Research to Practice to Research: Part 1 - A Practitioner's Perspective

Discussion Panel

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This is the first 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 AEROSPACE MANUFACTURING

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Advances in technology are critical for businesses to stay competitive in today's dynamic, global marketplace. This is especially true for manufacturing operations that rely on productivity gains and technical skills to offset competition from cheaper labor markets. In the context of ergonomics, technology improvements directly impact worker productivity by increasing efficiency and reducing waste associated with factors such as excessive takt time, quality problems and injury costs. Improvements can be in the form of hard technologies such as equipment and machines as well as advances in the state of the art in human biomechanical, physiological, and psychosocial sciences. Industry must rely on research to move these fields forward and drive innovation leading to continuous improvement and competitive advantage. Toward this end, partnering with research institutions can be very beneficial for businesses.

That said, transferring research findings into practice may be easier said than done, especially if the goals of each concern are out of sync. For instance, industry needs to continually innovate and invest in research to remain competitive, which drives focus on the near term outcomes and impact. Business calendars may not necessarily line up with academic calendars and this can cause tension. Also, parcelling research into theses and dissertations may arbitrarily constrain research from a company's perspective. Further complicating matters are difficulties associated with negotiating intellectual property rights and contract agreements. Who owns it if industry funds it? How can research findings be published without compromising sensitive company information? How about program/project management? What are the roles and responsibilities of principal investigators on both sides of a business and research relationship? Strong program and project management skills are also required to ensure clear pathways exist for transitioning technology from conceptual theories and ideas to application ready solutions that businesses demand. As part of this panel session, these issues and other lessons learned will be shared from an ergonomics in aerospace manufacturing perspective.

PERSPECTIVE FROM ACADEMIA: RTP IN CONSTRUCTION

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Over the past 12 years, the UC Ergonomics Laboratory developed two rigs for commercial drilling into concrete. The research and development was funded by the Center for Construction Research and Training (CPWR) and the National Institute for Occupational Safety and Health (NIOSH). Typical concrete drilling is done with a 6 to 25 lb hammer or rock drills and requires high hand forces and is associated with

musculoskeletal injuries to the arms, shoulders and back. The two rigs, one for overhead drilling and one for drilling in all directions (universal drill rig), were developed with feedback from commercial construction workers during extensive field testing. The final designs reduced biomechanical loads and had good productivity and usability characteristics (Rempel, et al., 2010; Rempel & Barr, 2015). The overhead rig was commercialized by Telpro Inc., in Grand Forks, North Dakota as the DrillRite™ Overhead Concrete Drill Press and sold in two models. The universal rig was commercialized by ErgoMek LLC, in Richmond, California as the DrillBoss™. The barriers to bringing these two ergonomic interventions to market will be discussed.

PERSPECTIVES FROM CONSULTING

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Sheree Gibson will discuss the need for effective, objective ergonomic models, which can both help us identify jobs/tasks where employees are at risk of musculoskeletal disorders and which will allow us to predict what the biggest contributors are. There is a particular lack of models for situations where employees rotate jobs or where jobs are non-cyclic. Other deficiencies are assessing risk to shoulders and lower extremities. With an aging population, injuries to these body parts become more prevalent.

PERSPECTIVES FROM THE MINING INDUSTRY

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Mining has long been recognized as one of the more physically-demanding sectors with significant exposures to risk factors for musculoskeletal disorders. Examples of tasks with these exposures include maintenance and repair work, housekeeping, and powered tool use. Although certain tasks can be characterized as repetitive, many of the exposures are not nearly as cyclical and routine as exposures found in other industry sectors. The variable nature of the work can be compounded by the changing workplace as mining progresses either underground or on the surface.

In spite of the ergonomics challenges mining presents, there have been many ergonomics successes in mining dating back close to 50 years with the work of the National Coal Board in the United Kingdom. In the United States, the former Bureau of Mines researched and now the National Institute for Occupational Safety and Health continues to research ergonomics applied to mining. Significant contributions have been made by academic and government researchers from Australia, Canada, and numerous other countries. While many of these contributions are founded in first principles of ergonomics, there are also many examples where the unique context of the problem has to be considered.

Two areas where difficulties arise when applying ergonomics research to mining are laboratory studies and assessment tools. Laboratory research has been fundamental to advancing our knowledge of how to design tasks, machines/equipment, tools, and workplaces to optimize safe and efficient job performance. The scientific method requires control and repetition of experimental treatments in order to understand the influence of independent measures on response variables. The exposure levels are also controlled as well, and influenced by practical and ethical considerations. For example, there are mining workplaces where 100-lb. bags of product are handled during production or preparation for shipment (e.g. palletizing). Other examples include handling heavy machine components, such as pumps and large screens, and using large hand tools in confined spaces. Replicating such high exposures in a laboratory setting would expose participants to unacceptable risk of injury. Thus, conducting experiments and interpreting the results relative to the implications for the mining workplace has limitations.

The second area where ergonomics research often fails to translate to mining is assessment tools. As with the examples in the preceding paragraph, most assessment tools assume a similar pattern of exposure. Typical mining tasks are rarely amenable to analysis with these types of tools. However, one approach to dealing with this is to focus on identifying exposure to risk factors rather than scoring or grading a particular task. These issues suggest that recommendations to use “action research” approaches that involve researchers working with organizations and practitioners to understand how to apply scientific knowledge in a specific context (Neumann et al., 2012) are valid. Recent research on developing ergonomics audits for mining (Dempsey et al., 2012) used a variant of this approach and was successful.

PERSPECTIVES FROM THE NAVY

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RtPtR Successes

There are now more ways to access and influence research (Naval Postgraduate School, NISE grants, etc.) that meet military applications (addressing tactics/techniques/procedures) or weapons systems (rapid acquisition needs). Additionally, there is more collaboration between innovation and maintenance centers than previously existed. Previously, innovation and research was focused on systems for the warfighter, but this did not aid the support systems and personnel that maintained the ships, planes, etc. By recognizing human-system interaction demands of unmanned systems (air, ground, undersea) technology can be

developed smartly rather than by playing catch-up.

RtPtR Challenges

Research often does not lead to application. Examples of this include research/theses that provide a general contribution to science or a better understanding of the "why" of a problem. Solutions and ideas need to be focused on mitigating a problem instead. Another challenge is with the procurement of a solution. There is a notable disconnect or time lag between innovation and the ability to procure that mitigation from a General Services Administration (GSA) schedule.

Disclaimer

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