

## Research to Practice to Research: Part 2 – An Academic’s Perspective

### Discussion Panel

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This is the second of two panels to discuss pathways and barriers in moving promising ergonomic concepts from research to practice and in moving important ergonomic problems from practice to research. The panelists are from a variety of industry sectors and academia. The session will start with a 5-minute introductory statement from each panelist; therefore, most of the session will be a discussion between panelists and the audience on the topic. On the research side there is difficulty in conducting good research capable of demonstrating a safety or productivity value for promising ergonomic interventions. Problems include poor access to workplaces to conduct the research, lack of funding, difficulty obtaining a control group, etc. Some practitioners believe that well-designed research is not necessary for industry to make decisions on adoption. On the industry side barriers to adopting promising ergonomic interventions include lack of convincing data, cost, anticipation of reduced productivity, poor usability, poor acknowledgement of a problem, and history/legacy (“we have always done it this way and the process works”). Likewise, practitioners may have difficulty convincing academics to study ergonomic problems that they face daily in the workplace and they may perceive that academics study concepts that have little value for industry. Barriers for academics to take on these important topics may be related to funding, lack of clear design related solutions, limited impact, and research on a topic that is too applied or related to a proprietary idea. The goal is to improve understanding of different perspectives and generate ideas for improving the process of research to practice to research (RtPtR).

### PERSPECTIVES FROM THE CONSTRUCTION INSURANCE INDUSTRY

James G. Borchardt, CPE, CSP, CRIS  
Principal/Managing Consultant  
Construction Ergonomics LLC  
Bettendorf, IA

Sang D. Choi, Ph.D., CPE, CSP  
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Recent research by Liberty Mutual finds the psychophysical capacity of today’s workers is about 69% of workers studied of the 1970 – 80s. Therefore, the set points or load constant (LC) of the NIOSH LE and its derivatives may need to be lowered. Professor Choi and Mr. Borchardt have begun promoting the concept of Ergonomic Action Level (EAL) where analysis and redesign of manual construction tasks begins at about 70% of the current LC. Such a shift suggests an increased need for mechanization, automation, modularization and prefabrication of manual construction tasks.

### RtPtR Challenges

NIOSH LE was designed for evaluating manual lifting/lowering tasks primarily performed indoors where the temperature and humidity is in a controlled, narrow range. Research is needed to evaluate complex MMH tasks beyond lifting and lowering, which are performed outdoors in a wide range of temperature and humidity.

### PERSPECTIVES FROM THE OIL AND GAS INDUSTRY

Hector Silva, MS  
Human Factors Engineering, Chevron  
El Segundo Refinery, Los Angeles

Mr. Silva and his colleagues have been studying human factors and human performance issues in the oil and gas industry,

### RtPtR Successes

As an American National Standards Institute (ANSI) A10 CSC member, Mr. Borchardt had the opportunity to contribute to the development of ANSI A10-40 *Reduction of Musculoskeletal Problems in Construction*, which passed in 2007 as the 1<sup>st</sup> nationally recognized voluntary standard for the construction industry.

An important element of using Snook’s Tables or NIOSH LE is being able to easily determine the weight of materials at the construction worksite. Ergonomic practitioners using a concept called the B Factor defined as density of construction materials per easy-to-measure units of volume allows weights of materials to be easily determined.

specifically in petrochemical refining. The focus of our efforts has been in improving emergency response training through effective use of simulation and feedback tools within the console operator population. One of the major projects we have conducted included the development of objective human performance metrics.

The project was initiated due to a need to expedite the process of producing expert console operators who work in this complex environment. Currently we know that the job of a console operator is becoming increasingly more critical. On one front there is the increased rate of retirement of expert individuals. On a different front is the increased use of imperfect automated systems to run refinery plants that take the operator out of the loop. Although emergency situations may have decreased in number, they have forced the console operators to be that much more effective when upsets do occur; for which they are less exposed to and thus have less experience to be effective with.

Due to the lack of prolific research done on this specific population in this domain, we decided to initially begin with task analyses of emergency situations. Through this we captured what “good” responses should look like, therefore providing the foundation to teach console operators the best practices. From these analyses we also extracted process variables that are directly related to human behaviors and performance. To ensure that these values were linked with human behavior, we conducted a research study that varied task load to induce potential changes in those variables. Having confirmed that, for the most part, we could trust these process variables as indicators of human performance, we have begun to develop a process for applying the results of the research as a form of feedback. Once completed, we would have the opportunity to study these feedback sessions in future research to show whether they expedite the acquirement of knowledge and skill required to successfully manage these events safely and efficiently.

#### **PERSPECTIVE FROM ACADEMIA: INTERVENTION DEVELOPMENT AND DEPLOYMENT IN LABOR-INTENSIVE AGRICULTURE**

Fadi Fathallah, PhD, CPE & Victor Duraj  
Agricultural Ergonomics Research Center,  
Department of Biological and Agricultural Engineering,  
University of California, Davis

In many agricultural commodities, farm work has not changed over the years, and still requires heavy and fatiguing physical labor resulting in a variety of reported musculoskeletal disorders (MSDs). This talk will demonstrate a variety of simple and complex interventions developed by our research group over the past two decades to help reduce the prevalence of MSDs among agricultural workers who perform labor-intensive jobs in the wine, grape and plant nursery industries. The talk will also include data from laboratory and field research studies, which highlight the potential effectiveness of

the interventions. Success stories of implementing and deploying some of these interventions will be shared, along with challenges faced in deploying other interventions, despite research data showing their potential effectiveness.

