

EVENT PROGRAM

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UNIVERSITY OF NEBRASKA AT OMAHA DEPARTMENT OF BIOMECHANICS



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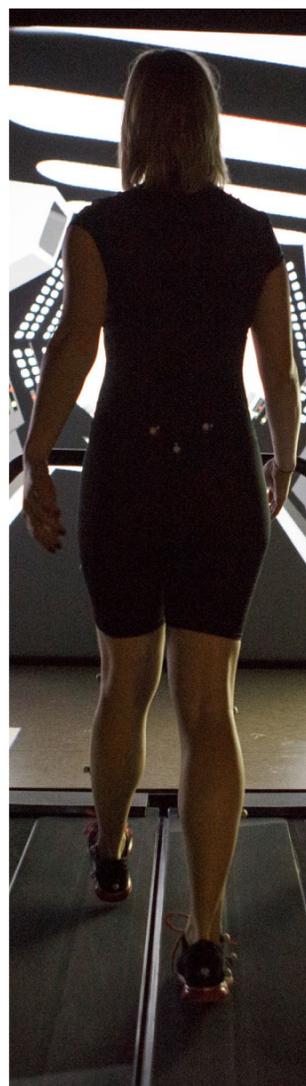
2016 Nebraska Research & Innovation Conference **SYMPOSIUM ON BIOMECHANICS**

OCTOBER 13 | OMAHA, NEBRASKA



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Message from the Nebraska EPSCoR Director

Dear Participants,

Welcome to the Symposium on Biomechanics! I thank our speakers for sharing their time and expertise with us.

Today's event extends an annual series of conferences and symposia that Nebraska EPSCoR has been organizing in support of research activities in this state. This year's event is a partnership between this state's Experimental Program to Stimulate Competitive Research and the newly established Department of Biomechanics at the University of Nebraska at Omaha.

The biomechanics program at UNO is spearheading biomechanics research in our state and region through collaborations with medical institutions and practitioners; thus, advancing the future of a growing area in our state's workforce.

Please enjoy today's knowledge transfer and networking opportunities, and make sure to visit the poster session to learn about exciting biomechanics research being conducted in Nebraska.

Best,

F. Fred Choobineh, P.E., Ph.D.
Director, Nebraska EPSCoR
Blackman Distinguished Professor of Electrical Engineering, UNL

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Special Thanks To:

Angela Collins, UNO Department of Biomechanics

Thompson Alumni Center, University of Nebraska at Omaha

Nebraska EPSCoR Staff:

Frederick N. Gartner, Accounting Technician

Lindsey Moore, Outreach Coordinator

Nancy Simnitt, Executive Assistant

Carole Wilbeck, Communications Specialist

Clint Chapman, Symposium Website Designer



SYMPOSIUM ON BIOMECHANICS

2016 Nebraska Research & Innovation Conference
Thursday, October 13, 2016
University of Nebraska at Omaha Thompson Alumni Center

AGENDA

8:30 am **Registration and continental breakfast**

MORNING SESSION

9:00 am **Welcome & Introduction**
Dr. Fred Choobineh, Nebraska EPSCoR
Dr. Nicholas Stergiou, University of Nebraska at Omaha

9:30 am **Using Animal Studies of In Vivo Muscle Function to Validate Hill-Type Muscle Models Applied to Evaluating the Biomechanics of Human Movement**
Dr. Andrew Biewener, Harvard University

10:30 am **Break**

11:00 am **Self-Organizing Coordination Dynamics of Bodies, Brains, Babies and Machines**
Dr. J.A. Scott Kelso, Ctr for Complex Systems & Brain Sciences, University of Florida Atlantic

Noon **Lunch**

AFTERNOON SESSION

1:30 pm **Tour of Facilities**| UNO Biomechanics Research Building

3:00 pm **Designing Equipment for Assisting Human Motion**
Dr. Carl Nelson, University of Nebraska-Lincoln

3:30 pm **The Myopathy of Peripheral Arterial Disease**
Dr. Iraklis Pipinos, University of Nebraska Medical Center

4:00 pm **Robots, Bioinspiration and STEM Learning**
Drs. Neal Grandgenett and Elliot Ostler, University of Nebraska at Omaha

4:30 pm **Poster session and reception** (ends 6:30 p.m.)



SYMPOSIUM ON BIOMECHANICS

Using Animal Studies of In Vivo Muscle Function to Validate Hill-Type Muscle Models Applied to Evaluating the Biomechanics of Human Movement

ANDREW BIEWENER

Department of Organismic and Evolutionary Biology
Harvard University

9:30 - 10:30 A.M.

ABSTRACT: Indwelling electrodes implanted in the muscles of animal models allow their in vivo function (fiber strain, force and neural activation) to be recorded across a range of locomotor behaviors. In vivo characterization of muscle function yields novel insights into how muscles contract to modulate force and work across movement tasks. Additionally, in vivo measurements of muscle fiber strain, force and work provide an important opportunity for validating Hill-type muscle model predictions, which are frequently used to model and evaluate human movement in both normal and pathological conditions but are rarely validated. By evaluating the predictive accuracy of Hill-type muscle models, we can identify which features of the muscle model can be adjusted to improve model performance. For example, we can test whether separating motor recruitment into slow and fast components improves model accuracy. In recent studies of human cycling, we evaluate traditional one-element versus a two-element (slow vs fast) models to evaluate how well they compare to measured changes in muscle-tendon force at the ankle joint. To date, we find that a two-element model performs modestly better than a simple one-element model and that estimates of muscle-tendon slack length are likely most important to deriving overall patterns of passive relative to active MTU force.

BIO: Andrew A. Biewener, Ph.D., is the Charles P. Lyman Professor of Biology in the Department of Organismic and Evolutionary Biology at Harvard University and the Concord Field Station Director. He served as Department Chair from 2001-2010, was President of the American Society of Biomechanics in 2001–2002, and is currently Deputy Editor-in-Chief of The Journal of Experimental Biology. Biewener has served as a regular member of the NIH Musculoskeletal Rehabilitation Sciences (MRS) study section (section Chair 2014-15), in addition to having served on several NSF grant panels. Biewener's laboratory focuses on the biomechanics and neuromuscular control of terrestrial locomotion, with relevance to biorobotics and biomedical engineering. He has published over 150 research papers, has trained 17 PhDs and 16 post-doctoral fellows. He teaches courses on Human Evolutionary Biology and Comparative Biomechanics, along with co-authoring an introductory biology textbook, *How Life Works* (MacMillan [2013, 2015]) and is working on a second edition of his book *Animal Locomotion* (Oxford Univ. Press).

