Dr. Sue Ferguson is a Senior Research Associate/Engineer with the Institute and the Biodynamics Laboratory. She received her PhD from OSU in 1998, specializing in biomechanics and rehabilitation. Sue studies occupationally related low back injuries, risk factors of initial and recurrent episodes, recovery process, and biomechanical effects of treatment.

Dr. Ferguson has published more than 20 articles in refereed journals and was one of several researchers receiving the Liberty Mutual Prize for innovative solutions to a world-wide injury problem. She also is incoming chair of the Human Factors & Ergonomics Society’s Industrial Ergonomics Technical Group.

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Richard J. Jagacinski
A professor in the Department of Psychology at Ohio State, Dr. Jagacinski has numerous research interests, including perceptual-motor coordination, human factors, aging, and decision making in dynamic contexts.

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Rich’s research investigates the dynamic structure of skilled performance. This includes behavioral stability and adaptivity. In 2003, he co-authored (with Dr. John Flach) the book, Control Theory for Humans: Quantitative Approaches to Modeling Performance (Erlbaum). He has recently collaborated with Dr. Steve Lavender and Tae Hoon Kim on the analysis of upper body - lower body coordination in the golf swing.

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Gregory Knapik

Greg is a Senior Research Associate/Engineer with the OSU Biodynamics Lab. He has a Masters degree in Mechanical Engineering from OSU. Greg’s research focuses on advanced biomechanical model development, applied ergonomics, and biomechanical studies. Greg currently directs a team developing advanced computational spine models for patient-specific surgical simulations.

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Steven A. Lavender

Dr. Lavender holds joint appointments in the Departments of Integrated Systems Engineering and Orthopaedics at Ohio State.

Steve directs the OSU Orthopaedic Ergonomics Lab (www.ortho.ohio-state.edu/research/ergonomics/index.htm). Here, he studies the musculoskeletal system’s response to work activities and potential workplace interventions, with the goal of improving the physical interaction between employees, their work, and the working environment.

Steve is a member of the Human Factors and Ergonomics Society, the American Industrial Hygiene Association, the Orthopaedic Research Society, the International Society for the Study of the Lumbar Spine, and the American Society of Biomechanics. He is also a Certified Professional Ergonomist.

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Candi C. McCain

Candi is the Fiscal Officer and Research Administrator for the Department of Integrated Systems Engineering. She also is an Administrative Associate with the Institute. She is responsible for fiscal operations, proposal preparation, and other organization duties.

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Ehud Mendel

Dr. Mendel is a professor of Neurosurgery at the OSU Medical Center and the Clinical Director of Ohio State’s Biodynamics Lab.

Ehud’s research focus is on the physiologic forces that impact...
spinal health and methods to optimize surgical therapy of spinal disorders. His clinical interests include minimally invasive spine surgery, surgery for primary and metastatic spine and brain tumors, and the application of local delivery technologies to the treatment of brain and spine tumors.

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Emily S. Patterson

Dr. Patterson is a Research Scientist at the Institute. Her research spans a wide variety of projects applying human factors research to improve joint cognitive system performance in complex, socio-technical settings, including healthcare, military, intelligence analysis, space shuttle mission control, emergency response, and emergency call centers.

Emily’s current work looks at issues in human-human technology interaction in complex systems, primarily in medical Informatics for patient safety, handover communications to transfer authority, resilience to human error, and rigor in information analysis.

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Peter A. Schabo

Mr. Pete Schabo is a Research Associate Engineer with Ohio State’s Biodynamics Laboratory and manager of the Center for Occupational Health in Automotive Manufacturing.

Pete has 26 years of experience in plant and project engineering, conducting ergonomic assessments and developing ergonomics designs and upgrades. He also led project management and development in the maintenance of industrial engineering systems.

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Carolyn M. Sommerich

Dr. Sommerich’s research focuses on ergonomics issues affecting workers in industrial, construction, and service sectors, students’ use of computers, occupational biomechanics, work-related musculoskeletal disorders, electromyography, biomechanical modeling, universal design, and intervention research.

Carolyn is the author of papers on a diverse range of ergonomics issues, including work-related MSDs of the shoulder, assessment of carpal tunnel pressure during keyboarding, development of an animal model of use-related carpal tunnel syndrome, and changes in patterns of trunk muscle activity in response to lifting task requirements, and ergonomic aspects of high school students’ use of tablet PCs.

A Certified Professional Ergonomist, Dr. Sommerich is also a member of the Ergonomics Society, the Human Factors and Ergonomics Society, the American Industrial Hygiene Association, the Institute of Industrial Engineers, the American Society of Safety Engineers, and the American Society of Biomechanics. She also serves as the faculty advisor to the student chapter of HFES.

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Primary Members

Dave studies how human and team cognition contribute to success and failure in complex, high-risk systems. His expertise was initially applied following the 1979 Three Mile Island accident in nuclear power. More recently, Dr. Woods has examined such diverse issues as coordination breakdowns between people and automation in aviation accidents and the national debates on patient safety.

Among Dr. Woods’ research interests are the foundations of cognitive systems engineering, cognitive factors behind human error, resilience engineering and management, data overload, team work in anomaly response, and how complex systems fail.

Dave is a Past President of the Human Factors and Ergonomics Society and was on the editorial board of that organization’s journal, Human Factors. He also has served on a National Academy of Engineering/Institute of Medicine study panel and on a National Research Council panel on research to define the future of the national air transportation system.

