



# Puget Sound Human Factors and Ergonomics Society

## Program for Day 1 (October 14)

Start	End	Thursday (Pacific Day Time)
8:00	8:10	Welcome
8:10	8:20	PSHFES Presidential Address to Attendees
8:20	8:25	Message from the Immediate Past President of HFES (national office)
8:25	8:30	<b>Platinum Sponsor Presentation - Preventure</b>
8:30	9:30	<i>Presentation 1</i> <b>Edie Adams, Ryan Chang, Kelly Schmidtbauer (Microsoft)</b>
9:30	9:35	<b>Platinum Sponsor Presentation – Joint Action Solutions</b>
9:35	10:35	<i>Presentation 2</i> <b>Marisol Barrero (Amazon Web Services)</b>
10:35	11:05	<b>Break</b>
11:05	12:05	<i>Presentation 3</i> <b>Lora Cavuoto (University at Buffalo)</b>
12:05	12:25	<i>nextg</i> <b>Student Presentations</b>
12:25	12:55	<b>Panel Discussion</b>
12:55	1:00	<b>Day 1 – Closing Remarks by the Moderator</b>

## Ergonomics and Biomechanics Product Making at Microsoft Devices



**Edie Adams, M.E.Des, CPE**  
Director of Ergonomics  
Microsoft

**Biosketch:** Edie is Director of Ergonomics at Microsoft. In the Human Factors Center for Excellence, Windows and Devices Design Team, she optimizes the physical comfort for products from Surface, PC Accessories, Xbox and HoloLens. Trained in product design, design research and occupational ergonomics, Edie is a Certified Professional Ergonomist (CPE) and holds a Master of Environmental Design degree in Industrial Design and a B.Sc. in Psychology from the University of Calgary. Her innovations have been recognized with over 120 US patents. Her design work is included in the permanent collection of the Museum of Modern Art in New York and The Chicago Antheneum. Edie has been a resident of Seattle since 1991, where she enthusiastically pursues her interests in art and architecture.



**Ryan Chang, Ph.D**  
Senior Human Factors Engineer  
Microsoft

**Biosketch:** Ryan is Senior Human Factors Engineer at Microsoft. He influences the product design and development process with data obtained from carefully designed biomechanical laboratory experiments, and an understanding of human physiology. Ryan specializes in biomechanics, experimental research and product development, interaction of humans and products, 3D motion analysis/tracking, EMG, and force measurements. He holds a Masters Degree from McGill University and a Ph.D in Kinesiology and Biomechanics from UMass Amherst.



**Kelly Schmidtbauer, M.S.**  
Senior Human Factors Engineer  
Microsoft

**Biosketch:** Kelly is a Senior Human Factors Engineer supporting Biomechanics and Human Factors at Microsoft. She holds a BA in Exercise Science from Willamette University and an MSc in Biomechanics from the University of Oregon. Prior to joining Microsoft in 2019, Kelly focused on Rehab and Military medicine.

**Abstract:** There is an aspiration centering product making within the Devices Design Team at Microsoft. It elevates and prioritizes human goals against those of technology, commerce, and time in delivering on a design vision. Through our efforts in Ergonomics and Biomechanics, we impact product design through a deep understanding of the physical interaction of people and products. Partnering with other disciplines in our Human Factors Center for Excellence, we build on that understanding by incorporating cognitive and emotional measures as well. We will present practical applications of ergonomics and biomechanics science in the design of our products in five areas: Hand biomechanics and sensory input; 3D human modeling: full body, upper limb, head; Device comfort: social, physical; Neuro-ergonomics: brain-work interface and Hardware/ Software Interaction; and Enlarging the size and range of the user population through accessibility and inclusion.

## Emerging Technologies in Ergonomics - Exoskeletons, Wearable Sensors, Computer Vision, Virtual Reality, and Artificial Intelligence



### **Marisol Barrero, M.S, CPE**

Global Ergonomist  
Amazon Web Services

**Biosketch:** Marisol Barrero joined Amazon Web Services as their Global Ergonomist in August 2021. Previously she worked for Toyota Motor North America in the Production Engineering Division's Safety Group, since December 2006. Most recently she managed the development and integration of safety-related technology and innovations across North American operations, which is a unique role that she started at Toyota. Prior to 2019, Marisol held the position of Regional Ergonomics Manager, where she managed a team of ergonomists to support Toyota's 15 North American manufacturing facilities. Prior to Toyota, she worked as an ergonomics consultant with Mitsui Sumitomo Insurance Group and Humantech, as well as a researcher with the National Institute for Occupational Safety & Health (NIOSH). Marisol received her B.A. and M.S. from Cornell University in Ithaca, NY. She has been a Certified Professional Ergonomist since 2006. Marisol is involved in several external organizations. She is the co-founder and current Board member of the Automotive Exoskeleton Group (AExG), which is sponsored via the Wearable Robotics Association. Marisol sits on the ASTM Exoskeleton Center of Excellence Research & Development Committee and is a member of F48, the first external standard on exoskeletons and exosuits. She is a regular speaker at various safety and technology conferences including Applied Ergonomics Conference, Enterprise Wearables Technology Summit, and WearRAcon.