Self-Organizing Coordination Dynamics of Bodies, Brains, Babies and Machines

J.A. SCOTT KELSO

Center for Complex Systems & Brain Sciences
Florida Atlantic University

11 A.M. - Noon

ABSTRACT: In the past 30 years the discovery of emergent phenomena regulated by higher order principles has profoundly influenced how we understand the organization of matter and how matter behaves. A key feature of such self-organizing systems is the separation of system timescales and a clear delineation of macro- and micro-events. Living things have also been demonstrated to display self-organization. There, however, macro and micro are relative terms and no clear separation of timescales exists. Self-organization rather takes the form of informationally coupled dynamical systems (coordination dynamics). This talk will illustrate how the identification of relevant coordination variables or order parameters on a given level of description has led to dynamical laws that govern stability and change. Examples will include the coordinated movements of people (including babies and ballet dancers), coordination within and between brains, and coordination between humans and machines. Concepts such as symmetry, symmetry breaking and degeneracy along with dynamical mechanisms (e.g. multistability, bifurcation, fluctuations, instability, and especially metastability) figure prominently in our understanding of such complex systems.

BIO: Scott Kelso, Ph.D., devotes his career to understanding how human beings (and human brains)—individually and together—coordinate their behavior on multiple levels, from cells to cognition to (most recently) social settings (see <http://www.ccs.fau.edu/hbb13/>). His approach has been grounded in the concepts, methods and tools of self-organization in physical and chemical systems (Synergetics, Dissipative Structures) tailored to the activities of animate, living things (moving, perceiving, feeling, thinking, learning, remembering, etc.), with a theoretical and empirical framework known as Coordination Dynamics. He was Senior Research Scientist at Yale University's Haskins Laboratories and held the Glenwood and Martha Creech Chair in Science at Florida Atlantic University (FAU) where he founded The Center for Complex Systems and Brain Sciences. He is also Visiting Professor of Computational Neuroscience at the Intelligent Systems Research Centre in The University of Ulster in Derry, N. Ireland.

Research by Kelso and colleagues has been published in *Science*, *Nature*, and other prominent journals. He is an author and Fellow of APA, APS, SEP and AAAS; his honors include the MERIT, Senior Scientist and Director's Innovations Awards from the NIH. In 2007 he was named Pierre de Fermat Laureate and was the Bernstein Prize recipient in 2011. Visit his faculty page at <http://www.ccs.fau.edu/~kelso/>.



SYMPOSIUM ON BIOMECHANICS

LUNCH, Noon - 1:30 p.m.

Please enjoy lunch with colleagues in UNO's Thompson Alumni Center.

At 1:15 p.m., Symposium on Biomechanics attendees will travel to UNO's Biomechanics Research Building for tours of this exciting new facility.

There will be shuttle buses waiting in front of the Thompson Center to transport symposium attendees to and from the BRB. For those who prefer to walk, maps will be available at the symposium's check-in table in the Thompson Center.

After the tours, please return to the Thompson Center for the afternoon speaker and poster session.

Designing Equipment for Assisting Human Motion: A Mechanical and Robotics Perspective

CARL NELSON

University of Nebraska-Lincoln

3:00 - 3:30 P.M.

ABSTRACT: Trends in today's population are towards increasing lifespan, and with this comes the need to preserve quality of life into the later years. Many challenges in this regard pertain to mobility and activities of daily living. In addition to the need for maintaining overall fitness and cardiovascular health, events such as stroke, brain injury, spinal cord injury, and any number of other conditions can lead to the need for therapy in order to foster healthy mobility at any stage of life. Therapeutic approaches can be very labor-intensive, but properly designed equipment can ease the burden on therapists and provide the mass repetition needed for effective therapy related to human motion. This talk will give an overview of how engineering design principles can be combined with expertise in human motion to produce effective mechanical and robotic solutions for therapeutic interventions. Several examples of therapy equipment design will be described to illustrate this synergistic process.

BIO: Carl Nelson, Ph.D., is a professor in the Department of Mechanical and Materials Engineering at the University of Nebraska-Lincoln. His areas of research and professional interest involve mechanical systems design and analysis, medical robotics (including both surgical and rehabilitation applications), modularity in mechanical systems, and graph-theoretic techniques in robotics and mechanical systems design, among others.



SYMPOSIUM ON BIOMECHANICS

The Myopathy of Peripheral Arterial Disease

IRAKLIS PIPINOS

University of Nebraska Medical Center

3:30 – 4:00 P.M.

ABSTRACT: In recent years, an increasing number of studies have demonstrated that a myopathy is present, contributes, and, to a major extent, determines the pathogenesis of peripheral artery disease (PAD). This talk will cover the following key topics related to the myopathy of PAD:

- Mitochondrial dysfunction, oxidative damage and inflammation in the leg muscle of patients with PAD
- Atrophy in the leg muscle of patients with PAD
- Biomechanical analysis of the gait of PAD patients
- Regeneration of adult skeletal muscle with the use of exercise, medications and revascularization operations

BIO: Iraklis Pipinos, M.D., F.A.C.S., is a Professor of Surgery at the University of Nebraska Medical Center. He concentrates his clinical practice in vascular surgery at the Veterans Affairs (VA) Nebraska and Western Iowa, where he is the Chief of the Vascular Surgery section. Dr. Pipinos' clinical efforts focus on open and endovascular surgery, with a particular interest on operations for the treatment of arterial occlusive disease. The major focus of the laboratory of Dr. Pipinos and his collaborator, Dr. Casale, is the development of regenerative medicine strategies for skeletal muscle tissue in the legs of patients suffering from peripheral arterial disease (PAD). PAD afflicts 5% of the US population older than 55 years of age and develops along with hardening (atherosclerosis) of the arteries of the legs. The laboratory of Drs. Pipinos and Casale is funded by the NIH (NIA and NHLBI) and evaluates the mechanisms that produce the clinical manifestations of PAD. The objective of the work performed in the laboratory is to improve patient prognosis and produce significant new diagnostic and treatment strategies for the care of patients with PAD.

Robots, Bioinspiration and STEM Learning

NEAL GRANDGENETT AND ELLIOTT OSTLER

University of Nebraska at Omaha

4:00 – 4:30 P.M.

ABSTRACT: Robotics continues to grow as an innovative STEM learning tool in the nation's P12 schools, with many projects funded by the National Science Foundation to bring new ideas and creativity into this powerful learning platform. Many instructional applications are "bioinspired", such as using mechanical linkages to model animal movement, using swarming robots to represent bird flocking behavior, and monitoring wildlife with robots. New 3D printing capabilities have also facilitated connections to P12 STEM learning. This presentation will tour various NSF funded educational robotics efforts that may well open the doors to an increased student interest in biomechanics study and careers.

BIOS:

Neal Grandgenett, Ph.D., is the Dr. George and Sally Haddix Community Chair of STEM Education in the College of Education at the University of Nebraska at Omaha. He won the 2016 Outstanding Teaching and Instructional Creativity Award from the University of Nebraska system, and teaches undergraduate and graduate courses in interdisciplinary STEM learning and research. Grandgenett has been a principal investigator or co-principal investigator on nearly \$18 million in NSF grants from the ITEST, DRK12, TUES, and Noyce programs, with four of these grants focused on using educational robotics as a core instructional strategy in formal and informal STEM learning.