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John R. Wilkins, III

Dr. Wilkins is a professor of epidemiology in Ohio State’s College of Public Health—Division of Epidemiology and Biostatistics. He also serves as an Adjunct Professor in the College’s Division of Environmental Health Sciences.

Jay is a member of the Society for Epidemiologic Research, the American Public Health Association, the International Society for Environmental Epidemiology, the International Society of Exposure Analysis, as well as the American College of Epidemiology.

Most recently, Dr. Wilkin’s research has focused on agricultural safety and health, the prevention of injuries to youth working on farms, and noise exposures to farm families.

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David D. Woods

Dr. Woods is a Professor in OSU’s Department of Integrated Systems Engineering and Co-Director of the Cognitive Systems Engineering Laboratory (http://csel.eng.ohio-state.edu/).
Awards & Recognitions Given to Members

Emily S. Patterson received a 2008 Lumley Research Award from OSU’s College of Engineering. This award recognizes the contributions of College faculty and staff who have shown success in pursuing new knowledge of a fundamental or applied nature. It also includes a cash prize of $1,500.

A study of Regional Air Traffic Flow Management, written by Philip J. Smith and co-authors Pratic Jha and Michael Balint (Lockheed Martin Transportation & Security Solutions) and Ian Crook (ISA Software) was named “Best Paper” at the 2008 Annual Meeting of the Air Traffic Control Association, held in Washington DC.

In October 2008, Carolyn M. Sommerich and Kevin Evans (OSU School of Allied Medical Professions) received a GE Healthcare Excellence in Sonography Award, based on their proposal, Utilizing a HCU System to Investigate Ergonomic Injury Among Autoworkers. Given by the Society of Diagnostic Medical Sonography, this $2,500 award will foster continuing education by the team and graduate students, to further the scientific investigation of imaging ergonomic injuries using ultrasound.

At the September 2008 Annual Meeting of the Human Factors and Ergonomics Society, two Institute members were approved to be part of the 2008-2009 HFES Domain and Committee Leadership. Philip J. Smith was named the Meetings Domain Leader. William S. Marras was named the IEA Representatives Committee Chair of the Outreach Domain.

In February 2009, William S. Marras was elected to the National Academy of Engineering. The NAE 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. It is one of four organizations that comprise the National Academies.

Membership to the NAE is one of the highest professional distinctions an engineer can receive. It honors those who made outstanding contributions to “engineering research, practice, or education, including 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.”

Dr. Marras was acknowledged specifically for his development of methods and models used to control costs and injuries associated with manual work in industry. Past or current members of the Academy include: Bill Gates (Microsoft); Lillian Gilbreth (a pioneer in industrial engineering); Steven Jobs (Apple); and Larry Page (Google).

Philip J. Smith was awarded the 2009 David J. Hurley Memorial Award for Aviation Traffic Management. This Medallion Award is presented to an individual working in the field of Aviation Traffic Management who has made an outstanding contribution in the area of Air Traffic Control collaborative decision making, balancing air traffic demand and capacity, or maximizing airspace and airport use, which has added to the quality, efficiency and/or safety of the Global Airspace System.

William S. 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.
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Dealing with uncertainties:
◊ Using alternative technologies to collect and process data to develop forecasts;
◊ Using alternative technologies to help identify and evaluate different strategies to deal with uncertainty (cognitive compatibility);
◊ Providing effective information access and display;
◊ Using distributed work solutions to reduce cognitive complexity;
◊ Avoiding over-constrained solutions; and
◊ Supporting strategies and tactics that enable effective adaptation.

Incorporating effective safety nets:
◊ Responding to different contributing causes:
  * Brittle technologies;
  * Human error; and
  * Unanticipated scenarios.
◊ Considering different classes of solutions:
  * Technological;
  * Human-centered; and
  * System-level solutions.

Designing effective roles and responsibilities for automation and people:
◊ Human as monitor;
◊ Learning and maintaining skills;
◊ Automation as backup for automation; and
◊ Human adaptation.

Supporting communication:
◊ Information overload; and
◊ Digital vs. voice.

Integrating of HF in the design process.

Designing organizations, work teams, individual job functions and physical facilities.

Selecting the best form of coordination:
◊ Management by directive;
◊ Management by permission;
◊ Management by exception; and
◊ Interactive collaboration.

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The goal of this project is to explore critical human factors issues in Collaborative Air Traffic Management, focusing on the important issues concerned with an integrated approach to the management of the airport surface and airspace. This research includes ethnographic studies at airline dispatch and ramp control facilities, as well as at FAA airport and en-route air traffic control facilities. It also includes the design and evaluation of new operational concepts and decision support tools to improve airport and airspace management, with an emphasis on the human factors issues that arise in the design and implementation of such new concepts.

The management of the National Airspace involves planning by both the flight operators and the FAA, in order to coordinate performance at several different levels, including individual aircraft, the fleets for different airlines and the flow of the thousands of aircraft through the airspace. This involves a complex interaction of planning and re-planning, which is currently performed by many different participants, with different priorities, using different tools, with access to different information and without full knowledge and consideration of each other’s needs and priorities. This task is made even more complex by the need to rapidly reconfigure the airspace and existing plans to compensate for weather, airspace availability, and facility unavailability. When this is done inefficiently, the result is delay and a failure to meet the needs of the flight operators. It can also have environmental impacts.