**Abstract:** Emerging technologies, particularly around the area of wearables, are truly changing the field of ergonomics as we know it. Regardless if you are a true believer or a skeptic, it is hard to dismiss the constant chatter. Whether it is reducing risk of MSDs, finding faster ways of completing ergonomics assessments, focusing on individual workers rather than processes, improving training retention, or making sense of all the data, emerging technologies can assist. Examples of technology, such as exoskeletons, wearable sensors, computer vision, virtual reality, and artificial intelligence will be provided, and potential ergonomics use cases will be noted.

## Strategies for Identifying and Monitoring Fatigue in the Workplace



### **Lora Cavuoto, Ph.D, CPE**

Associate Professor of Industrial and Systems Engineering  
University at Buffalo

**Biosketch:** Lora Cavuoto is an Associate Professor of Industrial and Systems Engineering at the University at Buffalo (UB). She received her PhD in Industrial and Systems Engineering from Virginia Tech. At UB, she directs the Ergonomics and Biomechanics Laboratory. Her current research focuses on quantifying physical exposures and physiological responses using wearable sensors to identify indicators of fatigue development and performance change. Her work has been funded by NIH, the DoD, CDC-NIOSH, and private industry. She is a Scientific Editor for Applied Ergonomics.

**Abstract:** Fatigue has become a topic at the forefront of the safety discussion, with workers and companies recognizing the prevalence and importance of the topic. Although safety managers may recognize that they have an issue with fatigue in their workplace, they are often unsure how to address the problem. A number of factors can lead to fatigue, including lack of sleep, work stress, physical task demands, and shift schedule. Without intervention, worker fatigue can be a risk factor for both acute and cumulative injuries. Prevention of the negative outcomes requires accurate and timely identification of fatigue, which can be supported by quantifying a worker's level of physical and physiological exposures along with their response to these exposures. The long-term goal of our work is to enable the individualized quantification of fatigue and subsequent risk in a manufacturing environment for intervention prescription. In working toward this goal, our recent objectives have been to apply wearable sensor technology to quantify the impact of work, develop models of fatigue estimation, and analyze the level of evidence for fatigue intervention. In this presentation, I will focus on the findings of our recent work and lessons learned for the assessment of fatigue in the workplace.

*next***g** Student Presentations

## Factors Influencing Firefighter Choice and Use of Gloves During Non-fire Suppression Activities



**Asheton Gilbertson, BA**  
Master of Science Candidate  
University of Washington

**Biosketch:** Asheton Gilbertson is a Graduate Research Assistant in the Department of Environmental and Occupational Health Sciences, University of Washington, Seattle, WA. Asheton has a Bachelor's Degree in Environmental Science from the Colorado College, Colorado Springs, CO. As a graduate student researcher and Northwest Center for Occupational Health and Safety trainee, Asheton seeks to master the methods of industrial hygiene and inform environmental safety and health best practices. Combining her passion for research and community engagement, Asheton wants to present meaningful opportunities to equip workers with the knowledge and skills that they need to protect their health.

**Abstract:** While firefighters are required to wear certified firefighting gloves for the duration of fire suppression activities, during non-fire suppression activities at a fire scene such as cleaning and rolling hoses, inspecting tools, and loading equipment back onto the fire engine, glove use is dictated solely by department-specific policies. Using structured interviews, this initial research aimed to 1) identify the types of gloves firefighters use for clean-up activities and 2) investigate factors that influence glove choice. A total of 20 career firefighters (14 male and 6 female) across 6 Puget Sound fire departments participated. Participant responses identified a range of glove use behaviors; of the 12 participants (60%) who doffed their structural gloves, many chose leather gloves (42%), mechanics gloves (17%), or gardening gloves (17%). An inductive thematic analysis revealed 1) comfort, 2) fit, 3) function, 4) protection, and 5) glove availability as the primary factors influencing glove use. Participant conversations demonstrated the highest prioritization for gloves to function effectively and efficiently. Concerns about current glove use included carcinogenic contaminant exposures (40%), an inability to effectively execute a task (30%) and developing long-term musculoskeletal injuries (15%). Further research is needed to compare the relative effectiveness of reported glove types to address these concerns.