Elliott Ostler, Ed.D., is the Paul Kennedy Professor of Educational Leadership at the University of Nebraska at Omaha, and won the 2016 Innovation, Development and Engagement Award from the University of Nebraska system. Ostler has spent two decades researching and applying the most effective non-traditional teaching techniques, including educational robotics, for students who struggle to learn mathematics and science. His unique instructional approaches have invited consulting opportunities with institutions such as NASA, JPL, Texas Instruments and The College Board, and earned a U.S. Patent that ultimately evolved into a successful business venture called the Initiative for Instructional Inventions and Solutions.

POSTER PRESENTERS: Symposium on Biomechanics

POSTER SESSION BEGINS AT 4:30 P.M.

1650 | Structured auditory stimulation affects human movement variability and associated cortical involvement | Boman Groff, Michael Hough, Steven Harrison, Nicholas Stergiou | Previous research has shown that variability present in simple human movements is not random, but deterministic, with a characteristic fractal structure. In rhythmic tapping and human gait, this fractal organization can be driven by synchronizing movements with a fractally structured auditory stimulus. Similar fractal organization has been detected in fMRI BOLD and fNIRS signals in resting states and during simple movements. This study investigates the relationship between the fractal organization of tapping movements driven by structured auditory stimuli, and the fractal organization in the central nervous system as revealed in cerebral hemodynamics measured by fNIRS.

1651 | Relationship between posturography and the gross motor portion of the Mullen Scales of Early Learning in infants | Zachary Motz, Mariah Taubenheim, Jordan Wickstrom, Benjamin Senderling, Venkata Naga, Pradeep Ambati, Anastasia Kyvelidou | The Mullen Scales of Early Learning (MSEL) is a general developmental measure from birth to 68 months of age. MSEL can be used to assess cognitive and motor abilities. The scales have been utilized a great deal recently to evaluate gross motor behavior in infants at risk for autism. The MSEL is a subjective and non-quantitative evaluation of gross motor behavior. However, recent experimental paradigms may provide an objective method of evaluating gross motor function. Sitting postural control is a fundamental gross motor skill that can be examined in infants during sitting. Thus, the purpose of this study was to evaluate the relationship of the gross motor portion of the MSEL with an objective.

1652 | Virtual Reality Alters the Structure of Variability in Older Adults when Dual-Task Walking | Molly Schieber, Julie Blaskewicz Boron, Angeline Helseth, Taylor Leeder, Sara Myers | Altered variability during dual-task walking is a predictor of falls. Interventions targeting fallers have begun to incorporate virtual reality (VR) systems but the effect of VR itself on dual-task walking ability has not been established. Two groups of healthy adults, older and younger, walked on a treadmill in VR and non-VR sessions and comprising five conditions each: walking only, word reading, semantic and phonemic fluency, and serial three subtractions. Sample entropy was used to quantify the temporal structure of variability in step length, time and width. Overall, dual-task walking with VR alters the structure of variability in the older group.

1653 | Spatiotemporal gait parameters are affected by footwear stiffness in toddler-aged children | Bryon Applequist, Anastasia Kyvelidou, John McCamley, Sara Myers | Footwear plays a significant role in, and can influence children's gait. Footwear type is especially important as a child grows and develops from a novice to an expert walker. Compared to barefoot walking, children generally have increased spatiotemporal (ST) gait parameters while walking with footwear. Gait variability has also shown to be affected by footwear. The degree of stiffness in footwear could have a large influence on children's gait and variability. This study investigated effects of footwear stiffness on ST gait parameters and gait variability in novice walkers. Children with an average age of 33.3 (7.0) months participated in a single data collection. Heel and toe marker positions were acquired for one minute of walking per condition. Participants walked on the treadmill in three levels of footwear stiffness (rigid: hard-soled stiff shoe, semi-rigid: EVA sole athletic shoe, compliant: moccasin soft-sole shoe) and barefoot. ST gait parameters and gait variability were calculated for each condition using marker and treadmill forces. ST parameters all increased in the rigid and semi-rigid footwear conditions compared to soft-sole and barefoot. Interestingly, there were no differences between barefoot and wearing a moccasin for any of the ST variables. There were no differences in SD and COV between any of the footwear conditions. The moccasin shoe promotes walking most similar to normal barefoot walking. Standard measures of variability failed to detect differences between footwear conditions. Further investigation into different measurements is necessary to parse out what effect footwear has on children's gait variability.

1654 | Gait Biomechanics In Patients With Peripheral Arterial Disease Can Be Predicted By Quality Of Life Measures Using Stepwise Linear Regression | Lauren Bowman, Jason M. Johanning, Iraklis I. Pipinos, Sara A. Myers | Physical activity induced pain, claudication, is the primary symptom of peripheral arterial disease (PAD). Current functional assessments for PAD patients are limited to physician interviews. Quality of life (QOL) questionnaires and maximum walking distance tests are used in research settings and haven't been compared with gait biomechanics. If there is a strong measure between research measures and gait biomechanics, clinicians may implement these methods in clinical settings. We predicted distances and QOL parameters would predict gait variables in PAD patients.

1655 | Patients with COPD that report muscle fatigue, instead of breathlessness, have reduced ankle kinetics | Sidney Baudendistel, Stephen I. Rennard, Jennifer M. Yentes | Chronic obstructive pulmonary disease (COPD) is a condition that not only affects the lungs but can also manifest as muscle abnormalities including weakness, reduced muscle metabolism, and muscle fatigue. The purpose of this study was to determine whether two subsets of COPD subjects, those with and without muscle fatigue, have significantly different biomechanical gait function. During the fatigue condition, the muscle fatigue group demonstrated significantly lower peak plantarflexion moment and power as compared to the high function group. All other conditions showed no differences. This difference may be due to an unknown variable not discovered within the phenotypes of COPD.

POSTER PRESENTERS: Symposium on Biomechanics

1656 | Locomotor adaptation through sensory modality augmentation | Jessica Fujan-Hansen, Troy Rand, Mukul Mukherjee | Healthy adults rely upon a balance of sensory inputs to maintain strong locomotion which is often altered by pathology. This study investigated the degree to which injected colored rhythms can effect spatio-temporal gait patterns via Virtual Reality technology and auditory afferent feedback in healthy young adults. Both visual and auditory stimuli were presented in three different noise structures: pink, white and periodic. Sample Entropy of spatio-temporal data assessed the individuals' ability to alter gait structure to match the sensory stimuli. The results from this project illustrate that auditory stimuli with characteristic temporal structures enable entrainment more than visual stimuli.