The mission of AT Ohio is to help Ohioans with disabilities learn about or acquire assistive technology. Assistive Technology includes devices, equipment, or services that help individuals with disabilities to function independently at work, home, or school.

The AT Ohio staff offers several programs and services to achieve our goal. This includes monitoring current legislative activity that affects persons with disabilities, as well as educating legislators about the needs and concerns of citizens who have disabilities.
Students will: learn foreign languages; better appreciate social, cultural, and technological differences; and become educated in differentiated contexts. When the project ends, students will have the capability to work in multi-national teams and apply a human-centered approach to systems design within the global economy.

It is believed that this project will be able to serve as a model for student exchange programs in other areas and with other countries. Publicizing its successes can encourage other engineering programs to globalize as well. This program not only encourages future international research collaborations, but it also allows students to keep pace with classmates, since they earn credits toward graduation.

PROJECT 2
Title: International Research Experience for Students (IRES) Collaborative Research: US-Brazil Cognitive Systems Engineering Program
Principal Investigators: David D. Woods, Clark Mount-Campbell (OSU Integrated Systems Engineering)
Funding Source: National Science Foundation, Office of International Science & Engineering
Funding Period: 09/15/06 - 08/31/10
Award Amount: $75,000
Description: This collaborative project expands upon an international pilot program of student exchange with Brazilian collaborators Dr. Jose Orlando Gomes (Federal U. of Rio de Janeiro) and Dr. Lia Buarque (Federal U. of Rio Grande do Sul). This project’s goal is to have undergraduate students develop an understanding of human factors engineering from a global perspective. Our approach is to use interdisciplinary teams to combine the use of Cognitive Task Analysis methods (to define challenges in conducting inferential analysis under data overload conditions) with design techniques (such as storyboarding) to develop innovative directions for soft-

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Research

Education Research

ware and training solutions. Through these activities, graduate and undergraduate students are cross-trained in Cognitive Systems Engineering & Design.

Research is conducted on five cross-cutting themes, to explore innovative solutions to intelligence analysts working under data overload conditions:

1. Integrated end-to-end workflow through all analytic functions by automating “bookkeeping” and supporting iterative analysis;
2. “Actionable” intelligence by representing the rigor of an analysis process to a decision maker (see figure below);
3. Finding critical data via emergent collaboration techniques;
4. Breaking “fixation” by considering multiple perspectives on data interpretation; and
5. Supporting virtual collaboration with open workspaces.

Healthcare Research

PROJECT 1
Title: A Pilot Study of Musculoskeletal Health and Disorders in Informal Caregivers Who Care for Adults with Physical Disabilities
Principal Investigators: Amy R. Darragh (OSU School of Allied Medical Professions), Carolyn M. Sommerich, Steven A. Lavender
Funding Source: The Ohio State University Medical Center, Center for Clinical & Translational Science
Funding Period: 04/01/09 - 03/31/10
Award Amount: $30,000
Description: The long term goal of this research is to develop innovative and practical ergonomic interventions to reduce the physical demands and related musculoskeletal conditions associated with informal (non-paid, familial) care-giving in the home.

Previous studies have focused on psychological stress associated with family care-giving, yet the effects of the physical burden of care-giving on the musculoskeletal health of family caregivers are understudied. However, it is widely known that high rates of work-related musculoskeletal disorders occur among paid home health care workers, as well as nurses and nursing aides in nursing homes and hospitals.

In general, patient handling is a known risk factor for musculoskeletal injury in working populations. Yet, little is known about the extent and burden on the musculoskeletal systems of informal caregivers who care for adults with physical disabilities. Musculoskeletal symptoms and disorders can lead to a cascade of major lifestyle changes for both patients and their family caregivers and, as such, could represent a major public health problem.

PROJECT 2
Title: A Study of Public Health Records and Coordination of Distributed Care in Emergency Medical Systems
Principal Investigators: David D. Woods, Sharon Schweikhart (OSU College of Public Health), Michael Smith (OSU Cognitive Systems Eng. Lab)
Funding Source: Google
Award Amount: $75,000
Description: 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.
# Research

## Information Processing Research

<table>
<thead>
<tr>
<th>PROJECT 1</th>
<th>Funding Period: 05/23/06 - 01/01/10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Title:</td>
<td>Multi-Level, Active Attention Surveillance</td>
</tr>
<tr>
<td>Principal Investigator:</td>
<td>David D. Woods</td>
</tr>
<tr>
<td>Funding Source:</td>
<td>National Science Foundation, Division of Information, Robotics, &amp; Intelligent Systems</td>
</tr>
<tr>
<td>Funding Period:</td>
<td>10/01/04 - 09/30/08</td>
</tr>
<tr>
<td>Award Amount:</td>
<td>$1,223,890</td>
</tr>
<tr>
<td>Description:</td>
<td>This research (part of the NSF’s Information Technology Research program and priority on national and homeland security) seeks to advance security surveillance monitoring, by introducing event-based reasoning. This uses a formal event-discovery protocol, aimed to uncover event categories and the temporal structure of events. While the methodology can be applied to a wide range of domains, this work is grounded in a campus security and surveillance paradigm. This research integrates the cognitive science, geography, and computer science disciplines, in an effort to create a paradigmatic shift in the way that surveillance systems are viewed and developed. The anticipated result is for surveillance information to be more meaningful, the surveillance systems more focused, and the cognitive skills of the operators more efficiently used.</td>
</tr>
</tbody>
</table>