## Effectiveness of Hand Dexterity Training with Tablet and Virtual Reality

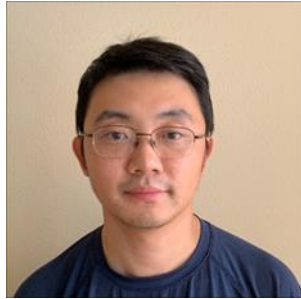


**Milla Liu**  
Doctoral Student  
University of Washington

**Biosketch:** Pin-Ling Liu (Milla) is a visiting scholar in the Dept. of Construction Management, University of Washington, Seattle, WA. Milla is pursuing her Ph.D. degree at the Dept. of Industrial Engineering and Engineering Management, National Tsing Hua University, Taiwan, R.O.C. Her current research involves human factor/ergonomics, occupational safety, biomechanics, and the development of smart assessment tools.

**Abstract:** Hand dexterity is crucial to many aspects of modern life. We developed and compared the effectiveness of two training methods for improving hand dexterity: tablet and virtual reality (VR). Participants were divided into Tablet, VR, and Control groups. Hand dexterity was tested two times using the Purdue Pegboard (PP). Between the PP tests, a break was given to the Control group, while the Tablet group and VR group completed 20 consecutive training tasks on their respective devices. After training, participants in the Tablet group and the VR group showed significant improvement in PP tests. This finding suggested that the training intervention was effective in the tablet and VR environments.

## Material-Cart Handling in the Roofing Industry: Creating Ergonomic Practices Through Research-to-Practice Partnership



**Zhenyu Zhang**  
Doctoral Candidate  
University of Washington

**Biosketch:** Zhenyu Zhang is a PhD candidate at the University of Washington's College of Built Environments. His research lies in the field of construction safety and participatory ergonomics. He has an undergraduate degree in Material Science and a master's degree in construction management, both from Chongqing University, China.

**Abstract:** By examining factors that affect four-wheel cart handling, this study proposed ergonomic practices for manual material handling to reduce overexertion injuries in the roofing industry. A roofing contractor was fully involved in experiment design and data analysis which ensured the results can be immediately transferred to practitioners to enhance ergonomic awareness and improve performance. An intervention program is currently being implemented to encourage adoption of the evidence-based practices.





# Puget Sound Human Factors and Ergonomics Society

## Program for Day 2 (October 15)

Start	End	Friday (Pacific Day Time)
8:00	8:10	Welcome
8:10	8:15	Message from the President of HFES (national office)
8:15	9:15	<i>Presentation 1</i> <b>Anjali Joseph (Clemson University)</b>
9:15	9:20	<b>Platinum Sponsor Interaction - Preventure</b>
9:20	10:20	<i>Presentation 2</i> <b>Blake McGowan (VelocityEHS)</b>
10:20	10:30	<b>HFE Professional of the Year Award Presentation</b>
10:30	11:00	<b>Break</b>
11:00	11:05	<b>Platinum Sponsor Interaction – Joint Action Solutions</b>
11:05	12:05	<i>Presentation 3</i> <b>Sara Pazell (ViVA health at work)</b>
12:05	12:45	<b>Panel Discussion</b>
12:45	1:00	<b>Raffle Drawing &amp; Closing Remarks by the PSHFES President</b>

## Improving Safety and Quality Through Evidence-Based Healthcare Design



**Anjali Joseph, Ph.D, EDAC**  
Professor of Architecture  
Clemson University

**Biosketch:** Dr. Joseph is Professor of Architecture, Spartanburg Regional Health System Endowed Chair in Architecture + Health Design and Director of the Center for Health Facilities Design and Testing at Clemson University. Dr. Joseph teaches in the graduate program in Architecture + Health at Clemson University where she trains Architecture students in designing healthcare environments to support patient, staff and organizational outcomes. Dr. Joseph's research focuses on multi-disciplinary systems approaches to improving patient safety and quality in high stress healthcare settings through the development of tools and built environment solutions. She has served as principal investigator on multiple grant funded projects from the Agency for Healthcare Research and Quality, the Kresge Foundation, the California HealthCare Foundation and the US Green Building Council. She currently serves as PI on a multi-year patient safety learning lab funded by AHRQ focused on designing safer and more ergonomic operating rooms. Anjali's work has been published in many peer-reviewed journals and she has spoken widely to national and international audiences. She was recognized as Researcher of the Year in 2018 by the Healthcare Design Magazine.

**Abstract:** The built environment is a key component of the healthcare system that impacts patient safety, patient experience and quality of care. Evidence-based design (EBD) is defined as the process of making decisions about the design of the built environment on credible evidence with the goal of improving healthcare outcomes. However, there is a lack of awareness regarding the pervasive influence of the built environment on caregiving activities, and how its design could reduce risks for patients and providers. Once a facility is built or an old one refurbished, its design and relatively permanent nature shapes the quality of care for decades to come. The healthcare facility design and renovation process offer a key opportunity to integrate human factors approaches with EBD to create safer environments for patients and staff. This presentation provides an overview of EBD and describes projects conducted in collaboration with healthcare organizations where human factors and systems engineering approaches have been used during the facility design process to identify problems in healthcare systems and to proactively develop solutions to address these issues.