1657 | Fit The Body For The Day | Sue Souders | A simple innovative program to prepare the body for the tasks of the day. Gentle simple movements for neuromuscular re-education. Can be done as a group or as needed to improve posture and provide more energy and increases morale. Decreases need for addictive drugs and painful procedures. Best to do daily for best results and great for shoulder and neck pain, esp. for texters and computer workers. Prevents MSD by improving the musculoskeletal system (tendons, ligaments) and soft tissue by improving circulation with proper movements that are soothing and healing to improve the circulation to the injured or overused area. Best to do when notice the signs of pain, which are stiffness, loss of motion and fatigue.

1658 | Infants Show a Preference for Social Images in the First Year of Life | Jordan Wickstrom, V. N. Pradeep Ambati, Lauren Wehrle, Benjamin Senderling, Anastasia Kyvelidou | The increasing occurrence of autism spectrum disorders (ASD) creates a crucial need for clinicians to identify ASD-related deficits as early as possible so that children may receive access to immediate intervention services. The purpose of this study was to investigate the gaze behavior in typically developing infants and infants at-risk for autism at three, six, nine, and 12 months of age. Identifying early preferential looking differences in infants may allow for an increased understanding of the underlying visual processes, the development of an early detection paradigm, and the advancement of foundational knowledge from which treatments for autism may be developed.

1659 | COPD: A potential biological aging catalyst for balance deficiencies | Jordan Freeman, Casey Caniglia, Stephen I. Renard, Jennifer M. Yentes | Patients with chronic obstructive pulmonary disease (COPD) experience balance deficits, likely due to severe skeletal muscle changes associated with the disease, resulting in higher incidence of falls. We hypothesized that presence of disease would cause balance deficits in younger COPD patients. Seven patients with COPD (44%±65yrs:74.8±6.4yrs;34%±65yrs:56.3±6.8yrs) and 19 controls (54%±65yrs:70.8±6.4yrs;14%±65yrs:55.7±6.0yrs) performed a series of balance measures. ANOVA results demonstrated a main effect for SOT(p=0.011), mFES(p=0.006), FAB(p<0.001), ABC(p=0.036), and no effect for the TUG(p=0.054) or the MCT(p=0.061). Young COPD were not significantly different than the control groups. However, they performed worse on the SOT, MCT, TUG, and ABC than both control groups.

1660 | Accessing standard balance tests in COPD patients to determine the best prediction of fall prevalence | Casey Caniglia, Jordan Freeman | Introduction: Chronic Obstructive Pulmonary Disease (COPD) is a respiratory in the lungs [2]. COPD also affects the musculoskeletal system; patients with COPD demonstrate an increased risk of falls [1]. Purpose: Understanding which balance test best predicts falls could potentially reduce the number of falls. The purpose was to examine six balance tests as predictors of future falls. Methods: Seven patients with COPD participated in this study. Functional tests: Sensory Organization Test, Motor Control Test, Timed Up-and-Go (TUG), and Fullerton Advanced Balance scale. Subjective tests: Activities Specific Balance Confidence scale and modified Falls Efficacy scale. Subjects were then contacted once a week for 6 months to record falls or unsteadiness. A correlational coefficient was performed on each test and rank of unsteadiness. Results: Our pilot study indicates that patients with COPD who take a longer period of time to complete the TUG report an increased number of times of being unsteady, P = 0.67. References: 1. Roig, et al. (2009) Respiratory Medicine. 2. Dalal, et al. (2012) Respiratory Research.

1661 | Gait biomechanics in patients with peripheral artery disease after revascularization | Sarah Baker, Sara A. Myers, Iraklis Pipinos, Jason Johanning | Peripheral artery disease (PAD) is a cardiovascular disease manifesting blockages to arteries while limiting blood flow to the legs. Patients with PAD have pain/tingling in calves, thighs, and/or buttocks emanating by physical activity called intermittent claudication. PAD causes physical function limitations and increases cardiovascular morbidity by 3-6 times. PAD becomes particularly more prevalent with age. Patients with PAD walk differently than their healthy counterparts. Surgical revascularization to restore blood flow is the typical intervention, but whether walking patterns are restored following surgery has not been studied. This study compared walking patterns of patients with PAD at baseline and six-months post-revascularization. Patients were recruited from a local medical center and they visited the biomechanics laboratory prior to and six-months after surgical revascularization. Subjects walked through a ten-meter walkway with an embedded force platform while ground reaction forces (600Hz; Kistler Instruments, USA) and lower extremity kinematics (60Hz; Motion Analysis Corp, USA) were recorded. The maximum distance individuals could walk was determined using the six-minute walk test. Inverse dynamics was used to calculate ankle plantarflexor moment and power at the end of stance phase (Visual 3D, C-Motion, Inc., USA). Differences between baseline and post revascularization were determined using paired t-tests (α=0.05). Maximum walking distance significantly increased post-surgery. No significant differences between baseline and six-months were detected for ankle powers or moments. Lack of functional training may prevent improvement of walking patterns and it may be necessary to include rehabilitation with functional exercises following surgical revascularization in patients with PAD.

POSTER PRESENTERS: Symposium on Biomechanics

1664 | Strategies to adapt speed differ depending on self-rated ambulatory function in individuals with a transtibial amputation | *Jenny Kent, Nicholas Stergiou, Shane Wurdeman* | Everyday life frequently demands changes in walking speed. In individuals with a lower limb amputation, the strategy adopted to alter speed may depend on the individual's ability to effectively utilize their prosthesis, and their dependence on the sound limb. The aim of this study was to determine how individuals with a transtibial amputation that perceive themselves to have greater ambulatory function adapt their strides bilaterally when walking at different speeds. Our preliminary results suggest that individuals that feel they are more able walkers respond to a requirement to change speed more consistently and symmetrically.

1665 | Comparison of Self-Paced, Fixed Speed, and Overground Walking | *Ryan Hartley, C. Wiens, M. Schieber, W. Denton, V. Marmelat* | Because treadmills are set at a fixed speed, they constrain subjects to walk differently than walking while overground, where subjects can speed up or slow down. To help alleviate this constraint, an algorithm has been developed that allows the treadmill to change speed according to the subject's movement. The purpose of this study was to compare self-paced, fixed speed, and overground walking. We hypothesize the walking patterns of the subjects during self-paced walking will be different from fixed speed conditions and more similar to overground. Subjects will complete three 15 minute walking conditions consisting of self-paced, fixed speed, and overground trials.