### PROJECT 2

| Title: | Macrocognitive Metrics and Measurement for the Commander's Predictive Environment |
| Principal Investigator: | Emily S. Patterson |
| Funding Source: | Air Force Research Laboratory |
| Description: | Macro cognition is conducted through joint activity of agents (human and/or machine) distributed in time and space with specialized knowledge and expertise and functionally distinct roles. Macrocognition research simultaneously considers interactions across three levels of analysis: 1) growth and decay of effective expertise and associated knowledge in individuals; 2) joint activity conducted in teams; and 3) factors that facilitate or inhibit organizational adaptability and resilience. The primary elements of research conducted in a macrocognition framework are: |

- Joint activity distributed over time and space;
- Coordinated to meet complex, dynamic demands;
- In an uncertain, event-driven environment with conflicting goals and high consequences for failure;
- Made possible by effective expertise in roles; (continued on page 16)
PROJECT 3
Title: Investigating Relationships among Macrocognitive Processes
Principal Investigators: Emily S. Patterson, David D. Woods
Funding Source: Office of Naval Research
Funding Period: 04/01/08 - 03/31/11
Award Amount: $450,000

Description: This project will increase our basic understanding of how teamwork is accomplished through a series of nested and interrelated macrocognitive subprocesses, through two phases. Phase I will examine interactions among team processes using a card-sorting technique. Phase II will explore how macrocognition in a small, ad hoc team is accomplished in an experiment where one-of-a-kind, collaborative problem-solving is needed to accomplish a planning task under competing demands for attention. New metrics will be explored to identify differences in team collaboration processes and strategies between teams in a face-to-face vs. a virtual condition.

Increasing the understanding of macrocognition will provide the necessary foundation for valid, reliable, coordinated cognitive research in team collaboration, which will, in turn, enable a common level of granularity when defining, measuring and discussing the cognitive processes in team collaboration.

- Shaped by organizational (blunt end) constraints; and
- That produces emergent phenomena (e.g., automation surprises, groupthink, mental simulations, escalation, knowledge shielding).

For all of the authors, the study of macrocognition involves conducting research either in an actual (naturalistic) work setting or else in a simulated (laboratory) setting, where complex problems are solved.

Common elements for these settings are:
- Complex environment;
- Embedded in a social context;
- Artifacts require technical expertise;
- Event-driven;
- Dynamic demands;
- Conflicting goals;
- Organizational constraints; and
- High consequences for failure.

This work takes existing macrocognition measures that were previously identified in a literature review and evaluates their applicability for a variety of settings in the US Air Force. Macrocognition is defined as the way we think in complex situations. With macrocognition, the scope of consideration is larger (more “macro”) than the traditional “microcognition” approach in terms of the number of people, time scale, conceptual perspective, and task complexity.
Low Back Disorder Research

Comfort may have a correlation to one’s physiology. Therefore, the aim of this study is to use biomechanical and physiological measures to obtain a more quantitative and objective view of seating comfort.

PROJECT 3
Title: Developing Methods for Low Back “Virtual Surgery”
Principal Investigators: William S. Marras, Ehud Mendel
Funding Source: Surgical implant company
Funding Period: 07/01/09 - 06/30/14
Award Amount: $5,800,000
Description:
The objective of this research is to integrate data from personalized MRI scans of one’s actual spine into the OSU-developed, biomechanically driven spine model. This will 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:
1. It will allow alternative surgical procedures to be tested on a computer, using a hybrid, biologically driven spine loading model. From this, the surgeon can determine which approach has the best chance for success. As an example, the surgeon could select from a number of alternative artificial discs, to choose that which best suits an individual’s specific spine and medical condition.
2. 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.
Military Planning Research

PROJECT 1
Title: Advanced Decision Architectures: Building Information Superiority in the Army through User-Centered Decision Support
Principal Investigators: David D. Woods, Philip J. Smith, B. Chandrasekaran (OSU Computer Science & Engineering), Wayne E. Carlson (OSU Industrial, Interior & Visual Communication Design), Nadine B. Sarter (University of Michigan), Emily S. Patterson, W. Gary Allread
Funding Source: Alion Science & Technology Corporation
Funding Period: 06/01/01 - 12/31/09
Award Amount: $545,769
Description: This research contains two sub-projects. The first involves Event Patterns as the Basic Unit of Communication in Human-Computer and Distributed Teams. Its objective is to understand and overcome challenges in making event patterns a basic building block of visualization and collaboration. The primary benefit is shifting the unit of display from data elements to events is a critical part of information fusion from dispersed sensor nets in surveillance and personnel detection, to control a mix of assets (soldiers, robots, UAVs), and for horizontal fusion of data to C2 commanders as they coordinate forces in complex and urban terrain. Examples include:

- The hierarchical event template structure integrates data from distributed sensors and algorithms to reveal events that deviate from typical behavior and threat behavior for surveillance and personnel detection.
- Point-of-view becomes a central variable in human-machine interaction, fusing information from and simplifying interaction with a suite of autonomous resources that monitor activities in a scene.
- Visual narrative organizes diverse data about mission plans and contingencies.

The second sub-project relates to Dimensions of Human-Robot Control. Its objective is to develop new forms of coordination between human and robotic resources.

The results can be used to help design future soldier-robot teams. The new concepts for remote perception are particularly relevant to Military Operations in Urban Terrain (MOUT), search and rescue, and using robots in confined spaces.