## Communicating the Value of Ergonomics and the Requirement for Technology to Business Stakeholders



### **Blake McGowan, MSc, CPE**

Senior Global Enterprise Account Manager  
Director of Ergonomics Research  
VelocityEHS

**Biosketch:** Blake McGowan, Director of Ergonomics Research at VelocityEHS, leads the Ergonomics Research group to incorporate the latest technical and scientific data into the Humantech® Ergonomics software solutions. He also consults with academia to transfer current research knowledge into the company's approach, systems, assessment methods, and guidelines. Blake received a Bachelor of Science degree in Kinesiology (Biomechanics and Neurophysiology) and a Master of Science degree in Kinesiology (Human Neuromechanics) from the University of Waterloo in Waterloo, Ontario. Blake has achieved recognition as a Certified Professional Ergonomist (CPE). He is a member of the National Occupational Research Agenda (NORA) Musculoskeletal Health Cross-sector Council, the American Conference of Governmental Industrial Hygienists (ACGIH) Physical Agents Committee, and Human Factors and Ergonomics Society (HFES). Blake has been with the company for over 20 years.

**Abstract:** Business stakeholders (plant leadership, quality, operations, manufacturing, board of directors, and investors) generally have a limited awareness or understanding of the value of ergonomics. Communicating it in a way they understand is critical, but it first must be defined clearly. In simple terms, ergonomics is the science of designing the workplace to match people's capabilities. When done right, two primary outcomes result—improved employee well-being and enhanced business performance. When business leaders understand these positive impacts of ergonomics will not be overlooked. Using data as language will demonstrate that ergonomics improves employee well-being by reducing absenteeism, voluntary turnover, recordable injuries, and worker's compensation claim costs. This results in improved business performance, including enhanced product quality, increased manufacturing performance, and better stock performance & corporate social responsibility. Generally, the business performance benefits are ten-times greater than the employee well-being benefits. Once business stakeholders understand the value of ergonomics, they need to understand why and how technology can be leveraged to improve the efficiency of risk assessments, to enhance the quality of the data, and to provide actionable insights. During this presentation, participants will learn how best to communicate the value of ergonomics and the need for technology to business stakeholders in the language and metrics they understand.

## Heat-in-Transit: The Human-Centred Design of a Bitumen Trailer (and other related cases)



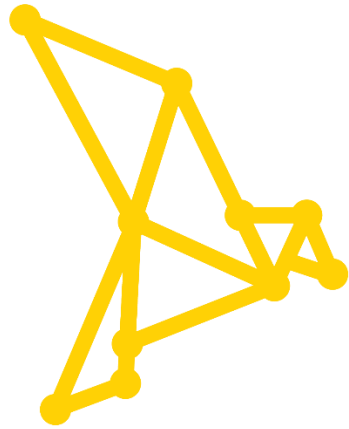
### **Sara Pazell, BAppSci(OT), MBA, Ph.D., CPE**

Managing Director  
ViVA health at work

**Biosketch:** Sara is a human-centred, work design strategist and the managing director for ViVA health at work (work design specialty consultancy), working across all industries (industrial and office work settings). She holds affiliations with five Australian universities, including that as an Industry Fellow with the Sustainable Minerals Institute at The University of Queensland. Sara provides teaching and research support in organisational science, human factors, ergonomics, health and wellness, safety, and allied health. Sara is part of the international advisory committee for the WELL Movement concept v2 and an expert faculty member for Australia's only certified Wellness Wise™ Practitioner training program. Sara was the committee chair for the Human Factors and Ergonomics Society of Australia's Good Work Design position paper and supporting resources. Her other passions include instructing yoga and sports & strength conditioning.

**Abstract:** Good work design that is human-centred supports productivity and well-being among workers. Human-centred design considers effective interaction with equipment, tools, and machinery throughout the product and production-employment lifecycle of the worker. This is a complex process since considerations must be made for product use: work conditions, decisions, and tactics; design regulations and standards; activity exposure; and the vast range of tasks that may be undertaken. Capital equipment, such as industrial vehicles and mobile plant, are expensive and retained for a significant operating period. A human-centred approach ensures improved performance. This presentation will describe the methods undertaken for the design review of heavy industrial vehicles and trailers. The pinnacle case, the redesign of a bitumen trailer, reveals how determination led to its innovation with the use of new heating elements to reduce transit time and, thus, operator fatigue. Other examples will be provided to describe the after-market assessment of the fit of a vehicle to the operator, tasks, and work conditions.

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