1666 | Reliability of Daily Motor Activity Variability Recorded Over 7 Days | *Nicholas Reynolds, Vivien Marmelat* | Human Daily Motor Activity (DMA), estimated from a time series composed of consecutive bouts of activity from an activity monitor, is characterized by complex temporal fluctuations. DMA variability has been proposed to be a marker of progression of neurological disease. However, it is necessary to determine the between-day reliability of DMA variability before using it as a potential prognosis tool. In this study, 23 healthy young individuals wore an activity monitor on the wrist for 7 consecutive days. The reliability of DMA variability was assessed using intra-class correlation. Cronbach's alpha was 0.701, suggesting a high between-day consistency of DMA variability

1667 | Stitching together short gait trials for understanding stride-to-stride organization over time | *Brandon Bischoff, Nick Reynolds, Megan Catlett, Vivien Marmelat* | The organization of stride-to-stride variability is estimated by a scaling exponent $\hat{\tau}$ that reveals significant insight about function and dysfunction of the locomotor system. The analysis of this variability requires continuous recording of a large quantity of stride intervals, e.g. participants walking for 15-30 minutes at a constant speed. This requirement becomes a major limitation when investigating populations such as the elderly or patients with Parkinson's disease. The aim of our study is to investigate whether "stitching" shorter gait trials to create one longer series of stride intervals will provide similar $\hat{\tau}$ -values compared to one continuous long gait trial.

1668 | Virtual Reality in Elderly Gait: Effects of Semantic Fluency | *Taylor Leeder, J. Boron, A. Helseth, M. Schieber, S.A. Myers* | Every 13 seconds an older adult visits the emergency room due to a fall. Gait variability is correlated with fall risk. Dual-task studies show that cognitive tasks interfere with gait but few studies have compared the effects of virtual reality (VR) versus non-virtual reality (NVR) environments. This study aims to explore cognitive and gait performance between VR and NVR sessions. Seventeen healthy adults (70 \pm 5 years) walked on a self-paced treadmill in two sessions, one with VR and one without. During these sessions they completed two trials, walking only and walking while performing the semantic fluency test. Subjects walked four minutes per condition, with the final three minutes used for analysis. Using paired-samples t-tests, there were no significant differences between sessions in the number of correct words across sessions for semantic fluency. However, when controlling for age, participants who were above 70 performed significantly worse than those under 70 ($p = .011$). When comparing walking only vs. the semantic task, there were significant increases in the VR condition for stride length ($p = .029$), step length ($p = .023$) and step time ($p = .020$). In the NVR condition step width was significantly increased between walking only and the semantic task ($p = .025$). We found no significant differences between the VR and NVR conditions for either task. However, step width was almost significantly increased in the VR walking only task ($p = .053$). These results are similar to existing literature in that older adults have a more variable gait in a dual-task environment.

1669 | The Effect of Happy vs. Sad Music on Gait Variability | *Shawn Daley* | The property of music to make people move has been a focus for motor rehabilitation in recent years. In measuring gait variability with musical stimulus, promising results show that music is a tool for enabling people to move in a healthier way. However, no research has examined how fluctuations in gait variability are affected by the happiness or sadness of music. Given music's ability to emotionally affect listeners, we make the hypothesis that walking with happy music will enhance the already known benefits of music on gait variability. This hypothesis will be tested with healthy young adults walking overground.

1670 | Mediolateral postural responses to anteroposterior translations in stroke survivors | *Troy Rand, Pierre Fayad, Mukul Mukherjee* | Standing postural control is a complex mechanism, being adaptable is important for dealing with changing environmental demands. The purpose of this research was to investigate support surface translations containing different temporal properties on the magnitude and structure of center of pressure in a population of stroke survivors. Magnitude of movement was increased in the direction of translation only. Interestingly, the entropy analysis demonstrated that the center of pressure pattern became more disordered in both the anteroposterior and mediolateral directions, but only in non-periodic translations. The entropy of periodic translations was similar to no translation in both directions.

POSTER PRESENTERS: Symposium on Biomechanics

1671 | Detecting inter-limb differences in movement variability post-TKA using acceleration | Prokopios Antonellis, Nicole Ray, Brian Knarr | Total knee arthroplasty (TKA) has become the surgical standard for the management of pain and disability associated with knee osteoarthritis. This study investigated the ability of acceleration to provide useful, discerning information regarding movement variability in individuals post-TKA. Data was collected for seven subjects post-TKA during a 3-minute treadmill walking trial at self-selected speed. Distal tibial acceleration was collected at 100 Hz using inertial measurement units. Maximum Lyapunov exponent was calculated to evaluate stride-to-stride fluctuations in state space. Data of one subject were processed and a substantially larger Lyapunov exponent was found on the surgical limb compared to the non-surgical limb. This preliminary study demonstrates the feasibility of acceleration data alone to provide information on human movement variability post-TKA and motivates the inclusion of shank acceleration as a variable of interest in future studies, as measures of raw acceleration are easier to implement in a clinical setting compared to traditional motion capture.

1672 | The relationship between perceived health outcomes and gait improvement following surgical intervention in peripheral arterial disease | Shane Lentz | Health attitudes regarding quality of life and the potential for recovery of function are related to treatment improvement levels in some populations¹. Patients with peripheral arterial disease (PAD) experience reduced quality of life and physical function from insufficient leg blood flow. The limited blood flow is caused by atherosclerotic blockages in the arteries in the legs. Muscular ischemia causes pain during walking, eventually forcing patients to stop to rest. The standard treatment to improve blood flow in patients with PAD is surgery. In this population, it is unknown how perceived health outcomes prior to surgery influences surgical outcomes. Thus, this project will determine whether a relationship exists between perceived health status, assessed through questionnaires, and improvement in gait biomechanics and maximum walking distances following surgery. If perceived health outcomes are positively related with improvements post surgery, educational and counseling programs to inform patients about the potential for improve health could potentially improve the level of improvement in gait and walking distances post surgery.

1673 | Two phenotypes of chronic obstructive pulmonary disease demonstrate differences in gait kinematics after treadmill walking | Wai Yan Liu, Jennifer Yentes | About 40% of patients with chronic obstructive pulmonary disease (COPD) are limited in their exercise capacity by alterations in their skeletal muscle and not by pulmonary problems. In addition, the use of bronchodilators does not improve exercise capacity in those limited by muscle fatigue. This study will therefore assess kinematic gait parameters in patients who are more limited by muscle fatigue versus breathlessness, before and after a treadmill protocol that provokes either one of these symptoms. We hypothesize that the muscle fatigue group will demonstrate less kinematic changes after treadmill walking compared to the breathlessness group, and we will correlate that with the duration and the rate of perceived exertion of treadmill walking.

1674 | Dual Tasking in a Virtual Reality Environment: Does Auditory Selective Attention Impact Gait? | Angeline Roth, Taylor Leeder, Molly Scheiber, Sara Myers, Julie Boron | Falling is a common problem with increasing age; each year approximately 2.5 million older adults are treated in emergency departments due to falls. During walking, slower step time and a double stance position allow individuals to feel more balanced while performing more than one task, hopefully decreasing fall risk. These changes in gait may result from increased selective attention required from a cognitive task, thus increasing dual task demands. This project aimed to investigate dual task costs of an auditory selective attention task. Seventeen healthy older adults (74 \pm 6 years) completed a series of different cognitive tasks such as dichotic listening (DL) in both virtual (VR) and non-virtual reality (NVR) environments on a split belt, self-paced treadmill. Step time and double stance were assessed with a paired T-test. Non forced DL was not significantly different between VR and NVR sessions. Performance in the forced right ($p < .05$) and forced left ($p < .01$) DL tasks however, showed a significant decrease in step time as compared to the walking control in the VR session. Time spent in a double stance showed similar results with forced right ($p < .05$) and forced left ($p < .01$) conditions significantly increasing in the VR condition compared to the walking control and the NVR condition. These preliminary results indicate that cognitive tasks requiring greater auditory selective attention in a VR environment may increase risk of falls. Further research is needed to conclude how to effectively improve auditory selective attention and balance in order to reduce fall risk.