PROJECT 2
Title: Continuous Adaptive Planning in the U.S. Army
Principal Investigators: Philip J. Smith, David D. Woods
Funding Source: US Army Research Laboratory
Funding Period: 06/01/01 - 12/31/09
Award Amount: $1,600,026
Description: A critical challenge for the military is to support distributed work in the development of robust operations plans. Especially challenging is the continuous and dynamic planning that occurs during the execution phase of operations, when revisions of these plans may be required in the face of unanticipated events.

In previous research, we have identified alternative architectures for supporting such distributed work, as well as a number of different technologies and processes that can be used to significantly enhance continuous distributed planning in military operations.

The relevant technologies include:

- Tools to support rich synchronous and asynchronous communication;
- Advanced displays to support visualization;

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Military Planning Research

- Artificial intelligence approaches to support planning and plan adaptation.

Such tools support the development of a common frame of reference by all participating agents, thus allowing them to more effectively communicate and coordinate during continuous planning activities. They also use active decision support technologies to allow mixed initiative interactions among human and computer agents.

This work for the Army Research Laboratory asks:
- How do different architectures for distributing work affect performance on tasks involving initial plan development and continuous dynamic planning during the execution phase of operations?
- Can tools be developed to effectively support the distributed plan development and adaptation process?

Several observational studies have been conducted at Army Warfighter exercises. A prototype tool to support asynchronous communication of rich multimedia messages, the Collaborative Multimedia Recording Environment (C-MRE), has also been developed and tested, showing improvements in situational awareness in the communication of battle operations orders of 47-65%.

PROJECT 3
Title: Collaborative Automatic Target Recognition (CATR)
Principal Investigator: David D. Woods
Funding Source: Air Force Research Laboratory
Funding Period: 02/01/08 - 09/30/09
Award Amount: $210,000

PROJECT 4
Title: Integrating Diverse “Feeds” to Support Command Presence
Principal Investigators: B. Chandrasekaran (OSU Computer Science & Eng.), David D. Woods
Funding Source: Alion Science & Technology Corp
Funding Period: 06/01/01 - 12/31/09
Award Amount: $3,641,738
Description: The goal of this project is to balance the new powers of sensor and robotic technologies with advanced decision-making concepts in an integrated demonstration that supports Army missions in asymmetric and insurgency conflicts.

PROJECT 5
Title: Human-Robot Coordination and Advanced Decision Architecture
Principal Investigator: David D. Woods
Funding Source: Alion Science & Technology Corp
Funding Period: 06/01/01 - 12/31/09
Award Amount: $1,069,463

PROJECT 6
Title: Collaborative Autonomy: Coordinating Human Supervisory Control and Highly Capable Automata
Principal Investigator: David D. Woods
Funding Source: Alion Science & Technology Corp
Funding Period: 06/01/01 - 12/31/09
Award Amount: $1,086,918
Description: This project aims to provide a general architecture for Collaborative Autonomy that is grounded in principles of human-centered computing, decision-centered design, and basic cognitive engineering findings. This can be applied to human-automation teams for urban operations, first response to chemical, biological or radiological incidents, analysis under data overload, perimeter or area surveillance, and time-critical targeting.
## Physical Ergonomics Research, Applied

**PROJECT 1**

**Title:** Developing a Distribution Ergonomics Research Group  
**Principal Investigators:** Carolyn M. Sommerich, Steven A. Lavender  
**Funding Source:** Material Handling Industry of America  
**Funding Period:** 12/01/08 - 11/30/09  
**Award Amount:** $50,060

**Description:**

The long-term objective of this research is to improve Distribution Center (DC) operations, for the benefit of the companies and their employees.

The project has two specific aims:

1. To create a center for DC operations that develops and evaluates interventions (methods, tools, processes, etc.), which will allow DC employees to work more efficiently and safely. This will be done through research efforts focusing on ergonomic science and lean engineering.

2. To develop partnerships with regional DCs and material handling equipment manufacturers, to assist the DCs in achieving or maintaining their status as a “workplace of excellence.” Workplace challenges will be addressed, and opportunities for improvement will be discovered, using ergonomics research and lean engineering principles.

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### Musculoskeletal Disorder Research

**PROJECT 1**

**Title:** Macaque Model of Carpal Tunnel Syndrome: Effects of Force and Posture Exposures  
**Principal Investigators:** Carolyn M. Sommerich, Steven A. Lavender  
**Funding Source:** National Institute for Occupational Safety and Health  
**Funding Period:** 08/01/08 - 07/31/11  
**Award Amount:** $718,269

**Description:**

Long-term, the goal of this research is to reduce the occurrence of work-related carpal tunnel syndrome (CTS). Thus, we need to refine our understanding of how physical factors in the work environment (i.e., force, task duration, posture, and repetition) contribute to CTS development.

Ultimately we aim to:

1. Characterize associations between various physical exposures and CTS development due to chronic overuse;  
2. Understand injury and recovery cycles; and  
3. Learn the degree to which modification of physical exposures can prevent CTS development or recurrence.

We have previously developed and used a new non-human primate model to demonstrate a direct link between chronic overuse and onset of median mononeuropathy at the wrist (diagnosis closely associated with CTS). In this study, we will apply this novel approach to quantifying relationships between selected work exposures and disorder development.