#### **PERSPECTIVES FROM THE OFFICE ERGONOMICS INDUSTRY: THE REVOLVING DOOR OF RESEARCH TO REALITY TO RESEARCH**

Michelle Robertson, PhD, CPE  
Center for Behavioral Science, Liberty Mutual Research  
Institute for Safety, MA

Several challenges exist when translating research results into real world application. Bridging applied field research with laboratory studies offers opportunities to cross-validate findings and identify new areas of investigation. Understanding the organizational culture when conducting field studies is critical. The impact of a defined organizational intervention is dependent on its context and content design. A series of field (Robertson, et al., 2008-2009) and laboratory (Robertson, et al., 2013) studies examined the effectiveness of several office ergonomics interventions. The findings from these field studies led to the study design and research hypotheses for a simulated call center extended lab investigation (Robertson, et al., 2013). Synthesizing these results has led to informing work safety and health practices to design and implement office ergonomics prevention programs in order to assess risk factors, reduce injuries and improve performance.

Liberty Mutual Research Institute for Safety has a unique unit, the Knowledge Translation Unit, which facilitates dialogue and exchange among Liberty Mutual Insurance customers and scientists. This enhances our research programs and promotes a broader application of research findings. The underlying philosophy is that the safety and health practices inform the science and the science informs the practice. These office ergonomics intervention tools and materials are designed specifically for integrating training with workspace flexible/adjustable design. They are being adopted and used by many of our Liberty Mutual customers through our Risk Control Services.

Some of the challenges we face in RtPtR (Research to Practice to Research) is the application of scientific field and lab studies. We can continuously learn, improve and understand the “how’s” and “why’s” of the effects of organizational workplace interventions on the safety and health of employees. In this panel discussion, Dr. Robertson, will present a synthesis of her office ergonomic findings, both field and lab, and draw conclusions of how each informs the science and practice in the real world. Also, challenges in conducting field research as well as balancing experimental design will be explored.

## **PERSPECTIVES FROM THE ARMY**

Donald Goddard, MS, LPT, CPE  
Ergonomist, Army Public Health Center,  
Aberdeen Proving Ground, MD

Research efforts designed to develop new ergonomics capabilities often require a tradeoff between faster-cheaper-better, where "better" involves devoting resources to improving the scientific rigor of the product. Striking a reasonable balance between costs, production speed and science is often encountered in applied research where stakeholders have an urgent need for a quick answer. A strategy for improving these decisions may be borrowed from the peer review process used by medical clinicians. Mr. Goddard will discuss techniques that may be used to improve communication and develop better products.

### ***Defining Requirements in terms of Customer Needs***

The first step to attain RtPtR success is to develop precise product specifications. This should include listing the features you, as the system designer, and stakeholders think the product will to accomplish its intended purpose. Products developed for a customer should incorporate opportunities for collaboration to ensure it will meet that customer's needs. Many products will be expected to interface with existing components in the organization. The functional requirements that the new product needs to meet in order to interface with the existing system should be identified. For example, many new products require information technology support. The needs of the host organization to either host applications or exchange data should be identified early in development. Functional requirements may entail different levels of complexity. Thus, some may be expressed by a simple statement; others may require more detailed descriptions.

### ***RtPtR Successes***

As an example, Mr. Goddard started a Small Business Innovation Research (SBIR) project several years ago that required a computer application be installed on computers in his organization. Coordination was initiated early in the development cycle to allow contractors and the information technology experts of the host organization to discuss the design and identify software design requirements. Since this computer application was primarily being designed to meet the needs of an internal customer, additional coordination was also accomplished to define the customer's needs and relay those to the contractor. A face-to-face meeting was held to allow the contractors to present their concepts for the project and receive feedback and clarification from the internal customer to tune the design to their needs.

### ***RtPtR Challenges***

US Army Public Health Center (USAPHC) Ergonomists are charged with the responsibility to serve the needs of a large community of customers. The size of the customer population makes it difficult to identify their problems and anticipate

products or strategies that can be used to better support them. For example, the lack of good communication makes it difficult to understand how to update USAPHC's Ergonomics course so that the training can improve customers' ergonomics capabilities.

The fluidity of the Army, where many personnel change jobs every two or three years also makes it more difficult to meet customers' needs. Several years ago Mr. Goddard was asked to develop a functional capacity evaluation to help define the rehabilitation needs of wounded warriors. The project was proceeding on schedule when, after 18 months, several members of the committee leading the effort were replaced and priorities were reassessed. This reassessment resulted in termination of the project.

Another common challenge faced when managing ergonomics projects involves decisions to designate valuable labor resources. With such a large customer population there are typically a large number of potential projects in the queue and limited staff available to support them. Decisions may be improved if some form a rubric were developed to evaluate projects, particularly when decisions involve tradeoffs between the quantity of resources invested in relation to the scientific quality of the project that would result.

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