1675 | Comparison of Gait Variability Among Patients With Peripheral Artery Disease and Without Related Pathologies | Alli Kalina, Jason M. Johanning, Iraklis I. Pipinos, Sara A. Myers | Patients with peripheral arterial disease (PAD) have altered walking performance compared with healthy individuals and may have related pathologies, including diabetes or foot ulcers. We hypothesize that patients with PAD only will have differences in gait variability than those with PAD and related pathologies. Walking performance measures included gait variability for the ankle, knee, and hip flexion/extension time series, six minute walk distance, and treadmill claudication times. Differences between groups were detected using a one way ANOVA with a significance level of 0.05. After comparing gait variability between groups, we found seven significant differences. The significant differences were in knee and ankle coefficient of variation, ankle standard deviation, six minute walk test, initial claudication distance, absolute claudication distance, and Lyapunov exponent of the knee. Further research may include more in-depth measures of each pathology.

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1676 | Development of Low Cost 3D Printed Transitional Prostheses | *James Pierce, N. Than, J. Peck, R. Srivastava, John Stollberg, J. M. Zuniga* | Due to the complexity and high cost of traditional prostheses, they are not accessible to children from low income, uninsured families, or to children from developing countries (Krebs et al., 1991 and Zuniga et al. 2015). Advancements in computer-aided design (CAD) programs and additive manufacturing offer the possibility of designing and printing prostheses at a very low cost (Zuniga et al. 2015). The purpose of the present investigation was to demonstrate the manufacturing methodology of 3D printed transitional prostheses, examine improvement in perceived changes in quality of life, daily usage, and activities performed with these types of devices.

1677 | Difference in inter-limb knee joint angle variability in patients post-TKA | *Katlyn Nimtz, Nicole Ray, Brian Knarr* | Contralateral progression of knee OA following TKA may be a result of persistent movement asymmetries. This study investigates how movement variability is altered bilaterally in the knee following TKA. Motion capture data was collected for 7 subjects post TKA while walking at a self-selected speed on a treadmill for three minutes. Stride to stride variability of knee flexion/extension angle was calculated using the Maximum Lyapunov exponent. Preliminary results for one subject show a difference in variability for knee flexion/extension between the subject's surgical and nonsurgical limbs with a Lyapunov exponent difference of 0.1766 bits/sec. The difference of ~0.2 bits/sec in variability is comparable to differences seen between healthy controls and individuals with a below knee prosthesis, suggesting loss of proprioception post-TKA may play a role in variability. Further investigation on movement variability is warranted to understand the rapid progression of contralateral knee OA post-TKA.

1678 | Exploring the Relationship Between Force-Velocity Behavior and Energetic Cost of Ankle Plantar Flexor Muscles | *Samuel Ray, Kota Takahashi* | In human walking, the relationship between foot and ankle structure and function is not fully known. The foot and toe structures seem to dissipate energy while the ankle generates force through the plantarflexor muscles. Increasing foot stiffness through added carbon fiber insoles has been shown to increase force output and decrease contraction velocity of the ankle plantarflexor muscles. This shift in the muscular force-velocity operating range may be beneficial in fast walking, where muscle force production is impaired due to high contraction velocity. We hypothesize that added foot stiffness will reduce the metabolic cost of walking at fast speeds.

1679 | Does vibro-tactile stimulation of the vestibular system influence standing postural control? | *Alyssa Averhoff, Nicholas Lempke, Pradeep Ambati, Anastasia Kyvelidou* | The vestibular system functions in preserving posture and balance as well as participating in the body's spatial recognition (Watson & Black, 2008). The purpose of this experience is to determine how the vestibular signals effect changes in balance, by stimulating the vestibular system through vibro tactors. We hypothesize postural sway variability will decrease significantly with the addition of vestibular stimulation. Subjects participated in the EquiTest system on Neurocom, with and without vestibular stimulation. Six conditions were tested, 1) eyes open, fixed surface 2) eyes closed, fixed surface 3) eyes open, surrounding tilting about the medio-lateral axis 4) eyes open, surface tilting about the medio-lateral axis 5) eyes closed, surface tilting about the medio-lateral axis 6) eyes open, surface and surrounding tilting about the medio-lateral axis. RMS AP values decreased as frequency increased and RMS ML values increased as frequency increased, indicating vibro-tactile stimulation on the mastoid process did have an effect on standing posture.

1680 | Dual-tasking and the effect of short-term training on risk of falling in patients with COPD | *Farahnaz FallahTafti, Jennifer M. Yentes* | Patients with COPD have more significant deficit in their balance control compared to healthy controls. Participants will be assigned to 3 groups: 1) healthy control group, 2) patients with COPD (untrained), 3) patients with COPD (trained). Gait variability will be measured to assess the predictability of future falls. In order to investigate attention demands of performing dual tasks, postural control and locomotion in patients with COPD and healthy controls, will be compared while walking on even and uneven surfaces under single and dual task conditions. Another aim of this study is to find out the effect of training dual task conditions on improving locomotor performance. The performance of patients with COPD (trained) will be compared to untrained subjects. We hypothesize that performing dual task may increase the risk of falling. Moreover; adapting to dual task training may decrease the required concentration for doing the task and prevent falling.

1681 | Foot Deformations During Human Walking | *Nickos Papachatzis, Jeffrey M. Patterson, Kota Z. Takahashi* | The ankle and foot system is a combination of flexible and adaptable structures. which are analogous to a spring that absorbs/stores and generates/returns mechanical energy during locomotion. Studies have shown that the foot muscles are able to modulate arch compression during static loading conditions. Our aim is to determine how humans modulate foot mechanical work across different levels of added loads (0, 15, 30% body weight). We hypothesized that the structures distal to the hindfoot (i.e., Heel Pad, Arch, MTP) will be able to maintain the same net work output during walking across a series of varying loads.

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1682 | Description and Comparison of Scaling Procedures in Computer Design Programs (Blender and Fusion 360) for 3D Printed Prostheses | Alexandra Maliha, Elizabeth Kosanke, Jorge M. Zuniga | Advancements in computer-aided design (CAD) programs offer the possibility of fitting transitional 3D printed prostheses at a distance. Blender, a computer design program, has been used to scale and fit prostheses. Newer CAD programs, such as Fusion 360, may improve and simplify the distance fitting procedure. The goal of this project is to describe and compare the fitting abilities of Blender and Fusion 360. Prostheses were scaled for human subjects using both programs, and all the scaled devices were measured within Fusion 360. Analysis yielded a comparison of the scaling abilities of the two programs.