The specific aims of this project are:

1. To quantify the combined effects of force and wrist posture in altering the expected development of CTS;  
2. To quantify the recovery period associated with a natural recovery from CTS; and  
3. To expand our database of maximum voluntary pinch exertion force of the macaque, which we use to predict and set experimental levels of force in our protocols.
The Distribution Ergonomics Research Center (DERC) will use participatory processes, involving DCs in and around Ohio and manufacturers of material handling equipment, to develop solutions to common ergonomic problems faced by the distribution industry. In this application, we are launching the DERC by using a five-stage participatory process. This will develop common intervention goals and a first set of ergonomic interventions focused on operations commonly found in participating DCs.

Stage 1. We are asking individuals who can represent our DC partners to participate in creativity-based focus groups. Common needs will be identified, and we will brainstorm and use other creative techniques for conceptualizing ergonomic solutions.

Stage 2. We will work with equipment manufacturers to begin developing solution concepts.

Stage 3. We will review the solution concepts with our stakeholder DC partners, adjusting the solution concepts as needed.

Stage 4. We will validate that these solution concepts reduce physical demands on employees, as well as assess the impact on system productivity, using the ergonomics laboratory facilities at The Ohio State University.

Stage 5. We will conduct implementation testing at selected industry sites, to assess usability issues and assess productivity measures.

Launching the DERC sets the stage for addressing ergonomics issues shared by distribution operations nationwide now and into the future.

PROJECT 2
Title: DC Torque Tool Assessment
Principal Investigators: Carolyn M. Sommerich, Anthony Luscher (OSU Mechanical Engineering)
Funding Source: Honda of America Manufacturing, Inc
Funding Period: 06/01/07 - 09/30/09
Award Amount: $276,805

Description:

The objective of this project is to develop a procedure and mechanism for testing DC torque tools. This will allow us to both predict the interaction between the tool, the task, and the employee, but also affect these relationships.

The project involves several stages, including:
1. A workplace survey to better understand how and where DC torque tools are used at various North American Honda production facilities;
2. The development, construction, and testing of a DC torque tool assessment rig, which can be used within Honda plants;
3. The development, construction, and testing of a device to measure the biomechanical properties placed on the operator during tool use;
4. The development and construction of a support stand used to simulate tool-task-operator work conditions in a laboratory setting; and
5. Developing data collection and modeling methods that relate output from simulation/tool assessment rig with output from human testing.

PROJECT 3
Title: A Comparison of the Dynamic, Physical Demands of Manual CPR with and CPR Performance using the LifeBelt™
Principal Investigator: Carolyn M. Sommerich
Funding Source: Deca-Medics, Inc.
Funding Period: 09/01/07 - 09/30/08
Award Amount: $12,875

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**Physical Ergonomics Research, Applied**

**Description:**

The objective of this study is to determine how physical demands differ when CPR is performed manually or with use of a LifeBelt™. Developed by Deca-Medics, Inc (www.decamedics.com), the aim of this new device is to make it easier for anyone to perform high-quality CPR compressions in the event of cardiac arrest.

Subjects certified in CPR are being tested using a Laerdal manikin. Manikin data report the quality of chest compressions (i.e., percent of correct compressions, percent of incomplete releases, and the average depth of compression). Subjects are outfitted with heart rate and oxygen consumption monitors, to determine their physiological demands, and also are asked to report their (subjective) levels of physical exertion and body part discomfort.

**PROJECT 4**

**Title:** Designing Musculoskeletal Disorder Interventions for Imaging Technologists

**Principal Investigators:** Carolyn M. Sommerich, Kevin Evans (OSU School of Allied Medical Professions), Steven A. Lavender, Blaine Lilly (OSU Integrated Systems Engineering)

**Funding Source:** Centers for Disease Control & Prevention, National Institute for Occupational Safety and Health

**Funding Period:** 09/01/08 - 08/31/11

**Award Amount:** $772,822

**Description:**

The long term goal of this research study is to reduce the high incidence of work-related musculoskeletal disorders (MSDs) and physical discomfort experienced by imaging technologists (i-techs). I-techs provide imaging services in hospital and clinical settings.

MSDs are a significant problem for this group, who are exposed to occupational risk factors often associated with MSD development. Through a participatory design process, this study aims to develop useable interventions that reduce physical risk factor exposures and are acceptable to these employees.

The specific aims of this project are to:

- In conjunction with i-techs, develop design concepts aimed at equipment and work method interventions that address biomechanical and physiologic concerns associated with imaging and imaging-related tasks;
- Fabricate prototype equipment and/or work method training materials based on the design concepts;
- Validate, through controlled experimental studies, that the intervention concepts developed reduce the demands placed on i-techs. Interventions will be refined and re-tested as necessary, based on participant feedback and experimental results; and
- Implement and evaluate prototype interventions in the field, to obtain usability and acceptability feedback from i-techs performing normal jobs duties.

The participatory design process will recruit groups of i-techs from five subspecialties: vascular sonographers, cardiac sonographers, diagnostic sonographers, diagnostic radiology, and mammography. They will participate in the initial design focus groups, the review of fabricated interventions, and the controlled studies to biomechanically evaluate the newly developed interventions.

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This project addresses the occupational exposure by imaging technologists to MSD risk factors. The problem is of even greater significance to public health, given a shortage of i-techs and an increasing demand for scans, thus making the health status of the imaging technologists a critical factor in the availability of health care services.

PROJECT 5
Title: Ergonomics Assessment of a Super Chair: Phase I
Principal Investigator: William S. Marras
Funding Source: Honda of America Manufacturing, Inc
Funding Period: 08/01/07 - 08/31/08
Award Amount: $90,738
Description:
This objective of this project was to study the feasibility and possible benefits of a prototype chair on which Associates could sit while performing their jobs. The assembly tasks selected represented different horizontal and vertical work “zones” inside the vehicle.

Work postures and muscle activities of the back, shoulder, neck, and forearms were compared between the standard work method (reaching or getting into the vehicle to perform the task) and use of the chair to perform the task.

Preliminary results provided guidance on which work “zones” benefited most by use of a SuperChair (i.e., less loading on the body), as well as the chair’s design features that could be improved.

PROJECT 6
Title: Ergonomics Assessment of a Super Chair: Phase II
Principal Investigator: William S. Marras
Funding Source: Honda of America Manufacturing, Inc
Funding Period: 03/14/08 - 12/31/09
Award Amount: $224,654
Description:
This follow-on project serves two purposes:
1. To test an improved Super Chair design, which was modified based on findings from the preliminary study.
2. To determine which assembly task locations produce a statistically significant reduction in shoulder and low back loads when performed using a Super Chair.

A total of ten individuals are being tested—five experienced Honda Associates and five college students inexperienced with these processes.

The outcome of this effort will be definitive guidance as to which work zones best benefit from use of a SuperChair and which (if any) should be avoided.

PROJECT 7
Title: Evaluation of Rotate Body System for Automotive Assembly
Principal Investigator: William S. Marras
Funding Source: Honda of America Manufacturing, Inc
Funding Period: 05/01/06 - 07/31/09
Award Amount: $224,906
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**Physical Ergonomics Research, Applied**

**Description:**
This project’s primary goal is to determine how new technology—in this case, an overhead auto body carrier system—can best be used during assembly to reduce injury risk among employees.

Honda personnel determined where assembly processes could potentially benefit from this equipment:
1. Specific areas inside the vehicle;
2. Underneath the vehicle body; and
3. Within the engine compartment.

Work postures and muscle activities were recorded of the spine, shoulders, neck, and forearms as both experienced Honda Associates and inexperienced college students each performed representative assembly tasks within the three vehicle locations. The baseline condition simulated the current assembly process (no vehicle rotation). Subjects also repeated these tasks with the vehicle rotated between 15° and 90°, at 15° increments.

This study has demonstrated:
- The role that rotate body carriers can play in addressing ergonomics issues in automotive manufacturing;
- The types of assembly tasks that can most benefit from new and innovative technology; and
- The extent to which a rotated vehicle can impact work postures and muscle loading.

**PROJECT 8**

**Title:** Identification of Factors affecting EMS Workers’ Adoption of MSD Interventions

**Principal Investigator:** Steven A. Lavender

**Funding Source:** National Institutes of Health

**Funding Period:** 09/01/09 - 08/31/11

**Award Amount:** $415,000

**Description:**
This study aims to better understand research-to-practice issues involved with the adoption and sustained use of interventions geared to prevent musculoskeletal disorders in Emergency Medical Service personnel.

This project has three goals:
1. Use the *integrated technology acceptance model* and *task-technology fit model* to identify and quantify how much specific perceptual and attitudinal factors contribute to the adoption and sustained use of previously validated MSD interventions;
2. Measure the degree to which individuals who "champion" an intervention affect its adoption and use; and
3. Study the diffusion of two specific interventions within and between EMS organizations.

This will allow us to identify opportunities for secondary interventions aimed at facilitating the adoption and diffusion of validated interventions aimed to reduce MSDs.

**PROJECT 9**

**Title:** Development of Risk Exposure Limits for Automobile Assembly Tasks

**Principal Investigator:** William S. Marras

**Funding Source:** Honda of America Manufacturing, Inc

**Funding Period:** 11/01/09 - 10/31/09

**Award Amount:** $100,000

**Description:**
The aim of this project is to improve upon a previously developed ergonomics assessment tool that identifies shoulder injury risk among auto assembly workers.

To accomplish this, we will measure the amount of muscle fatigue that develops among Honda Associates as they perform repetitive assembly tasks across the range of shoulder postures used for current processes. This will allow us to pinpoint the specific activities responsible physically demanding shoulder use, which can be used to improve how these assembly processes are performed.
Technical Assistance Projects

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Industrial Assessments (selected)

Aircraft Seat Handling
This most-recent project with the company involves ergonomics assessments of airplane seat handling, particularly those that evaluate injury risk to the low back. Also included is the testing of feasible interventions aimed at reducing this type of risk.

When aircraft require full maintenance, rows of passenger seats are completely removed from the plane, taken to a shop for inspection and repair, and then replaced. The primary ergonomics issues include the weights of the seats, the need to maneuver them through small doors (especially on specific aircraft), and their repeated handling through the repair process.

Institute members are working with American’s safety & health personnel to develop a systems solution to these concerns. It involves: quantifying baseline physical demands and injury risk during all aspects of seat handling; using these data to brainstorm with employees about possible solutions; and then testing those having the most potential to impact risk.

Work Posture Assessments in Food Processing
A maker and bottler of salad dressing faced questions concerning the proper (seated or standing) postures of employees who worked along their assembly lines. Following a walkthrough of the production operations, recommendations specific to each workstation were provided to the company.

Guidelines also were given, so that company health & safety personnel could determine proper working postures for future assembly line operations.