1683 | Planning Sequential Motor Actions in Children with Hemiplegic Cerebral Palsy | Swati M. Surkar, Rashed M. Hoffman, Brenda L. Davies, Jamie E. Gehringer, Regina B. Harbourne & Max J. Kurz | HCP have difficulty planning the discrete motor actions performed with their hemiplegic arm. In this study, we evaluated if the discrete motor planning deficits have a cascading effect on the ability of children with HCP to plan a sequence of movements. Fifteen TD children (mean age 4.9 + 1.4 years) and twelve children with HCP (mean age 5.7 + 1.2 years) participated in this investigation. The sequential motor task consisted of initially reaching for an object, followed by placing it in one of six possible target positions of varying endpoint complexity. An eight-camera motion capture system (120 Hz) was used to record the resultant trajectory of a reflective marker that was placed on the hand. Our results suggest that each movement sequence was planned separately since the complexity of the final target only influenced the kinematics during the second movement sequence and not the first.

1684 | Increases in ROM and Circumference of the Forearm After 6 Months of Using a 3D Printed Transitional Hand Prosthesis | Zoe Reed, Hunter Peterson, David Salazar, Jean Peck, Rakesh Srivastava, Jorge M. Zuniga | Children's prosthetic needs are complex due to their small size, constant growth, and psychosocial development (Krebs et al., 1991 and Zuniga et al. 2015). The cost of maintenance and replacement of upper-limb prostheses represent an obstacle for many families (Krebs et al., 1991 and Zuniga et al. 2015). The development and use of low-cost transitional prosthetic devices to increase ROM, strength, and other relevant clinical variables would have a significant clinical impact in children with upper-limb differences. Thus, the purpose of the study was to identify anthropometric, active range of motion, and strength changes after 6 months of using a wrist driven 3D-printed transitional prosthetic hand for children with upper limb differences.

1685 | Does the Continuity Between the Achilles Tendon and the Plantar Fascia Influence Foot and Ankle Power Production? | Jeffrey Patterson, Kota Z. Takahashi | There is an anatomical continuity between the Achilles Tendon (AT) and the plantar fascia (PF), but this continuity deteriorates with aging. This deterioration has implications for the transfer of energy and force between the AT and PF, and may contribute to the age-related loss in foot and ankle power production in older adults. The purpose of this study is to determine whether the AT-PF continuity influences foot and ankle power production in-vivo in young and older adults. We will use ultrasound to measure displacement of the AT when extending the hallux, and displacement of the PF when selectively activating the gastrocnemii muscles. It is hypothesized that older adults will have a decreased AT-PF continuity compared to young adults, and that degraded continuity will be correlated with reduced foot and ankle power production during walking.

1686 | Individuals with Multiple Sclerosis Redistribute Positive Mechanical Work from the Ankle to the Hip during Walking | Rashed M. Hoffman, Brenda L. Davies and Max J. Kurz | Persons with multiple sclerosis (PwMS) walk slower and have altered spatiotemporal kinematics. While these gait alterations have been thought to be due to decreased power generation at the ankle, the distribution of mechanical work across the lower extremity joints is not well characterized. Our results show that PwMS generate a similar amount of overall mechanical work as age-matched controls; however, the ankle joint produces less positive mechanical work, and the hip joint generates more positive mechanical work. These results imply that PwMS may adopt a hip compensatory strategy for sustained mobility.

1687 | Altered Sensorimotor Cortical Oscillations in Individuals with Multiple Sclerosis Suggests a Faulty Internal Model | Dave Arpin, J.E. Gehringer, E. Heinrichs-Graham, M.J. Kurz, T.W. Wilson | Multiple sclerosis (MS) is a demyelinating disease that results in motor impairments. However, the neurophysiological changes responsible for these motor problems remain unknown. Prior magnetoencephalographic brain imaging experiments have established that the post movement rebound (PMBR) seen in the sensorimotor cortical oscillations is related to the certainty of the internal model. We evaluated the PMBR in individuals with MS and healthy controls as they performed a goal-directed knee force task. A weaker PMBR was seen in the pre/postcentral gyri for individuals with MS. These results suggest that the internal model is faulty and likely related to the aberrant motor actions.

1688 | A Quantitative Solution to the BESS Balance Test | Mason Schleu, Brian Knarr | The effects of balance disorders can have a large quality of life impact on those who suffer from them. Currently, tests that assess balance are often qualitative and rely on visual scoring of performance by a clinician. Quantitative testing may provide a better description of balance and allow for earlier detection of disorder, but is often cost-prohibitive and unavailable to many clinicians. The goal of this project is to create and validate a low-cost system to collect quantitative balance data using smart phone sensors. Balance will be assessed during the Balance Error Scoring System (BESS) test and over ground walking while collecting data simultaneously using a smartphone and laboratory force plate. Smartphone data will be compared to force plate and standard scoring data to determine the validity and usefulness of smartphone sensors as a low-cost method for assessing balance.

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1689 | Air Resistance in Toppling Football Flight | *Jesse Lin, Chase M. Pfeifer, Judith M. Burnfield, Timothy J. Gay* | This research studied the effect of football kicking geometries on ball flight trajectory. A mechanical kicker (Figure 1) was used to systematically study the effect of kick angle, $\hat{1}$, and impact position, $\hat{2}$, (Figure 2) on ball flight. A computer program was constructed to simulate football flight under these conditions, enabling study of the role of air drag on ball flight.

1690 | Beta cortical oscillatory changes associated with learning an isometric ankle plantarflexion motor task | *James Gehringer, David J. Arpin, Elizabeth Heinrichs-Graham, Tony W. Wilson and Max J. Kurz* | The oscillatory changes that occur before movement onset reflect planning motor actions. Moreover, stronger beta event-related desynchronization (ERD) during the planning stage is associated with greater certainty in the action. We do not understand how learning a task changes these oscillations. Nine adults practiced three blocks of a discrete isometric ankle plantarflexion target-matching task. The cortical activity and behavioral data were recorded during the first and third blocks. Our results showed behavioral improvements after practice in all measures and paralleled changes seen in the oscillatory activity. Stronger beta ERD suggest the participants had greater certainty in selecting an appropriate force.

1691 | Peak Vertical Ground Reaction force & Stance Phase time to assess post-TKA interlimb asymmetry | *Abderrahman Ouattas, Nicole Ray, Brian Knarr* | The purpose of this study was to determine if post-TKA locomotor asymmetry could be identified using stance phase time differences between the surgical and the contralateral limbs by comparing it to the interlimb peak vertical ground reaction force (pVGRF) as a reference. 18 adults (66 ± 6 years, 11M, 7F) who undergone TKA surgery (11.19 ± 6.47 months) were selected for this study. Accelerometers were placed at the lateral malleolus while motion and force data were collected using 8 camera system (Motion Analysis Corp., CA) and an instrumented split-belt treadmill (Bertec Corp., OH). Results indicates interlimb asymmetry during stance time and pVGRF but no coefficient correlation was recorded between the two variables ($F r = -0.01$; $SS r = -0.23$) In conclusion, stance time is not a valid measurement to assess interlimb asymmetry for post-TKA patients. Interlimb loading patterns ought to be measured post-TKA surgery to assess locomotion asymmetry using sophisticated tools such as force platforms.

1692 | Pediatric ICARE for Walking and Fitness: Development and Biomechanical Analysis | *Chase Pfeifer, Judith M. Burnfield, Thad W. Buster, Sonya L. Irons, Guilherme M. Cesar, Carl A. Nelson* | To improve or sustain walking and fitness, many children with physical disabilities participate in ongoing therapy sessions in pediatric clinics or through special services provided within the school system. Unfortunately, specialized pediatric rehabilitation devices are often not available in smaller clinics and school settings due to the price. To address this need the commercially available ICARE (Intelligently Controlled Assistive Rehabilitation Elliptical) was modified to address the needs of children as young as three years old. Preliminary findings suggest that a set of modifications could be integrated into the ICARE to address the rehabilitation and fitness needs of children and adults.

1693 | Foot Temperature Profile During and After Prolonged Walking | *John Kotsalis, Dustin R. Slivka, Iraklis I. Pipinos, Kota Z. Takahashi* | Foot temperature regulation is important for maintaining structural integrity, and impaired temperature regulation has been associated with foot complications; such as ulcer formations in patients with diabetes and/or peripheral artery disease. Currently, there is limited knowledge on how foot temperature increases during prolonged walking, as well as the recovery of temperature after walking. The purpose of this project is to quantify foot temperature profiles during and after walking in healthy human adults. These insights will inform mechanisms of foot temperature regulation, and form a foundation to compare against patients that have diabetes and/or peripheral artery disease.

1694 | Relationship Between Metabolic Cost of Transport and Stride-to-Stride Variability | *Chase Rock, Vivien Marmelat, Jennifer Yentes, Kota Takhashi* | During walking, humans tend to select a movement strategy that conserves the most metabolic energy. The ability to walk economically requires the optimization of a variety of factors, including changes in stride characteristics. While gross variation of strides is related to energy consumption, how this variation is organized from stride to stride may also contribute to metabolic economy. The purpose of this study is determine the relationship between metabolic energy consumption, stride variability, and stride-to-stride organization. By measuring stride length and gas exchange across a range of treadmill walking speeds, we will be investigating how the magnitude of stride length fluctuations relates to the organization of the fluctuations, and how these both relate to metabolic energy expenditure. We expect that both measures will be correlated with metabolic cost of transport, indicating that walking economically requires appropriate stride length maintenance and organization.

1695 | Validation of Postural Sway Measurements using Wii Balance Board | *Zachary Meade, Kota Takahashi, Jenny Kent, Nicholas Stergiou* | The WBB can be acquired for \$100 or less and previous studies have confirmed the accuracy of the magnitude of sway in the WBB even when considering battery life and prior usage. One critical element that has been neglected in all the prior studies involving the WBB is the temporal structure of postural sway (i.e., how postural sway varies across time). This analysis is essential to understanding the postural ability in a large sample population. This study will use the detrended fluctuation analysis (DFA or) and other calculations to quantify how the sway patterns vary across time, which will allow researcher and clinicians to reliably utilize the WBB. The purpose of this study is to conduct a comprehensive evaluation of the postural sway measurements using the WBB.

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1697 | Software-Based Teaching of Biomechanics to Engage Undergraduate Students | Angel Gonzalez, Sidney Baudendistel, Kota Takahashi, Neal Grandgenett | The purpose of this study is to determine whether software-based training can improve learning outcomes in Biomechanics. An existing biomechanics course is redesigned by integrating software-based training to compliment the lecture portion of the course. A questionnaire was handed to every student at the beginning of the semester. Open ended questions were answered by the students as well as questions based on Likert Scale. At the end of the semester, students will be reevaluated with post-Likert Scale question to estimate student apprehension of the Biomechanics course.

1697 | Does Leg Dominance Affect Center of Pressure? | Nicholas Than, Adam Rosen, William Smith, Melanie McGrath, Jennifer Yentes | It is quite common to use center of pressure (COP) as a measure to assess stability in populations with chronic ankle instability (CAI). Participants often perform single-leg standing, and analysis is conducted without regard to whether or not the leg stood upon is the subject's dominant leg; however, studies have demonstrated differences between dominant vs. non-dominant legs. This could affect COP measures, and thus results and conclusions. Therefore, the purpose of this study is to determine whether or not dominant leg needs to be taken into account when assessing stability using COP.

1698 | Motion Timing Gates using Break-Beam Technology and App User-Interface | Joey Palmowski, Chase Pfeifer, Tom Frederick | Sports performance testing is a great indicator of an athlete's ability. Due to the cost of state-of-the-art timing gates, the majority of high school and junior college programs use hand timing (stop watch) to perform these tests which are subject to larger variability and false scores (average 0.31sec faster). In collaboration with the University of Nebraska-Lincoln, Dashr has developed and validated wireless, visible light timing modules that can be used for standard and custom timing events at a fraction of the price of products currently on the market. Validation testing has determined that the Dashr system is accurate within 0.004 sec.

1699 | Modular Robotic System for Assessment and Exercise of Human Movement | Jose Baca, Mohan Sai Ambati, Mukul Mukherjee, Prithviraj Dasgupta | This project proposes the development of a low-cost, portable, modular robotic system to improve the mobility and agility of post-stroke patients. Post-stroke patients face a huge economic burden as traditional rehabilitation paradigms require both equipment and assistance, and are labor intensive for therapists; immobility of the patients also demands the presence of caregivers, which contributes to increasing costs. This project addresses these challenges by developing a basic understanding of the research issues and techniques involved in building a therapeutic robotic system for providing easy and affordable rehabilitation exercises to post-stroke patients.

1700 | Healthy Gait on Unpaved Terrain is More Variable than Gait on an Indoor Hallway | Connor Reed, Brian A. Knarr | Approximately 50% of total knee arthroplasty (TKA) patients require a secondary TKA. Coordination and loading patterns of TKA patients have been identified in laboratory settings; however, data from real-world environments has not been collected. This project will determine relationships between real-world performance and movement patterns in healthy individuals. Participants will perform 3-minute walk tests on an indoor surface, outdoor paved surface, and an outdoor unpaved surface while wearing an inertial measurement unit. We hypothesize that walking on the unpaved surface will show greater variability. This project will provide a foundation for future projects focusing on the prevention of repeat TKAs.