Valve Manufacturing
In an effort to focus more on ergonomics issues, a company that produced valves, fittings, and tubes asked Institute members to conduct an ergonomics walk-through of their facility. This walk-through involved discussions with production employees, the taking of photographs and measurements of work processes, and preliminary risk assessments. A high-level report was developed and presented to company personnel, which identified the primary ergonomics issues that existed within the facility. These were accompanied by examples from throughout the plant. Recommendations also were given regarding directions the company should take to more fully introduce ergonomics solutions within the company.

Automotive Seat Assembly
The goal of this project was to determine the ergonomics issues involved with securing fabric to seat frames. This process was observed in two manufacturing facilities.

A review of these processes found that several workstation features were beneficial from an ergonomics perspective. These included height- and position-adjustable work platforms, devices to make the fabric more pliable, and reduced exposure to this repetitive process (through job rotation). However, several concerns were noted, including: the inherent design of clips used to fasten seats to their frames; a large amount of pinch gripping; and the wide range of (awkward) body postures to perform the task.

Both short- and long-term solutions to this process were recommended, as were suggestions for future courses of action.

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## Industrial Assessments (selected)

### Analysis of a Simple Method to Reduce Back Injuries, by “Working at the Right Height”

The National Institute for Occupational Safety and Health wished to know if an inexpensive and easy-to-use device could help reduce back injuries in the Retail Trade.

A bookstore was used as the test site. Experienced employees wore the Lumbar Motion Monitor as they shelved books using either an industry standard book cart or a powered cart (www.beyond-products.com). The aim of the powered cart was to allow work be done “at the right height” (near the waist), to reduce bending and stress on the low back.

Initial results have shown that using the powered cart reduced book-handling from a moderate injury risk level to low risk. Savings from fewer predicted back injuries when using this new device would pay back its cost in a short time period, demonstrating that a simple, relatively inexpensive way to raise MMH work to “the right height” could have large benefits in a retail trade environment.

### Office Assessments (selected)

#### Sign Language Interpreting during Video Relay Calls

Upper extremity cumulative trauma disorders are common among sign language interpreters. This is due to the rapid hand and arm movements required of this profession. Interpreters who work in the video relay business (serving to assist the deaf community with business and personal matters over the telephone) also interact with computers. This exposes them to additional ergonomics concerns.

The Institute continues to work with a company who provides this service. It has involved: reviewing the computer workstation equipment used by interpreters and recommending improvements; leading roundtable discussions to better understand and address the psychosocial and environment demands of the job; and providing go-forward plans to more fully integrate ergonomics throughout the company’s office.

#### Computer Workstation Evaluations at an Extension Office

Office employees experiencing physical discomfort were provided ergonomics evaluations of their computer and office workstations. Verbal recommendations were given, to improve the employees’ set-ups using existing equipment. Suggestions for equipment that could be purchased to further improve employees’ workspaces also were given.

#### Computer Work in a Health Management Office

The Institute conducted workstation evaluations of employees who processed paperwork for large portions of their workday. Following the ergonomics assessment, no-cost recommendations were given, to improve the employees’ set-ups using existing equipment. Suggestions for equipment that could be purchased to further improve employees’ workspaces also were given.

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*Images of Industry-Standard Cart and Powered Cart*

Institute for Ergonomics, The Ohio State University

Year in Review: Research: 2009 - 2010
Ergonomics Training for an Automotive Assembly Supplier

The Institute conducted an on-site ergonomics training course to an ergonomics team of safety and health personnel who worked for a parts supplier to a Japanese automaker.

This three-day course educated participants how to systematically implement ergonomics within their facility. It was customized through the use of photos and case studies, to show how important principles could be applied to work tasks the team was familiar with. The course:

- Demonstrated how extensive anthropometric differences can be across employees;
- Explained basic biomechanical principles and how they relate to various parts of the body exposed to cumulative trauma;
- Taught the use of various ergonomics assessment tools; and

Required attendees to conduct an unassisted ergonomics assessment in their facility, using their new knowledge about ergonomics.

Ergonomics in Call Centers

Employees in call centers often take high volumes of telephone or dispatch calls throughout their work day. This exposes them to physical and psychological stress. Distributors of furniture and equipment used in call centers asked to receive a one-day ergonomics training course that was geared specifically for this industry.

In the training, participants learned about the relationship between call center work and cumulative trauma. They also were informed how equipment can contribute to this trauma and how the equipment they provide customers helps ease (or, in some cases, adds to) call center job demands.

Ergonomics Awareness Training to Prevent Back and Shoulder Injuries

Approximately 2,000 production employees for a valve manufacturer received a one-hour awareness training. In groups of about 30, these individuals learned about the physical, individual, and psychosocial risk factors that relate to back and shoulder cumulative trauma. This ergonomics training overview was customized to the facility, so that the examples shown would be more readily understood by attendees.

- Bi-Annual Ergonomics Short Course

The Institute’s highly successful training course continues to be given each Spring and Autumn on Ohio State’s main campus in Columbus. Attended by health and safety professionals, managers, engineers, and others from around the world, this intensive, 3-½ course taught participants:

- How to systematically identify risk factors known to produce musculoskeletal disorders;
- Methods for not only reducing injuries but increasing work productivity; and
- How to use a variety of well-established ergonomics assessment tools.

Attendees learn about ergonomics principles through in-class lectures, demonstrations, and hands-on workshops. These are presented by several Institute members who share their individual expertise with the class.